Adolescents are most motivated by encouragement from someone who knows their abilities and the domain

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Abstract

Parents and teachers often encourage students (e.g., "You can do it!") when they encounter challenges, but these messages are not always effective. Whose encouragement motivates students the most, and why? Here we tested the hypothesis that others' domain knowledge (e.g., knowledge about course materials) and ability knowledge (e.g., knowledge about students' abilities in the course) each inform how students evaluate their encouragement. In a large-scale survey, we find that middle school students (n=288) and high school students (n=425) are most likely to seek out and be motivated by encouragement from someone with both domain and ability knowledge, rather than only one or the other. This effect emerged both when students reasoned about hypothetical classmates (Study 1a) and real people in their lives (Study 1b). Moreover, we find that confidence in others' performance estimates linearly increases when they have greater ability and domain knowledge (Study 1c). Collectively, this work suggests that students do not find all encouragement equally motivating. Rather, students find encouragement most motivating when the speaker has knowledge of their abilities and the domain.

Keywords: Motivation; Encouragement; Social Cognition; Knowledge

Introduction

Students are constantly faced with learning decisions, like which classes to take or how hard to study, that have long-term consequences for their academic achievement (e.g., Yeager et al., 2019; Duckworth, Peterson, Matthews, & Kelly, 2007). However, students often have to make these decisions with incomplete knowledge. For example, a student may have to choose between taking regular math or AP calculus without knowing their aptitude in either or even the difficulty of the courses. How then do students make these learning decisions?

One critical source of input for students' learning decisions is feedback from others. In particular, parents and teachers frequently try to motivate students by providing encouragement (e.g., "You can do it!"; Beets, Cardinal, & Alderman, 2010). Encouragement may be an especially valuable form of feedback, as it typically conveys expectations about future performance (e.g., Henderlong & Lepper, 2002). Past work has shown how specific types of praise (e.g., ability vs. effort praise, Mueller & Dweck, 1998; inflated praise, Brummelman, Thomaes, Orobio de Castro, Overbeek, & Bushman, 2014; generic praise, Cimpian, Arce, Markman, & Dweck, 2007) differentially impact children's motivation. Yet, we know relatively little about whether motivational feedback is interpreted differently depending on who provides it. Here, we fill this gap by examining the person-specific factors that make social feedback more or less motivating for students.

Intuitively, even the exact same piece of encouragement ("You can do it!") can be more or less motivating depending on who it comes from, because of what they know. For example, imagine that you are struggling in an advanced-level cognitive science methods course, and you are thinking about dropping the class. Let's say that your parent tells you, "You can do it!" While this may make you *feel good* (Yoon, Tessler, Goodman, & Frank, 2020), this may not necessarily motivate you to stick with the course—presumably, your parent does not know the course content, nor your abilities in cognitive science. Now let's say that your labmate, who has already taken the course, tells you, "You can do it!" This encouragement may genuinely motivate you to keep persisting in the course—your labmate knows the course material and knows your technical skills. Although parents and labmates differ in many ways aside from what they know (e.g., how close you are to them, or how much authority they have), one possibility is that their domain knowledge (e.g., the material in a course) and ability knowledge (e.g., your skills related to the course) are key dimensions by which you evaluate their encouragement. That is, independent of the student's relationship to the speaker (e.g., a parent vs. a labmate), encouragement may be most motivating when it comes from someone who has *both* domain and ability knowledge, compared to someone who has only domain knowledge or ability knowledge, or neither.

Indeed, prior work in developmental cognitive science provides some initial support for this hypothesis. First, young children understand that people can have knowledge about different domains (e.g., Lutz & Keil, 2002; VanderBorght & Jaswal, 2009). Furthermore, children seek out information from more knowledgeable teachers (e.g., Birch, Vauthier, & Bloom, 2008; Harris, Koenig, Corriveau, & Jaswal, 2018) and evaluate testimony and demonstrations depending on others' knowledge (e.g., Bonawitz et al., 2011; Gweon, 2021). Second, recent work suggests that children can infer others' knowledge or beliefs about their own abilities from others' observations of the self (Asaba & Gweon, 2021). School-aged children can use these representations to interpret others' pedagogy (Bass, Mahaffey, & Bonawitz, 2021). For instance, 6-8 year-olds are more likely to take a teacher's recommendation of which task to try if the teacher has accurate beliefs about their abilities (Bass et al., 2021).

Notably, these studies have tested the role of others' domain knowledge and ability knowledge in isolation (i.e., only manipulating one type of knowledge) and only in the context of evaluating teaching. Thus, it is not known whether students consider *both* others' domain knowledge and their ability knowledge when reasoning about their *motivational feedback*. Although past work suggests that children are sensitive to mental states when reasoning about others' testimony (e.g., Gweon, 2021), it is possible that students simply treat others' encouragement as positive reinforcement (Forness, 1973) and do not consider who is providing the positive feedback. It is also possible that students evaluate motivational feedback depending on whether others are knowledgeable or ignorant, but do not take into account how relevant others' knowledge is to their current academic decision.

