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Adolescents Report Being Most Motivated by Encouragement From People Who Know Their Abilities and the Domain

Mika Asaba, Melissa Santos, Julian Jara-Ettinger, and Julia A. Leonard
Department of Psychology, Yale University

Students often receive encouragement but do not always find it motivating. Whose encouragement motivates students and what cognitive mechanisms underlie this process? We propose that students' responses to positive feedback (e.g., encouragement) hinge on mental state representations, specifically what the speaker knows. Across three studies, we find that U.S. adolescents (n = 581–759 11- to 19-year-olds per study, preregistered; >80% racial/ethnic minorities; >36% low income) report being more motivated by, more confident in, and more likely to seek out encouragement from hypothetical and real-world speakers (e.g., parents, teachers, peers) who are knowledgeable about both their abilities (e.g., students' math skills) and the task at hand (e.g., math). To make feedback most effective, our findings suggest that students should seek and receive encouragement from those who know them and their activities well.

Public Significance Statement

Parents, teachers, and friends often encourage students (e.g., "You can do it!") when they encounter challenges, but these messages are not always effective. We found that middle and high school students, who are in the midst of making important academic decisions, do not trust encouragement from just anyone—they evaluate it based on who provides it to them and what they know. Our findings suggest that for encouragement to be most effective, it is critical that students have people in their lives who know them and their activities well.

Keywords: encouragement, mental state reasoning, social cognition, motivation, adolescence

Supplemental materials: https://doi.org/10.1037/dev0001920.supp

Motivational issues in adolescence compound: When students fail to put effort into their coursework, or altogether avoid rigorous courses, they are less prepared for higher education and job opportunities (e.g., Duckworth, 2013). To motivate students to keep persisting and seek out challenges, educators, friends, and caregivers often provide encouragement, a common form of positive feedback. However, encouragement is not always effective (e.g., Amemiya & Wang, 2018). Why? Classic theories of achievement motivation suggest that people's persistence toward a challenging goal depends, at least partially, on their expectation that they can achieve the goal (e.g., Atkinson, 1957; Bandura, 1991). Thus, one possibility is that receiving motivational feedback (e.g., "You can do it!") may increase persistence to the extent that it increases one's beliefs that attaining one's goal is likely (Fishbach & Finkelstein, 2012). However, little is known about *whose* feedback students find most motivating and the cognitive mechanisms underlying this process.

Prior research has shown that people are highly influenced by those with authority or power. For example, endorsements from celebrities can influence preferences for political candidates (Pease & Brewer, 2008) or actions in climate change campaigns (Boykoff & Goodman, 2009). In pedagogical contexts, even preschool children tend to favor informants who are perceived as more dominant (Bernard et al., 2016; Chudek et al., 2012). Furthermore, in most prior experiments on children's responses to feedback, the feedback given to children

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Mika Asaba https://orcid.org/0000-0002-8071-1675
The study design, hypotheses, sample size, data collection, exclusion criteria, and analysis plan were preregistered. All data, analysis code, full demographic information, and preregistrations of study and analysis plans are available at https://osf.io/vu3ya/ (Asaba et al., 2023).

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Correspondence concerning this article should be addressed to Julia A. Leonard, Department of Psychology, Yale University, 100 College Street, New Haven, CT 06510, United States. Email: julia.leonard@yale.edu

comes from a parent or an experimenter, who are arguably authority figures in children's lives (e.g., Brummelman, 2020; Cimpian et al., 2007; Fishbach et al., 2010; Henderlong & Lepper, 2002; Mueller & Dweck, 1998). Thus, one possibility is that students are most motivated by encouragement when it comes from authority figures. For example, imagine that a student is struggling while studying for a challenging math exam. If students mostly care about the speaker's authority, then they would be most encouraged by their teachers (English teacher, math teacher) and equally so.

At the same time, recent work has shown how people consider a speaker's mental states when evaluating their feedback (e.g., their communicative goals, Yoon et al., 2016). In particular, students may attend to what the speaker knows about the task at hand (their domain knowledge). For example, the times when students usually seek out or receive motivational feedback are often when they are embarking on a new challenge (e.g., a new course) and have uncertainty about their ability to succeed. In these moments, receiving positive feedback from an expert with domain knowledge (i.e., understanding of a specific topic, including its task difficulty) could help convince students that their goal is indeed achievable. Indeed, past work has shown that children make more effective decisions about their learning when they know the difficulty of the task (Bennett-Pierre et al., 2018; Serko et al., 2022). If this is correct, then a student who is studying for a math exam might be more motivated by encouragement from their math teacher than from their English teacher, even though they are both authority figures, because the math teacher knows more than the English teacher about the content and difficulty of the math exam.

In addition to domain knowledge, students may also consider what the speaker knows about their abilities (ability knowledge). People allocate their effort based on their abilities (Baer & Odic, 2022; Leonard et al., 2023; Magid et al., 2018; Metcalfe & Finn, 2013; Metcalfe & Kornell, 2005). For example, adults and children are more likely to stick with a challenge, when they are improving on a task versus plateauing (Leonard et al., 2023; Ten et al., 2021). Receiving encouragement from someone who knows the student's abilities may be motivating because this person can reasonably assess whether the student is capable of reaching their goal with effort. Thus, receiving encouragement from someone who is knowledgeable about *both* the domain and the student's skill may be most motivating (as opposed to someone with knowledge of just one aspect or neither), as they can most accurately estimate students' future success. For example, now imagine that the student's math teacher has seen their progress over the semester. Receiving encouragement from the math teacher now that they have seen the student's performance may be more motivating than receiving encouragement from them at the beginning of the semester.

Critically, whether students consider others' knowledge states when reasoning about motivational feedback depends on their capacity to represent them in the first place. Prior work shows that even young children can reason about others' domain knowledge (e.g., what others know about specific topics, and their difficulty, Lutz & Keil, 2002; VanderBorght & Jaswal, 2009; Williams & Danovitch, 2019) and ability knowledge (e.g., what others know about one's skill in specific topics, Asaba & Gweon, 2022; Bass et al., 2021). Furthermore, children can use representations about domain knowledge or ability knowledge to decide whose teaching to seek out (Birch et al., 2008; Koenig et al., 2004) and to interpret others' subsequent teaching (Bass et al., 2021). Thus, even young children are capable of representing others' knowledge states, but it is not known if students consider others' knowledge when reasoning about encouragement. To the extent that students treat encouragement as information about their future outcomes, they should consider a speaker's knowledge states. However, if students simply use encouragement to feel good about themselves, they may accept it at face value, without considering the speaker's mental states.

In the current article, we test whether students' responses to others' encouragement hinge on their representations of others' knowledge about a domain (e.g., calculus) and knowledge about students' abilities (e.g., their skills in calculus). We specifically test adolescents, given that they are in a critical period of academic growth, where they have more autonomy over their learning (see Eccles & Roeser, 2009; Wentzel, 1998). We predicted that adolescent students would be more likely to be motivated by encouragement from speakers who are high in domain and ability knowledge ("knowledge overlap"), compared to speakers who are high in only one or the other (e.g., people who are domain experts) or low in both. As alluded to earlier, we also consider the following alternative possibilities: That students only seek and listen to authority figures (e.g., their teachers, regardless of their knowledge), only people who are highly knowledgeable about a domain (e.g., their math teacher, even if they do not know their abilities), or only people who are highly knowledgeable about their abilities (e.g., their parent, even if they do not know the course content).

To test these various possibilities, we intentionally used relatively generic, vague forms of encouragement ("You can do it!") that are considered to be lower quality (Hattie & Timperley, 2007) but more common than behavior-specific feedback (see Jenkins et al., 2015, for a review). If we observe that the speaker's domain and ability knowledge matters even for these generic forms of encouragement, then that would be strong evidence in favor of our hypothesis. We also tested whether our hypothesis would bear out when students *seek out* encouragement. Because seeking out encouragement does not necessarily mean that one would receive it, it is possible that students would seek encouragement from different people than they would take it from, such as authority figures (e.g., teachers) or those who would most readily give it to them (e.g., their friends).