Current Study

Here we ask whether students in the United States seek out and respond to encouragement depending on the speaker's domain and ability knowledge. Rather than focus on the emergence of these capacities by testing young children, we examine a period of development when others' motivational messages may have important, real-world impact: adolescence. Middle and high school students are in a critical period of academic growth, in which they typically have more autonomy over their learning decisions, but often experience setbacks (e.g., struggling in a course) and can fall behind without proper support (see Eccles & Roeser, 2009; Wentzel, 1998).

We tested two main predictions: Students are most likely to (i) seek out and (ii) be motivated by encouragement from a speaker who has both domain and ability knowledge ("knowledge overlap"), compared to a speaker who has either domain or ability knowledge, or neither, even when all speakers provide the same content of encouragement. To this end, we conducted a large-scale, preregistered online study with three main sections (Study 1a, 1b, and 1c; separate exclusion criteria for each section), through the Character Lab Research Network.[1] Study 1a explicitly provided speakers' (hypothetical classmates) domain and ability knowledge to participants (e.g., "a classmate who knows your math abilities and has already taken your math class") and asked participants whose encouragement they would seek out and find motivating. Study 1b asked participants to reason about encouragement from people in their actual lives (e.g., their parents, teachers, peers) and provide ratings on each person's domain and ability knowledge. Finally, Study 1c investigated a potential mechanism underlying participants' judgments in a 3rd-person paradigm: confidence in others' performance estimates. Throughout, we specifically focus on encouragement about math and science (i.e., STEM) courses, given that STEM enrollment and participation can lead to increased career opportunities and social mobility, especially for disadvantaged students (Rozek, Ramirez, Fine, & Beilock, 2019). Our survey, preregistrations, data, analyses, and full demographic information can be found here: https://osf.io/vu3ya/.

Study 1a: Hypothetical Classmates

In Study 1a, participants were asked to reason about encouragement from hypothetical classmates, whose knowledge was explicitly provided.

Participants

We tested *n*=288[2] middle school (ms) students (Mean age: 12.26 years, SD: .91, Range: 11-15; Gender: 44.1% girls, 45.1% boys, 4.9% other, 5.9% no response; Race: 64.2% White, 59.7% Hispanic, 15.6% Black, 8.3% Asian, 1.4% Multiracial, 10.4% no response), and *n*=425 high school (hs) students (Mean age: 15.74 years, SD: 1.23, Range: 13-19 years; Gender: 50.4% girls, 45.4% boys, 2.1% other, 2.1% no response; Race: 48.9% White, 38.1% Hispanic, 18.8% Black, 7.3% Asian, 3.1% Multiracial, 0.7% Pacific Islander, 0.2% American Indian/Alaska Native, 8.9% no response) from the United States. Additional students were tested but excluded for not completing the section (*n*=11 ms; *n*=9 hs) or providing the same rating for all test questions (*n*=26 ms; *n*=70 hs).

Methods

Participants read six vignettes about first-person hypothetical academic situations (four test vignettes, two control vignettes; order randomized), and provided ratings for four classmates (order randomized) in each vignette, for a total of 24 ratings per participant.

The test vignettes were about studying for a math/science exam (persistence context) or deciding whether or not to take an advanced math/science course (challenge-seeking context). Two vignettes asked whose encouragement they would seek out (Seek DV), and two asked how motivated they would be given others' encouragement (Motivation DV), for four test vignettes total (persistence/challenge-seeking context and domain of math/science counterbalanced across vignettes).

The following are examples of Seek and Motivation vignettes: "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?" (Seek - challenge-seeking context about math); "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!'" (Motivation - persistence context about math).

[1] A consortium of middle and high schools in the US that partner with scientists to advance research that help students thrive.

[2] A power analysis using pilot data showed that we needed at least 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.

For each vignette, participants provided ratings for 4 hypothetical classmates, who varied in their domain and ability knowledge (following example shows math domain): a classmate who (i) "knows your math abilities and has already taken the math class" (Knows Both), (ii) "knows your math abilities and has not taken the math class" (Knows Abilities), (iii) "does not know your math abilities and has already taken the math class" (Knows Class), and (iv) "does not know your math abilities and has not already taken the math class" (Knows Neither). Ratings were on a 5-point scale: Not at all likely to Extremely likely (Seek DV) or Not at all motivated to Extremely motivated (Motivation DV).

The two control vignettes were designed to address the possibility that students treat any knowledge as equally beneficial, regardless of its relevance to the context. The controls were identical to the test vignettes, except that they were about an English course, rather than math or science (e.g., "Let's say that you have a difficult English exam coming up..."). Participants saw one seek vignette and one motivation vignette. The same 4 classmates as in the test vignettes were used (e.g., a classmate who knows their math abilities and has already taken the math class), such that their knowledge was less relevant to the context; i.e., encouragement about studying for an English exam from a classmate who has knowledge about the math course and math ability may be less meaningful than encouragement from that same person about a math exam. To avoid confusion about these scenarios, we included a note that there are no typos in the text.

Our key hypothesis was that participants would consider hypothetical classmates' domain *and* ability knowledge for both Seek and Motivation DVs, such that they would provide the highest ratings to the classmate with the knowledge overlap (the "knows both" classmate), followed by the classmate who knows only one or the other, and provide the lowest ratings to the classmate who knows neither. We also predicted that we would see this pattern specifically in the test vignettes, and not in the control vignettes. Note that we varied the learning behavior (persistence vs. challenge-seeking) and domain (math vs. science) to develop a richer set of vignettes, but we did not expect to find differences between them.

Results

We fit linear mixed-effects models for each DV (Seek, Motivation) separately for Test and Control vignettes, and separately for middle school and high school students. As per our preregistration, for all analyses in all experiments, we used the maximal model that converged (Barr, Levy, Scheepers, & Tily, 2013), so the random-effects structure may vary across models depending on when they converged. For brevity, we describe the final models for the Test Seek and Test Motivation vignettes for high school students only.

For the Test Seek vignettes, the final model consisted of ability knowledge (1 or 0), domain knowledge (1 or 0), and their interaction as fixed effects, and random slopes and intercepts for ability and domain knowledge by participant. The Test Motivation model was the same, except we included random slopes and intercepts for ability knowledge by participant and random slopes and intercepts by ability and domain knowledge by learning behavior (persistence, challenge-seeking).

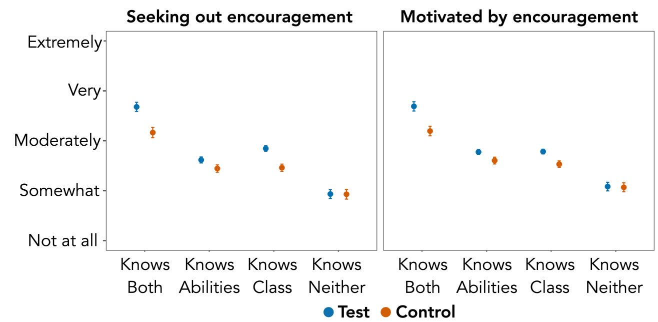

Figure 1: Results from Study 1a (High School). Mean ratings for how likely participants would be to seek out (Seek) encouragement or be motivated by encouragement (Motivation) from each classmate. Error bars represent 95% CIs.

For the Test Seek vignettes, we found a significant interaction between domain and ability knowledge (ms: $\beta = .27$, $p < .001$; hs: $\beta = .15$, $p < .001$), and significant positive effects of ability knowledge (ms: $\beta = .73$, $p < .001$; hs: $\beta = .68$, $p < .001$) and domain knowledge (ms: $\beta = .75$, $p < .001$; hs: $\beta = .91$, $p < .001$) on how likely participants were to seek encouragement from each classmate. See Figure 2.[3] Similarly, for the Test Motivation vignettes, we found a significant interaction between domain and ability knowledge (ms: $\beta = .21$, $p = .008$; hs: $\beta = .21$, $p < .001$), and significant positive effects of ability knowledge (ms: $\beta = .63$, $p < .001$; hs: $\beta = .69$, $p < .001$) and domain knowledge (ms: $\beta = .68$, $p < .001$; hs: $\beta = .70$, $p < .001$) on students' (self-reported) motivation following encouragement. Follow-up analyses (lmer model with classmate type predicting ratings) revealed that both samples provided higher ratings to the "knows both" classmate compared to the "knows abilities" classmate, the "knows class" classmate, and the "knows neither" classmate, for Seek and Motivation vignettes ($p's < .001$).

Surprisingly, for the Control Seek vignette, we also found a significant interaction between domain and ability knowledge (ms: $\beta = 1.33$, $p < .001$; hs: $\beta = .19$, $p = .018$), significant positive effects for domain knowledge (ms: $\beta = .56$, $p < .001$; hs: $\beta = .53$, $p < .001$) and significant positive effects of ability knowledge only for high school students, not middle school students (ms: $\beta = .08$, $p = .344$; hs: $\beta = .52$, $p < .001$). Similarly, for the Control Motivation vignette, we found a significant interaction between domain and ability knowledge for the middle school sample ($\beta = .22$, $p = .041$), and a marginal interaction for the high school sample ($\beta = .13$, $p = .079$), and in both groups, significant positive effects of domain knowledge (ms: $\beta = .56$, $p < .001$;

[3]Due to space constraints, all figures show only the high school results. Middle school results look qualitatively the same.