To test our predictions, we conducted large-scale, preregistered online surveys with a racially and economically diverse sample of middle and high school students through the Character Lab Research Network (CLRN). This investigation was part of a larger data collection effort that included a variety of studies designed by scientists affiliated with CLRN. CLRN simultaneously rolled out multiple independent studies, and students were randomized to one of the studies running in their school. Students who were randomly assigned to this study included 6th–12th graders. Studies 1a and 1b served as an initial test of our hypothesis with a simple 2×2 design: We varied hypothetical speakers' domain knowledge and ability knowledge and asked participants to judge which speakers' encouragement they would seek out and find motivating. In Studies 2a and 2b, we investigated a potential mechanism underlying participants' judgments in a third-person paradigm: confidence in speakers' performance estimates. Finally, in Study 3, we tested for evidence of this effect in real-world contexts by asking whether participants consider people's domain and ability knowledge when reasoning about hypothetical encouragement from people in their own lives (e.g., their parents, teachers, peers).

Across all studies, we specifically focused on encouragement in a context that has real-world importance: Pursuing coursework in science, technology, engineering, and math (STEM) and persisting in these courses at school. We specifically tested our hypothesis in contexts where students have uncertainty over which STEM-related courses to pursue (e.g., which course to take) or how hard to try in them (e.g., whether to keep studying for an exam). Taking STEM courses during middle and high school can help students pursue a career in the burgeoning STEM workforce; however, students, especially those from disadvantaged backgrounds, often stop enrolling in STEM courses in high school (Xie et al., 2015). This trend may be exacerbated by prior work suggesting that adolescents from marginalized racial and/or gender groups are relatively skeptical of positive feedback in academic contexts (Lawrence et al., 2005). Thus, our work hopes to inform whose feedback adolescent students genuinely find motivating both to advance theory related to motivation and practice related to persistence in STEM.

General Method

These studies were conducted on school computers during class time in participating schools in the United States over the course of a 2- to 3-week testing window. On a predetermined testing day, a teacher proctor at each school administered the CLRN research activities to students. To introduce the study, teachers read a script that explained to students that all research activities were part of an educational research initiative at their school, that participation was voluntary, that they were not being graded, and that teachers would not see their answers. Teachers also instructed students to focus on their own computers and (if relevant) not to look at classmates' screens. Upon logging into the CLRN platform, all students first viewed an assent screen that reiterated this information and, in addition, explained that parents would not see their responses and that their names and any other unique identifying information would not be shared with researchers. Students who agreed to participate were then directed to the experiment. We conducted two surveys via Qualtrics during the 2021–2022 school year. Each survey contained multiple sections with distinct prompts. For clarity, we will label each of these sections as a separate study. Data collection for the first survey occurred in November 2021 (Studies 1a, 2b, and 3). Data collection for the second survey occurred in April 2022 (Studies 1b and 2a)

Study 1a

In Study 1, participants received encouragement from hypothetical speakers, whose knowledge was explicitly provided. We varied each speaker's domain knowledge (whether they are knowledgeable about a particular topic) and ability knowledge (whether they are knowledgeable about the student's ability in that topic), for four speaker types: a speaker who knows both the domain and the student's abilities in the domain, a speaker who knows only the domain and not the student's abilities, a speaker who knows only the student's abilities and not the domain, and a speaker who knows neither. We matched participants' relationships to the speaker, such that all speakers were said to be participants' "classmates" (Study 1a) or simply "people" (Study 1b). We predicted that participants would consider both kinds of knowledge, such that they would be more likely to seek out and be motivated by the speaker who has both domain and ability knowledge, compared to the speakers who have knowledge in just one or the other, or neither. Study 1a was the initial experiment testing this hypothesis, and Study 1b provided a conceptual replication and addressed alternative explanations.

Method

Participants

We tested $n = 700$ middle and high school students from the United States ($M_{\text{age}} = 14.36$, $SD_{\text{age}} = 2.03$, age range = 10–19). A power analysis using pilot data (see Supplemental Materials) showed that we needed 100 participants in Study 1a to detect the effects of domain knowledge and ability knowledge at 90% power. We oversampled to ensure that we could detect these possible effects and to test for any differences by grade level. There were roughly equal numbers of participants in each grade level (6th–12th grade, $n = 79$–119). Based on our preregistered exclusion criteria, we excluded participants for not completing the section ($n = 20$) or for providing the same rating for all test questions ($n = 96$). In addition (not preregistered), we excluded participants who completed the entire experiment (Study 1a, Study 2a, and Study 3) in less than 25% of the median time (under 5.5 min; $n = 3$).

Participants reported their gender as girl (47.4%), boy (45.7%), other (3.3%), preferred not to say (1.6%), or did not provide a response (2%). Participants reported their race and ethnicity as White and Hispanic/Latino (43.3%), White and non-Hispanic/Latino (20%), Black and non-Hispanic/Latino (14.7%), Asian and non-Hispanic/Latino (7.4%), Black and Hispanic/Latino (3%), multiracial and non-Hispanic/Latino (2%), Asian and Hispanic/Latino (.4%, $n = 3$), multiracial and Hispanic/Latino (.4%, $n = 3$), Pacific Islander and Hispanic/Latino (.3%, $n = 2$), American Indian/Alaska Native and non-Hispanic/Latino (.1%, $n = 1$), Pacific Islander and Hispanic/Latino (.1%, $n = 1$), and no response (8%, $n = 57$). Additionally, 36% of students received free or reduced-price lunch; students with family income at or below 130% of the Federal Poverty Level ($34,450 in 2021 for a family of 4) receive free meals, and students with family income between 130% and 185% of the Federal Poverty Level ($49,025) receive reduced-price meals. The remaining did not receive free/reduced-price lunch (56%) or did not respond (8%).

Procedure

Participants read six vignettes about first-person, hypothetical academic situations (four test vignettes, two control vignettes; order randomized), and provided ratings for four classmates with varied knowledge (order randomized) in each vignette, for a total of 24 ratings per participant. Our vignettes concerned two common situations in which students need to decide how to allocate their efforts: deciding whether to continue studying for a challenging test (persistence scenario) and deciding whether to take an advanced course (challenge-seeking scenario). Each vignette ended with a test question about how likely participants would be to seek out encouragement from a particular speaker (seek measure), or how motivated they would be by a speaker's encouragement (motivation measure). To create the four test vignettes, we crossed scenario type (persistence, challenge-seeking) with measure type (seek, motivation).

Here is an example of a vignette with a challenge-seeking scenario and a seek measure:

> Let's say that you are considering classes next semester and want help deciding whether you should take the standard math class, or whether you are ready for the advanced math class. How likely are you to turn to the following people for encouragement to take the advanced math class?

Here is an example of a vignette with a persistence scenario and a motivation measure:

> Let's say that you have a difficult math exam coming up soon, and you are feeling overwhelmed and stressed. For each of the following people, how motivated would you be to study for the test if they said, "I think you can do it! You got this!"

For each vignette, participants rated four hypothetical classmates who varied in their domain and ability knowledge (e.g., their knowledge about the math course and one's abilities in the math course): a classmate who "knows your math abilities and has already taken the math class" (knows both), "knows your math abilities and has not taken the math class" (knows abilities), "does not know your math abilities and has already taken the math class" (knows domain), and "does not know your math abilities and has not already taken the math class" (knows neither). All ratings were on a 5-point scale: not at all likely, slightly likely, moderately likely, very likely, or extremely likely (seek measure) or not at all motivated, slightly motivated, moderately motivated, very motivated, or extremely motivated (motivation measure). Two test vignettes had the seek measure, and two had the motivation measure. Ratings for the four classmates were solicited on the same page of the survey.

The control vignettes were designed to address the possibility that students simply trust experts (e.g., those with high domain knowledge), even if their knowledge is not relevant to the context. They were identical to the test vignettes, except that the scenarios were about an English course or exam, rather than math/science (e.g., "Let's say that you have a difficult English exam coming up"). Due to time constraints, we chose to show two control vignettes (rather than all four that fully cross scenario type and measure); participants saw the challenge-seeking scenario with the seek measure and the persistence scenario with the motivation measure. The same four classmates as in the test vignettes were used (e.g., a classmate who knows their math/science abilities and has already taken the math class), but now their knowledge was less relevant to the context. That is, encouragement about studying for an English exam from a classmate who has knowledge about the participant's math course and math ability may be less meaningful than encouragement from that same person about a math exam. In pilot data, some participants thought that these scenarios contained typos, for example, that we meant to say that the exam was a Math exam, not an English exam. To avoid any confusion about these scenarios, we included a note that there were no typos in the text. This study was fully within-subjects—each participant saw all six vignettes and provided 24 ratings.

Preregistered Analysis Plan

Our key hypothesis was that participants would consider hypothetical classmates' relevant domain *and* ability knowledge for both the seek and motivation measures, such that they would provide higher ratings to the classmate with the knowledge overlap (the "knows both" classmate) than the classmates who know only one or the other and the classmate who knows neither. Critically, we predicted that we would only see this pattern in the test vignettes and not in the control vignettes, where domain and ability knowledge should be less relevant to the students' decisions. Note that we varied the scenario (persistence, challenge-seeking) and domain (math, science) to develop a richer set of vignettes, but we did not expect to find differences between them.

To test these predictions, we fit linear mixed-effects models for each measure (seek, motivation) separately for test and control vignettes, for four models total (test seek, test motivation, control seek, control motivation). For all analyses across studies, we report the maximal model that converged (Barr et al., 2013; full structure described in detail in the next paragraph; see Supplemental Materials for formulas). Note that we preregistered running separate models for middle school students and high school students. However, for simplicity and because we did not find differences between these groups, we report analyses combining across middle and high school students and include grade level (6th–12th grade) as a control variable. See Supplemental Materials for original, preregistered analyses for middle and high school students separately.

The test seek model consisted of fixed effects for ability knowledge (1 or 0), domain knowledge (1 or 0), their interaction, and grade level (6th–12th grade), random slopes and intercepts for ability and domain knowledge, and their interaction, by participant, and random slopes and intercepts for ability knowledge by scenario type (persistence, challenge-seeking). The test motivation model was identical, except random slopes and intercepts for domain knowledge (and not ability knowledge) by scenario type were included. We were agnostic as to whether our predictions would result in interactions between ability and domain knowledge or main effects of both. As follow-up analyses, we ran linear mixed-effects models predicting response (seek or motivation) as a function of the type of classmate ("knows both," "knows neither," etc.), participant's grade level, and random intercepts for participant. For the control seek and motivation vignettes, the fixed effects structure was the same as above, and included random slopes and intercepts for ability and domain knowledge, and their interaction by participant.

Finally, we ran exploratory analyses to test whether our main findings are robust to participants from disadvantaged groups. We fit the models above to two subsets of participants: (a) participants who are a racial and/or ethnic minority (i.e., not White and/or Hispanic/Latino) and (b) participants who receive free and/or reduced-price lunch (an indicator for lower socioeconomic status). We perform these same split analyses for all experiments and report the results in the Supplemental Materials. Given that students from these backgrounds may be especially prone to forego STEM coursework (Xie et al., 2015), it is useful to test how our hypotheses hold for these students alone.

Results

For both the seek and motivation measures, we found significant interactions between ability and domain knowledge (seek: $b = .19$, $p < .001$; motivation: $b = .21$, $p < .001$) and significant positive effects of ability knowledge (seek: $b = .71$, $p < .001$; motivation: $b = .63$, $p < .001$) and domain knowledge (seek: $b = .86$, $p < .001$; motivation: $b = .74$, $p = .005$). We did not find evidence for an effect of grade level on either measure (seek: $b = .00$, $p = .664$; motivation: $b = .01$, $p = .358$). Consistent with our predictions, follow-up analyses confirmed that participants provided the highest ratings to the "knows both" classmate compared to each of the other classmates for both measures (bs $\geq -.84$, ps $< .001$). We find consistent results for participants from disadvantaged groups for all analyses (see Supplemental Materials for exact values).

Counter to our predictions, we also found similar patterns in the control scenarios as the test scenarios: significant interactions between ability and domain knowledge (seek: $b = .19$, $p = .002$; motivation: $b = .16$, $p = .007$) and positive effects of ability knowledge (seek: $b = .56$, $p < .001$; motivation: $b = .50$, $p < .001$) and domain knowledge (seek: $b = .55$, $p < .001$; motivation: $b = .55$, $p < .001$). We found a slight negative effect of grade level in the control seek scenario ($b = -.04$, $p = .023$) and did not find evidence for an effect of grade level in the control motivation scenario ($b = -.01$, $p = .465$). See Figure 1A.

Exploratory follow-up analyses comparing the test and control vignettes (for the seek and motivation measures combined, controlling for grade level and using Bonferroni adjusted α level of .0125) found that participants provided higher ratings for the "knows both" classmate ($b = .40$, $p < .001$), "knows abilities" classmate ($b = .13$, $p < .001$), and the "knows class" classmate ($b = .24$, $p < .001$) in the test vignettes compared to the control vignettes. We did not find a significant difference between test and control vignettes for the "knows neither" classmate ($b = .002$, $p = .916$), suggesting that participants were not simply providing higher ratings to all speakers in the test vignettes. There were no significant effects of grade level for any of these comparisons. These post hoc analyses show that students report that they would be more likely to seek out and listen to a classmate with the relevant domain and/or ability knowledge than one with irrelevant domain and/or ability knowledge.

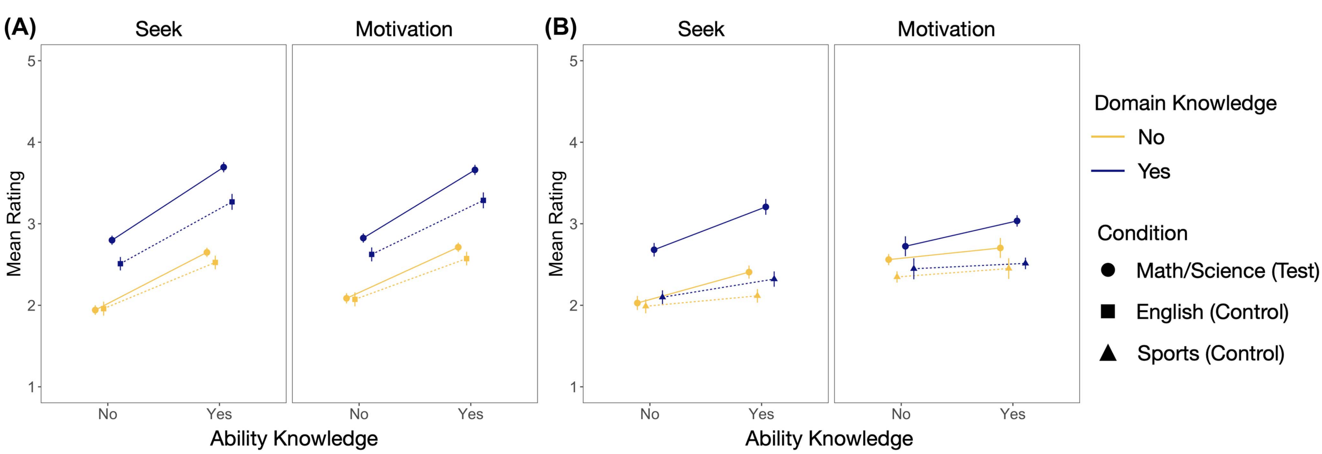
Discussion

Taken together, these results provide initial evidence that students consider others' domain and ability knowledge when reporting how likely they would be to seek out and be motivated by speakers' encouragement. Specifically, participants reported that they would be most likely to seek out and be motivated by encouragement from hypothetical speakers with both domain *and* ability knowledge, especially when such knowledge is relevant to the task at hand.

Nonetheless, one might wonder why we found similar patterns of responses in the control vignettes as in the test vignettes. There are at least three possible reasons to explain this. First, all speakers were the participants' "classmates," who would presumably share other classes with the participant and generally have some understanding of courses at the school. So, it is possible that a classmate with knowledge about the participant's math class and/or math abilities may also have some knowledge of their English class and/or English abilities, such that their encouragement regarding an English class would still be somewhat meaningful. Second, and relatedly, knowledge about students' math abilities may in fact provide broad knowledge about a student's abilities to perform in school (e.g., how conscientious or organized the student is). Thus, participants may think that others' knowledge of math abilities *is* actually relevant to an English course. Third, participants provided ratings to all speakers for a vignette on the same page. Given this, it is possible that students were simply trying to follow a pattern and provide responses in line with our manipulation for both the test and control vignettes. We explore these possibilities in Study 1b.

Figure 1

Results for Study 1A (A) and Study 1B (B)



Note. The *Y*-axis shows mean ratings for how likely participants would be to seek out encouragement from a speaker (seek) and how motivated participants would be following encouragement from a speaker (motivation). The *X*-axis shows the ability knowledge manipulation, and colors represent the domain knowledge manipulation (black shows domain knowledge, and gray shows no domain knowledge). Study 1A contained vignettes about a math/science class (test: shown as circles and with a solid line) and an English class (control; shown as squares and with a dashed line), and participants provided ratings to speakers who varied in whether they had domain knowledge (knowledge about a math/science course) and ability knowledge (knowledge about the student's ability in the math/science course). Study 1B only contained vignettes about math/science, and participants provided ratings to speakers who had domain knowledge and ability knowledge regarding math/science (test) or sports (control; shown as triangles and with a dashed line). See Method section for further details. Error bars are 95% confidence intervals. See the online article for the color version of this figure.

Study 1b

Study 1b had three goals. First, we aimed to replicate Study 1a in a separate sample of middle and high school students. Second, we sought to further test whether students simply trust encouragement when a speaker is perceived to be knowledgeable, even if their knowledge is not relevant to the context. In Study 1b, the speakers were not the participants' "classmates" anymore, but just a "person" to minimize any unintended inferences about the speaker's knowledge (i.e., a classmate may have general knowledge about the courses at the school). We also changed the control domain to "sports" rather than "English" under the assumption that knowledge of a person's sports ability and/or sports class would not be as relevant to their STEM ability or classes. Third, participants provided ratings for each speaker type on separate pages, rather than providing ratings for each of the four speakers on the same page. We made this change to remove the potential concern that participants may have been biased toward following an assumed pattern of results when all questions were presented at once. We also made this change to reduce the relatively high exclusion rate from Study 1a of students responding with the same response to all test questions.

Method

Participants

We tested $n = 759$ middle and high school students from the United States (independent sample from Study 1a; $M_{\text{age}} = 14.68$, $SD_{\text{age}} = 2.09$, age range = 10–22). There were roughly equal numbers of participants in each grade level (6th–12th grade, $n = 91$–128). According to our preregistered exclusion criteria, we excluded participants for not completing the section ($n = 93$); no participants were excluded for providing the same rating for all test questions. Additionally (not preregistered), we excluded participants for completing the experiment in less than 25% of the median completion time (4.57 min; $n = 8$).

Participants reported their gender as girl (44.8%), boy (49.0%), other (2.1%), preferred not to say (3.5%), or did not respond (.5%). Participants reported their race and ethnicity as White and Hispanic/Latino (44.1%), White and non-Hispanic/Latino (15.4%), Black and non-Hispanic/Latino (12.9%), Asian and non-Hispanic/Latino (9.4%), Black and Hispanic/Latino (1.8%), multiracial and non-Hispanic/Latino (3%), Black and Hispanic/Latino (1.8%), multiracial and Hispanic/Latino (1.1%), Pacific Islander and non-Hispanic/Latino (7%, $n = 5$), Asian and Hispanic/Latino (.3%, $n = 2$), American Indian/Alaska Native and Hispanic/Latino (.3%, $n = 2$), Pacific Islander and Hispanic/Latino (.3%, $n = 2$), American Indian/Alaska Native and non-Hispanic/Latino (.1%, $n = 1$), or no response (10.67%). Additionally, 40.4% of students received free/reduced-price lunch, and the rest did not (48.9%) or did not respond (10.7%).

Procedure

Each participant saw two test vignettes (test seek, test motivation) and two control vignettes (control seek, control motivation), each with four speakers, for a total of 16 ratings. All vignettes concerned persistence scenarios, in which students were deciding whether to continue studying for a challenging exam. We reduced the number of test vignettes to two, rather than four, due to time constraints. We asked the same seek and motivation questions as before. The order of the vignettes and speaker order within vignettes were randomized.

Participants underwent a short attention check game (a simple "spot the difference" game) after two vignettes to maintain engagement in the task. These vignettes were similar to Study 1a, except for three differences. First, we referred to each speaker as a "person" not a "classmate." Second, we changed the control knowledge content to be sports, so the speakers in the control vignettes have knowledge about sports and students' sports abilities; all test questions were about math/science courses and exams. Third, we presented and asked about one speaker per experiment page. As before, this study was fully within-subjects.

Preregistered Analysis Plan

As in Study 1a, we predicted that participants would consider both the speakers' relevant domain knowledge *and* their ability knowledge for both the seek and motivation measures. We predicted that this pattern would emerge only in the test vignettes and not in the control vignettes.

We followed the same analytical plan as in Study 1a. The final test seek model consisted of ability knowledge (1 or 0), domain knowledge (1 or 0), their interaction, and grade level (6th–12th grade) as fixed effects, and random slopes and intercepts for ability knowledge and domain knowledge, and their interaction, by participant. The final test motivation model was identical, except the interaction term between ability and domain knowledge in the random effects was excluded, because the model including the interaction term in the random effects did not converge. The control seek model was identical to the test seek model, and the control motivation model was identical to the test motivation model.

Results

For the test vignettes, we found significant positive effects of ability knowledge (seek: $b = .38$, $p < .001$; motivation: $b = .17$, $p = .004$) and domain knowledge (seek: $b = .65$, $p < .001$; motivation: $b = .19$, $p = .001$) and a significant interaction for the seek vignette ($b = .15$, $p = .020$), but not the motivation vignette ($b = .12$, $p = .20$). We did not find evidence for an effect of grade level (seek: $b = .01$, $p = .402$; motivation: $b = .01$, $p = .639$). Follow-up analyses confirmed our predictions that participants provided the highest ratings to the "knows both" classmate compared to each of the other classmates for both measures (bs $\geq -.42$, ps $< .001$; exploratory). See Figure 1B.

For the control seek vignette, we again found significant main effects of ability knowledge ($b = .13$, $p < .001$) and domain knowledge ($b = .11$, $p = .003$), but no significant interaction ($b = .09$, $p = .073$). For the control motivation vignette, we did not find significant effects for ability knowledge ($b = .09$, $p = .067$), domain knowledge ($b = .10$, $p = .061$), nor their interaction ($b = -.01$, $p = .857$).

We ran exploratory follow-up analyses comparing participant ratings in the test and control vignettes (controlling for grade level and using Bonferroni-adjusted α level of .0125). As in Study 1a, participants provided higher ratings in the test vignettes for the seek and motivation ratings combined, compared to the control vignettes, to the knows both classmate ($b = .77$, $p < .001$), the knows abilities classmate ($b = .28$, $p < .001$), the knows class classmate ($b = .46$, $p < .001$), but not the knows neither classmate ($b = .08$, $p = .016$).

Discussion

Study 1b replicated our findings from Study 1a showing that students report that they would be most likely to seek out and be motivated by encouragement from a speaker who has both ability and domain knowledge, compared to speakers who have just one or the other, or neither. In the control scenarios, participants were presented with speakers who were knowledgeable or not about an irrelevant domain (sports) and irrelevant ability (participants' physical abilities) and provided encouragement about a math/science exam. Though we did not find evidence that speakers' irrelevant domain and ability knowledge impacts students' reports of their motivation, we still found positive effects for both knowledge types on students' seeking behaviors. Critically, students reported that they would be more likely to seek out and be motivated by encouragement from a speaker with relevant domain and ability knowledge, than a speaker with irrelevant domain and ability knowledge. Combined with Study 1a, these results suggest that students consider the relevance of others' knowledge when making decisions about whose encouragement to seek out and listen to, but may not completely discount speakers with irrelevant knowledge when seeking encouragement.

Study 2a

Across Studies 1a and 1b, we found that students reported that they were most likely to seek out and be motivated by encouragement from a speaker who holds knowledge of the relevant domain and students' abilities. In Studies 2a and 2b, we examined why this might be the case. We hypothesized that students would be most confident in feedback from speakers who are high in both. Further, considering that encouragement can be thought of as a prediction of future success, here the speakers provided performance predictions rather than generic statements of encouragement.

Furthermore, we sought to investigate whether the precise quantity of domain and ability knowledge impacts students' evaluations of feedback, which we were unable to test in the prior studies because we presented the speakers' knowledge as binary (knowledgeable vs. not). For example, if a student is studying for a calculus exam, one possibility is that they would feel more confident in others' predictions when others' domain and ability knowledge increases. If this were the case, then we would expect them to be more likely to trust encouragement from a friend who knows all their past test scores than a friend who knows only some of their prior test scores, and least likely to trust encouragement from a friend who knows none of their prior scores. Alternatively, it is also possible that the student would entirely discount predictions from speakers who do not have full knowledge. If this were the case, then we would expect that the student would be most likely to trust the friend who knew all of their test scores and would be equally untrusting of encouragement from the friends who knew some or none of their test scores. To test these possibilities, we developed a third-person task that parametrically varied a speaker's domain and ability knowledge and probed participants' confidence in the speakers' performance estimates.

Method

Participants

We tested $n = 592$ middle and high school students (from the same sample as Study 1b; $M_{\text{age}} = 14.69$, $SD_{\text{age}} = 2.06$, age range = 11–19). Roughly equal numbers of students were from each grade level (6th–12th grade, $n = 73–104$). According to our preregistered exclusion criteria, additional participants were tested but excluded for not completing the section ($n = 65$), providing the same rating for all test questions ($n = 108$), failing more than one check question (see the Method section; $n = 68$), or completing the experiment in less than 4.57 min (25% of the median completion time; $n = 4$; not preregistered). Participants' gender, race, ethnicity, and other demographic variables (free/reduced-price lunch) had a similar breakdown as in Study 1b; see Supplemental Materials for full demographic information.

Procedure

Participants read third-person vignettes about students in a math class. First, they learned that students in the classroom had taken four math quizzes and were about to take a fifth quiz. Each math quiz was out of 4 points. They read that there was a big storm at the school recently that spread students' math quizzes all over the floor. As students were cleaning up the quizzes, some students saw some of their classmates' scores. Then, participants underwent 10 test trials.

In each trial, participants met a unique student (e.g., "Avery") who was about to take their 5th math quiz, and a unique speaker (e.g., "Lucy"; names randomized) who made a guess about the student's score on the quiz. Participants were shown how many of the student's previous four quizzes the speaker had seen (e.g., "Lucy saw 1 of Avery's 4 quiz scores"), and the speaker's score on the fifth quiz (e.g., "Lucy has already taken this [5th] quiz and got 4 of 4 problems correct"). Then, participants were told, "Lucy guessed that Avery will get 4 of 4 problems correct on the quiz. How confident are you in Lucy's guess?" (5-point scale from *Not at all confident* to *Extremely confident*).

We parametrically manipulated the speaker's ability knowledge by varying how many of the student's prior quiz scores the speaker had seen (0, 1, 2, 3, or 4 quiz scores), and the speaker's domain knowledge by varying their own quiz score (0, 1, 2, 3, or 4 points), for 25 trials in total. We manipulated speaker knowledge in this way due to prior work suggesting that even young children can use others' observations of an agent's performance to infer their knowledge about the agent's abilities (Asaba & Gweon, 2022) and can use others' performance to infer their knowledge about a domain (e.g., Harris et al., 2018). The design was within-subjects, such that each participant saw 10 randomly selected trials of the 25 possible trials.

Preregistered Analysis Plan

Similar to prior experiments, here we predicted a positive relationship between each knowledge type (domain knowledge, ability knowledge) and participants' confidence in the speaker's score prediction. We fit a linear mixed-effects model with fixed effects for the speaker's ability knowledge (the number of the student's quiz scores the speaker saw, 0–4 quizzes), domain knowledge (the speaker's score on the final quiz, 0–4 points), grade level (6th–12th grade), and the interaction between ability knowledge and domain knowledge, predicting participants' confidence ratings (1–5). The random effects structure for the final model that converged included random slopes and intercepts for ability and domain knowledge by participant.

Results

We found a significant interaction between ability and domain knowledge (b = .03, p < .001) and positive effects of ability knowledge (b = .19, p < .001) and domain knowledge (b = .17, p < .001). This means that participants provided higher confidence ratings when speakers had greater ability knowledge and greater domain knowledge. We did not find an effect for grade level (b = −.03, p = .089). See Figure 2A for results.

As an exploratory analysis, we compared this model with one that treats each type of knowledge as categorical (ability knowledge: speaker saw 4 of 4 quizzes, or 0–3 quizzes; domain knowledge: speaker received 4 of 4 points, or 0–3 points). This analysis allows us to check whether the precise quantity of domain and ability knowledge impacts students' confidence, or whether students are only considering whether the speaker has full knowledge or not. We found that the model that treated each type of knowledge as continuous fit participant data reliably better than the model that treated that treated knowledge as "all or nothing" (Akaike information criterion δ = 914.47).

Discussion

These results show that participants' confidence in others' performance estimates depends on the precise quantity of both others' domain knowledge (how well they did on the final quiz) and ability knowledge (how many of the student's quizzes they previously saw). As domain and ability knowledge increased, participants' confidence in the speaker's performance estimate increased. Furthermore, the interaction between ability and domain knowledge suggests that as ability knowledge increases, the effect of domain knowledge becomes stronger and vice versa. Given that encouragement can be viewed as a performance estimate, these results provide initial support for our hypothesis that confidence underlies the knowledge overlap effects from Studies 1a to 1b.

Study 2b

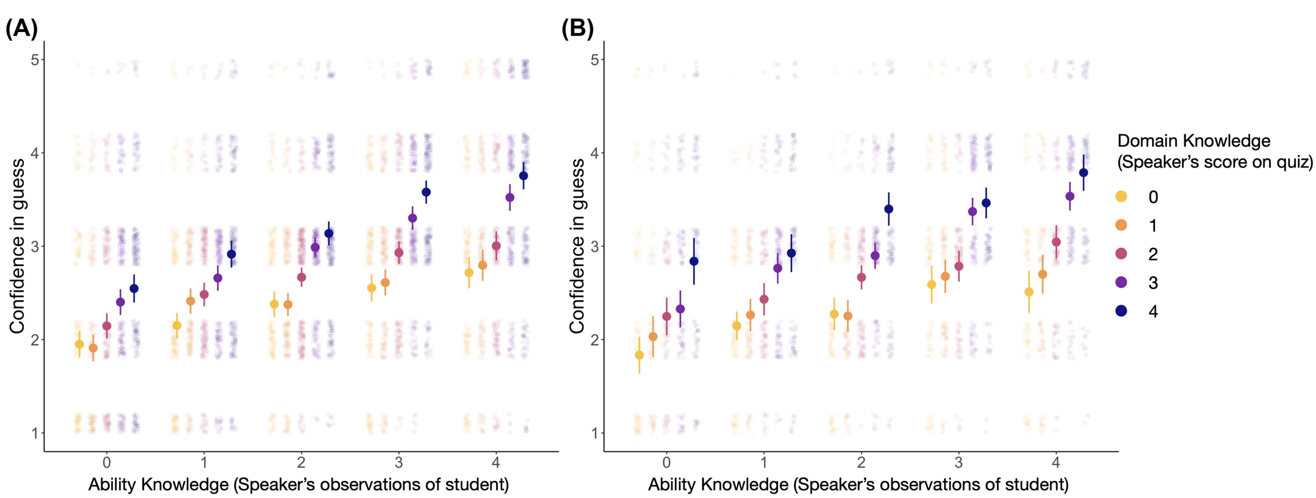
In Study 2a, participants were more likely to trust positive performance estimates from a speaker who has higher domain and ability knowledge. However, it is possible that students' evaluations of the speaker's predictions are not specific to cases where the speaker's guess is positive. Rather, reasoning about the speaker's domain and ability knowledge may underlie students' evaluations of their feedback in general, even when the specific content of the prediction is not known. Thus, in Study 2b, we provide a conceptual replication of this study that further tested the scope of students' evaluations of speakers' performance estimates. Specifically, we tested whether the same pattern as in Study 2a would emerge when the speaker's guess about the student's performance is not revealed.

Method

Participants

We tested n = 646 middle and high school students from the United States (from same sample as Study 1a; M_{age} = 14.42, SD_{age} = 2.04, age range = 10–19). Roughly equal numbers of students were

Figure 2
Results for Study 2A (A) and Study 2B (B)



Note. Ability knowledge (how many of the student's previous quiz scores the speaker saw; 0–4 quizzes) is on the X-axis; domain knowledge (the speaker's score on the final quiz; 0–4 points) is shown in different colors from gray to black. In Study 2A, the speaker always guessed that the student would get all problems correct (e.g., "Lucy guessed that Avery will get 4 of 4 problems correct on the quiz."). In Study 2B, the speaker's guess of the score was not revealed to participants (e.g., "Lucy guessed what Avery's score will be."). Participants reported how confident they were in the speaker's guess on a scale of 1–5 (*not at all confident* to *extremely confident*). Large dots show group means and small dots show individual ratings. Error bars are 95% confidence intervals. See the online article for the color version of this figure.

from each grade level (6th–12th grade, $n = 74–102$). Additional students were tested but excluded due to not completing the section ($n = 42$), providing the same rating for all test questions ($n = 95$) and failing more than one check question (see the Method section; $n = 34$). In addition (not preregistered), we excluded participants who completed the entire survey (Study 1a, Study 2b, and Study 3) in less than 25% of the median time (under 5.5 min; $n = 1$). Participants' gender, race, ethnicity, and other demographic variables (free/reduced-price lunch) had a similar breakdown as in Study 1a; see Supplemental Materials for full demographic information.

Procedure

This study was identical to Study 2a, except for two changes. First, participants learned that the speaker made a guess about the student's performance on the final quiz, but the speaker's guess was not revealed ("Lucy guessed what Avery's score will be."). As in Study 2a, participants reported their confidence in the speaker's guess ("How confident are you in Lucy's guess?"). Second, due to time constraints, each participant responded to five randomly selected trials, rather than 10. Thus, this study was within-subjects, with each participant undergoing 5 of the 25 possible trials.

Preregistered Analysis Plan

Here, we predicted that we would observe consistent results as in Study 2a, and that there would be a positive, linear relationship between each knowledge type (domain knowledge, ability knowledge) and participants' confidence in the speaker's score prediction. We followed the same analytical plan as in Study 2a, and fit a linear mixed-effects model with fixed effects for ability knowledge, domain knowledge, grade level, and the interaction between ability and domain knowledge. As in Study 2a, the random effects structure included random slopes and intercepts for ability and domain knowledge by participant.

Results

Replicating Study 2a, we found a significant interaction between ability and domain knowledge ($b = .03$, $p = .001$) and significant positive main effects of ability knowledge ($b = .17$, $p < .001$) and domain knowledge ($b = .22$, $p < .001$). Again, this suggests that participants are more confident in speakers' predictions the more the speaker has ability knowledge and domain knowledge. We did not find an effect of grade ($b = .02$, $p = .076$). See Figure 2B for results.

Next, we tested whether participants are genuinely considering the precise amount of domain and ability knowledge rather than whether the speaker has complete knowledge or not. As before, we found that the model that treated knowledge as continuous fit participant data more strongly than a model that treated knowledge as categorical (Akaike information criterion $\delta = 369.198$; exploratory analysis).

Discussion

In sum, Studies 2a and 2b showed that participants use the amount of others' domain knowledge and ability knowledge to determine how much confidence to place in a speaker's guess, both when the speaker provides a positive performance prediction (Study 2a) and even when the speaker's prediction is not revealed (Study 2b). Specifically, rather than only trusting performance estimates from those who are fully knowledgeable, participants' confidence in the speaker increased as their domain knowledge and ability knowledge increased. Furthermore, Study 2b suggests that speakers' domain and ability knowledge may inform how students evaluate feedback broadly (e.g., both positive and negative feedback), beyond just encouragement.

Thus far, these studies have focused on situations in which students were presented with hypothetical speakers whose knowledge was explicitly provided (Study 1) or inferred from their observations and performance (Study 2). Thus, the implications of these studies may be limited to cases where students are reasoning about novel or hypothetical speakers and when information about the speaker's knowledge is explicitly stated or available. To address these limitations, Study 3 explored whether our hypotheses hold in more naturalistic contexts.

Study 3

In Study 3, we investigated whether our hypothesis extends to students' reasoning about encouragement from *real people* in their lives. We presented participants with similar hypothetical scenarios as in Study 1 (studying for a challenging math exam) and asked them to report how likely they would be to seek out and be motivated by encouragement from actual people in their lives (their parents, peers, teachers). Further, by asking about participants' teachers and parents, we can test whether students simply trust authority figures (e.g., their teachers, parents), even if they do not hold high domain or ability knowledge. At the end of the section, we asked participants to report each person's domain and ability knowledge.

Method

Participants

We tested $n = 576$ middle and high school students (from the same sample as Study 1a and 2b; $M_{age} = 14.36$, $SD_{age} = 2.02$, age range = 11–18). Roughly equal numbers of students were from each grade level (6th–12th grade, $n = 71–100$). Additional participants were tested but excluded due to not completing the section ($n = 109$) or providing the same rating for all test questions ($n = 45$; preregistered criteria). Participants' gender, race, ethnicity, and other demographic variables (free/reduced-price lunch) had a similar breakdown as in Study 1a; see Supplemental Materials for full demographic information.

Procedure

First, participants wrote down (nick)names for: a parent/caregiver, their math teacher, their math teacher from the previous year, their English teacher, a friend in their math class, a friend not in their math class, and an older friend/sibling who has taken their math class (if applicable). We asked about these people, because they plausibly represented individuals in students' lives who likely vary based on their knowledge of students' abilities in math and domain knowledge of math. Participants underwent two phases in this section: seek and motivation ratings, a brief filler task (see Supplemental Materials), followed by domain knowledge and ability knowledge ratings.

In the first phase, participants were asked to imagine that they were stressed while studying for a difficult math exam. For each person that they listed above, they were asked how likely they would be to seek out encouragement from them (seek measure, 5-point scale from *not at all likely* to *extremely likely*) and how motivated they would be to study for the exam, given encouragement ("You got this!") from them (motivation measure, 5-point scale from *not at all motivated* to *extremely motivated*). Questions were asked in a fixed order (seek, then motivation) and blocked by person (e.g., participants answered all questions for each person), with person order randomized.

In the second phase, participants were asked how much each person knows about the math in their math class (domain knowledge, 5-point scale from *none at all* to *a great deal*) and their abilities in their math class (ability knowledge, 5-point scale from *none at all* to *a great deal*). As an exploratory measure, participants were additionally asked how supported they felt by each speaker (support, 5-point scale from *not at all supported* to *extremely supported*), so that we could test whether knowledge states predict whose encouragement students seek out and listen to above and beyond social support. As in the first phase, questions were asked in a fixed order (ability knowledge, domain knowledge, and support) and blocked by person, with person order randomized. This study was fully within-subjects: participants responded to the seek and motivation test questions, domain knowledge, ability knowledge, and support questions for each person listed.

Preregistered Analysis Plan

Here, we predicted that, controlling for the specific category of speaker (e.g., parent, math teacher), participants would consider their ability and domain knowledge for both the seek and motivation measure. We fit separate models for each measure. The seek model consisted of ability knowledge, domain knowledge, their interaction, grade level (6th–12th grade), and person type (math teacher as baseline; seven categories of people) as fixed effects, and random slopes and intercepts for domain knowledge by participant. The motivation model had the same fixed effects, except the random effects structure included random slopes and intercepts for both ability knowledge and domain knowledge by participant.

Transparency and Openness

The study design, hypotheses, sample size, data collection, exclusion criteria, and analysis plan were preregistered. All data, analysis code, full demographic information, and preregistrations of study and analysis plans are available at https://osf.io/vu3ya/ (Asaba et al., 2023).

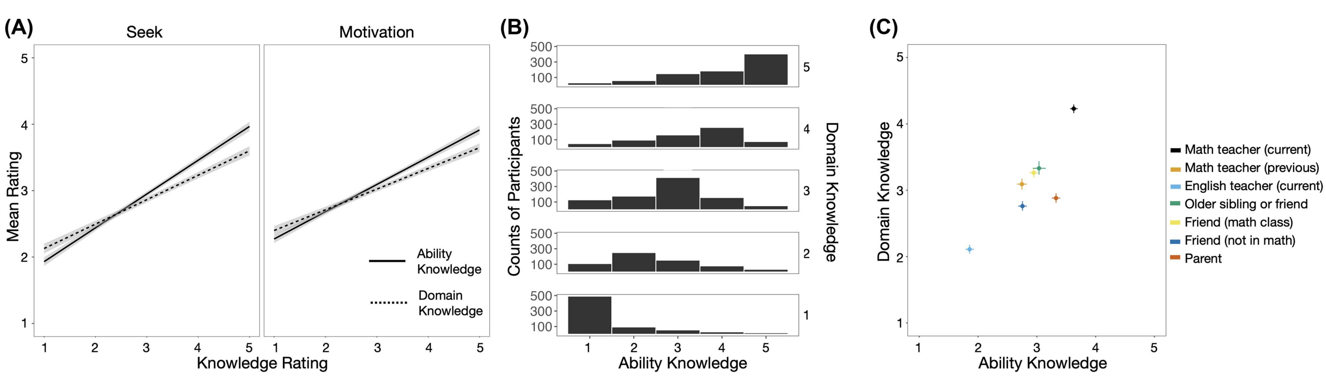
Results

We found significant positive effects for ability knowledge (seek: $b = .38$, $p < .001$; motivation: $b = .32$, $p < .001$) and domain knowledge (seek: $b = .14$, $p < .001$; motivation: $b = .17$, $p < .001$) controlling for person type and grade level; see Figure 3A. We found no interaction between ability and domain knowledge (seek: $b = .00$, $p = .744$; motivation: $b = -.01$, $p = .160$). Furthermore, we found a significant negative effect of grade level (seek: $b = -.04$, $p = .004$; motivation: $b = -.05$, $p = .001$), suggesting that participants in higher grade levels were less likely to seek out and be motivated by encouragement in general than participants in lower grades. We also found that participants provided higher ratings to the math teacher compared to nearly all other categories of people (English teacher, parent, friend in math class, friend outside of math class, and older friend or sibling; $|b|$s $> .14$, ps $< .022$), except for the previous math teacher for the seek measure ($b = -.09$, $p = .136$) and math friend for the motivation measure ($b = .06$, $p = .306$), suggesting that participants would not categorically seek out or be motivated by speakers simply because they are authority figures (e.g., teachers, parents).

Exploratory analyses revealed that participants' responses to the domain knowledge, ability knowledge, and support questions were significantly correlated (repeated-measures correlations: ability and domain knowledge $r = .56$, $p < .001$; ability knowledge and support $r = .52$, $p < .001$; domain knowledge and support $r = .32$, $p < .001$). Indeed, participants provided a very low proportion of pairs of

Figure 3

Results for Study 3



Note. (A) Correlation between knowledge ratings (solid line = ability knowledge; dashed line = domain knowledge) and the seek measure and motivation measure. (B) Histogram of participant ratings for domain knowledge and ability knowledge across person type (e.g., parent, math teacher, math friend). (C) Mean domain and ability knowledge ratings by person type. Error bars and bands represent 95% confidence intervals. See the online article for the color version of this figure.

ratings that were high in domain knowledge and low in domain knowledge and vice versa (see Figure 3B for distributions of knowledge ratings). That is, despite asking about a range of people in students' lives, this study did not capture people who are high in only one type of knowledge, as we intended. The General Discussion section explores this result further.

Given that perceived support was highly correlated with domain knowledge and ability knowledge, next we examined whether domain and ability knowledge predict how likely students are to seek out and listen to various people, after partialing out the variance captured by perceived support. Specifically, we tested whether domain knowledge and ability knowledge predict the residuals of regressions trained on participants' responses to the support question for the seek and motivation measures. We find significant effects for ability knowledge (seek: $b = .09$, $p < .001$; motivation: $b = .03$, $p = .008$) and domain knowledge (seek: $b = .05$, $p < .001$; motivation: $b = .04$, $p < .001$) on the residuals for both measures. These results suggest that domain and ability knowledge indeed inform students' decisions about whose encouragement to seek out and listen to, even when taking into account how generally supported students feel by the speaker.

Finally, we explored which person has the highest ability knowledge and domain knowledge on average. To examine this, we ran linear mixed-effects models with fixed effects for person type (e.g., math teacher, parent, etc.) and grade level (6th–12th grade) as fixed effects and random intercepts for participant. We found that, for both domain and ability knowledge, participants provided higher ratings to the math teacher compared to all the other types of people (all ps $< .001$ for domain and ability knowledge; see Figure 3C). We also found negative effects of grade level (math knowledge: $b = -.06$, $p < .001$; ability knowledge: $b = -.06$, $p < .001$), showing that participants in higher grade levels provided lower domain and ability knowledge ratings to these people in their lives.

Discussion

Study 3 found a similar pattern as Studies 1 and 2, even though students were reasoning about real people in their lives, and their knowledge was not explicitly provided: Students reported being most likely to seek out and be motivated by hypothetical encouragement from people in their lives with high domain and ability knowledge. Furthermore, rather than providing similar seek and motivation ratings to all authority figures (e.g., teachers, parents), participants differentiated between them and provided the highest ratings to their math teacher (who also had the highest average domain and ability knowledge ratings). Finally, results from Study 3 also suggest that students report being less likely to seek out or be motivated by encouragement as they get older, which is consistent with their overall lower knowledge ratings of the people they considered (see Greene et al., 2010, for a similar developmental decline). See Figure 4 results for mean ratings for each experiment and measure.

General Discussion

Across three preregistered studies, we investigated whose encouragement middle and high school students report that they would seek out and find motivating in academic STEM contexts. We predicted that students would be more likely to report seeking out and being motivated by encouragement from a speaker with relevant domain knowledge (e.g., math knowledge) and relevant ability knowledge (e.g., their math skills). We found support for this hypothesis when students reasoned about hypothetical classmates, whose knowledge was explicitly provided (Study 1) and real people in their lives, whose knowledge was not provided (Study 3). Furthermore, we found that confidence in others' performance predictions may be a mechanism underlying these processes: Students' confidence in a speaker's performance estimate linearly increased as the speaker's domain and ability knowledge increased (Study 2).

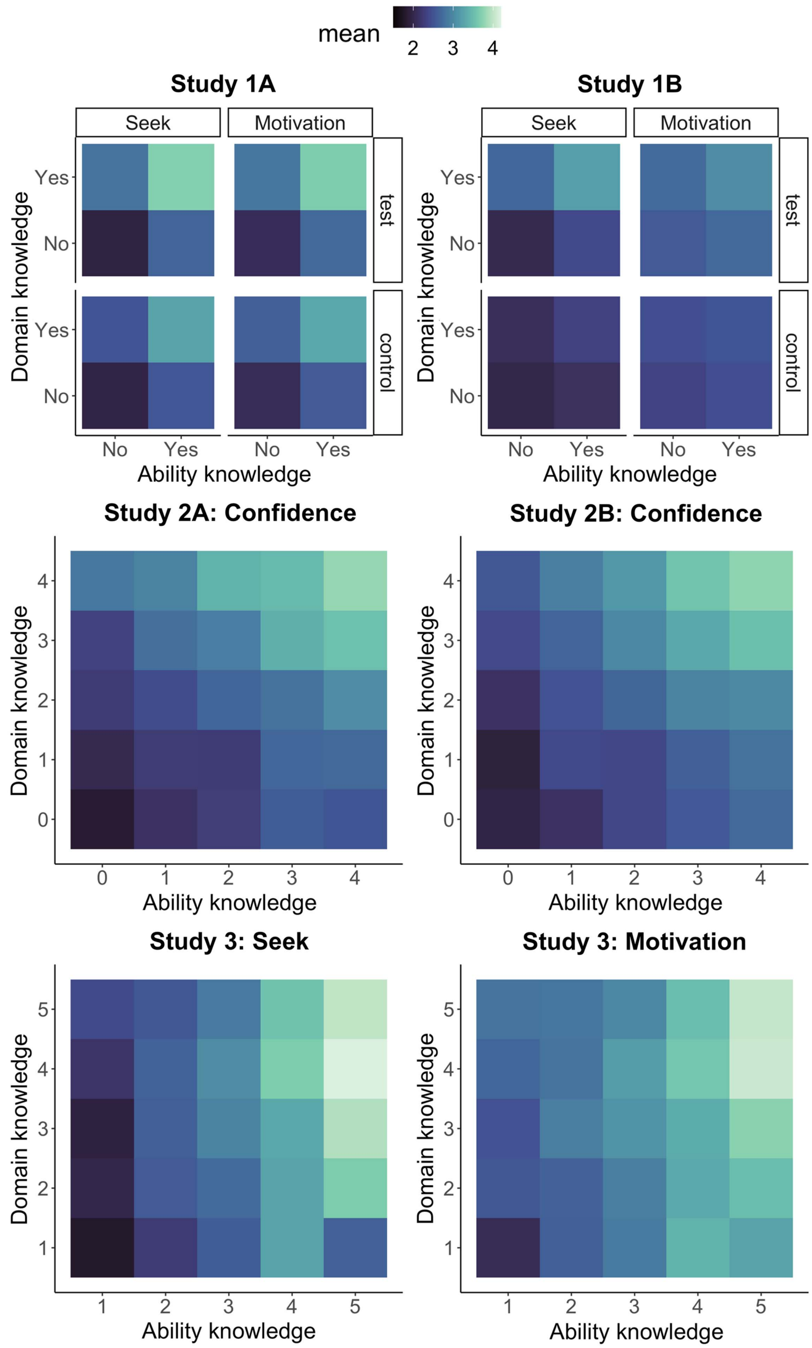
Our findings are consistent with prior literature on children's evaluations of pedagogy (Bass et al., 2021; Lutz & Keil, 2002), which suggests that children consider domain knowledge and ability knowledge when interpreting others' statements of fact or task recommendations. Our work also contributes to literature on positive feedback by examining the cognitive processes underlying how students evaluate this input. Prior work has focused on the effect of different contents or types of praise on behavior (Henderlong & Lepper, 2002; Henderlong Corpus & Lepper, 2007; Jenkins et al., 2015; Kamins & Dweck, 1999; Lipnevich et al., 2023; though see Asaba et al., 2018). Here, we find that students' responses to feedback go beyond its exact content: Students treat the same generic, vague encouragement differently depending on the speaker's knowledge about their abilities and the task at hand. Notably, we observed this effect when the speakers' relationships to the participant were matched (e.g., all peers; Study 1a, 2a–2b) and when they varied (parents, teachers, peers; Study 3). Of course, certain contents of feedback may be more motivating than others (e.g., detailed feedback, see Lipnevich et al., 2023) or affect student–teacher relationships and classroom satisfaction (Burnett, 2002). Future work can test how the effects of the specific content of feedback and its speaker interact to influence students' persistence.

Results from Study 2 suggest that *confidence* in a speaker's judgments may underlie the effect of students being more likely to seek out and be motivated by encouragement from a speaker with high domain and ability knowledge. Specifically, Studies 2a–2b revealed that participants were more confident in a speaker's performance predictions, when the speaker had seen more of the student's prior quiz scores (i.e., ability knowledge) and had received a higher score on the final quiz (i.e., domain knowledge). These findings are consistent with prior work showing that children and adults are more likely to listen to a speaker, when they have more confidence in their testimony or pedagogy (Harris et al., 2018). However, we did not ask participants to rate how likely they would be to seek out and be motivated by encouragement from speakers in Study 2, so it is unclear how exactly participants' confidence in performance predictions relates to whose encouragement they would seek out and be motivated by. One possibility is that students' actual feedback-seeking and persistence behaviors linearly track with their confidence in the speaker. It is also possible that the relationship between confidence and these achievement behaviors is more nuanced and follows a different pattern (e.g., a step function). More research is needed to directly test the relationship between students' confidence in a speaker's feedback and their achievement-related behaviors.

Throughout, we also considered two alternative possibilities: that students are most motivated by (a) experts in one dimension (e.g., high ability knowledge *or* high domain knowledge) or (b) authority figures. Across all experiments, we found that students reported

Figure 4

Mean Ratings for Measures in Studies 1–3



Note. Domain knowledge is shown on the *Y*-axis and ability knowledge is shown on the *X*-axis. Mean participant ratings for each measure are shown from darker to lighter colors (lower to higher means); all measures (seek, motivation, and confidence) were on a 5-point scale. In Study 1a–1b, domain knowledge and ability knowledge were binary (yes or no). In Studies 2–3, domain knowledge and ability knowledge were manipulated (Study 2) or rated (Study 3) on a 5-point scale. See the online article for the color version of this figure.

that speakers with high domain *and* ability knowledge were more motivating than speakers with only high domain *or* ability knowledge. Furthermore, we did not find evidence here that students solely seek out or listen to encouragement from authority figures (e.g., their teachers), regardless of their knowledge. However, in addition to others' knowledge states, students may consider other features of the speaker. For example, in Study 3, we found that how supported students felt by each speaker also predicted their report of how likely they would be to seek out and be motivated by the speaker. Thus, an important line of future research is to investigate how students consider others' knowledge states alongside other social factors, such as speaker warmth or closeness (Finkelstein et al., 2017), and how these factors may influence each other.

Our work has a number of limitations. First, the findings from our study are limited in the extent to which they might generalize to other populations and contexts. Specifically, our claims are limited to students in the United States, a context where parents and educators typically use positive feedback as a tool to motivate children and raise their self-esteem (Brummelman, 2020). It may be particularly important for students in this cultural context to discern whose feedback is meaningful by considering the speakers' knowledge. However, in contexts where positive feedback is less prevalent or not typically used as a motivational tool, this type of reasoning may be less critical. Future work should explore whether and how students consider others' knowledge states in cultural contexts where positive feedback is given less often.

Second, our claims are limited by our experimental design choices. We presented students with hypothetical scenarios and measured their responses via self-report. Although these experimental methods allowed us to carefully control speaker knowledge and minimize other confounding variables, they are limited in how they might generalize to students' actual feedback-seeking and motivation behaviors. For example, there may be differences in who students *report* that they would seek feedback from and who students *actually* seek feedback from: It could be that students default to seeking feedback from people they feel closest to (Fishbach et al., 2010) even if such people do not have relevant knowledge. Furthermore, for all studies, we employed a within-subjects design, such that participants observed multiple types of speakers in each study. Although this design allowed us to reduce participant-level variability and increase power, it may have also inadvertently increased the likelihood that participants inferred the study's purpose and expectations. To address both of these limitations, it would be ideal to run a large-scale, between-subjects experiment manipulating students' perceptions of others' knowledge states and measuring students' actual feedback-seeking and persistence behaviors. Such a study would ideally pair a highly controlled in-lab experiment with a naturalistic experiment with students' actual peers, teachers, and parents.

This work prompts future lines of inquiry, especially regarding real-world implications. First, future work can explore the extent to which domain and ability knowledge naturally co-occur in the real world. In Study 3, when participants provided knowledge ratings themselves, we found strong correlations between domain and ability knowledge and did not find interactions between them. It is unclear whether these correlations reflect high overlaps in these types of knowledge in the real world, or whether we simply did not ask about the "right" people that would fully cross domain and ability knowledge. It is also possible that, in the real world, these types of knowledge depend on one another (e.g., having ability knowledge about a student might require or depend on relevant domain knowledge). Second, these questions prompt future research on exactly what contents of knowledge are most relevant to students' decision-making in the real world. Our studies presented speaker knowledge in different ways: Study 1 explicitly provided speaker knowledge, Study 2 operationalized domain knowledge as the speaker's own performance and ability knowledge as the speaker's prior observations of the student's performance, and Study 3 asked participants to provide knowledge ratings themselves. Although we observed consistent effects across experiments, it is not clear which aspects of domain knowledge (e.g., broad content knowledge, task difficulty) or ability knowledge (e.g., general aptitude in a domain, specific skills needed for a task) most predict students' seeking and motivation behaviors and future work should fill this gap.

Another future direction is to test the implications of these findings for interventions aimed at increasing academic achievement. Currently, schools often recruit motivational speakers for school assemblies or graduates (e.g., commencement speakers) who often know little about the students and give generic feedback and advice. It would be important to test how motivating these speakers are on students' actual behaviors, compared to knowledgeable sources in students' lives. Given our findings, we hypothesize that a more effective approach may be to match students with mentors who are knowledgeable about them and their tasks (e.g., matching students with peers in older grades; see Karcher, 2005) to see if this model increases academic success. Another approach would be to provide more opportunities for teachers, peers, and parents to learn about students and their coursework at the beginning of the year, such that they gain knowledge in both, and thus create a supportive environment for students. Note that we found consistent results across experiments when we analyzed only responses from participants who are racial minorities or participants who receive free and/or reduced-price lunch (see Supplemental Materials for details). Given that students from disadvantaged backgrounds tend to enroll in fewer challenging STEM courses (e.g., AP classes, Xie et al., 2015), it may be especially important to test the effectiveness of the abovementioned interventions in at-risk populations. Finally, future work should test the long-term effects of such interventions on achievement beyond high school and even well-being.

Conclusion

Students are often faced with decisions about what tasks to pursue and how hard to try. Here, we find that not all encouragement is equally motivating. Rather, encouragement is most motivating when it comes from someone who knows about the domain of the task and students' abilities in that domain. To effectively motivate students from all backgrounds to take on and persist with challenges, it may be important to match them with people who they will actually listen to: those who know their abilities and the task at hand.

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