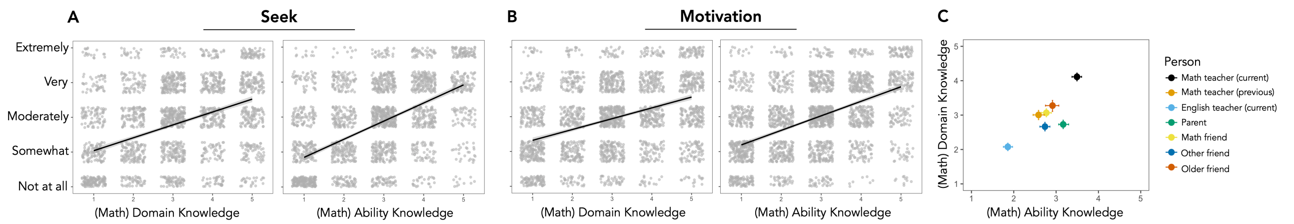

Figure 2: Results from Study 1b (High School). A and B: Individual ratings (grey dots) for Seek (A) and Motivation (B) ratings collapsed across person type (e.g., math teacher, parent), with best fit line and standard error. C: Mean Domain and Ability knowledge ratings by person. Error bars represent 95% CIs.

hs: $\beta = .46$, $p < .001$) and ability knowledge (ms: $\beta = .57$, $p < .001$; hs: $\beta = .54$, $p < .001$).

However, exploratory follow-up analyses comparing the test and control vignettes revealed that middle and high school students provided higher ratings to the "knows both" classmate, the "knows abilities" classmate, and the "knows class" classmate in the test vs. control vignettes. We did not find differences between test and control ratings for the "knows neither" classmate. These post-hoc analyses suggest that students 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.

Taken together, these results provide initial evidence that students consider others' domain and ability knowledge, when reporting whose encouragement they would seek out and be motivated by. Though we found similar patterns of results in the Test and Control scenarios, our exploratory analyses suggest that students were not simply using a heuristic that any knowledge is equally motivating. Rather, students were more likely to seek out and be motivated by encouragement from hypothetical individuals with more *relevant* domain and/or ability knowledge. However, in the real world, students do not receive explicit information about others' domain and ability knowledge. To test whether students spontaneously consider others' domain and ability knowledge when evaluating their feedback, we asked students in the next study to reason about hypothetical encouragement from real people in their lives without explicitly providing their knowledge.

Study 1b: Real People

In Study 1b, we used similar hypothetical scenarios as in Study 1a, but had participants reason about encouragement from *real people* they know (e.g., their parents, teachers, peers). At the end of the section, we asked participants to rate each person's domain knowledge and ability knowledge.

Participants

We surveyed n=264 middle school students and n=411 high school students (from the same survey as Study 1a). Additional students were tested but excluded due to not completing all parts of the section (n=45 ms; n=64 hs) or providing the same rating for all test questions (n=16 ms; n=29 hs).

Methods

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.

Next, 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 DV, 5-point scale from Not at all to Extremely Likely) and how motivated they would be to study for the exam, given encouragement from them (Motivation DV, 5-point scale from Not at all to Extremely Motivated). Questions were asked in a fixed order (Seek, then Motivation) and blocked by person (e.g., math teacher, parent; person order randomized).

Finally, 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 current math class (Ability Knowledge, 5-point scale from None at all to A great deal). Thus, by the end of this section, participants responded to the Seek and Motivation test questions, and Domain Knowledge and Ability Knowledge questions for each person.

Results

Using the same analytical plan as Study 1a, we ran the maximal models that converged for the Seek and Motivation questions, separately for the middle and high school samples. For the Seek and the Motivation models for the high school sample, we included fixed effects for domain knowledge (1-5) and ability knowledge (1-5), and their interaction, and random slopes and intercepts for ability knowledge by person type (e.g., parent, math teacher) and participant. See OSF for middle school models (https://osf.io/vu3ya/).

Strikingly, participants considered others' domain and ability knowledge when evaluating their encouragement without explicit prompting: Both middle and high school students reported that they would be more likely to seek out encouragement from those with more domain knowledge (ms: β = .16, p = .002; hs: β = .13, $p < .001$) and ability knowledge (ms: β = .37, $p < .001$; hs: β = .39, $p < .001$); we did not find an interaction between domain and ability knowledge (ms: β = −.81, p = .600; hs: β = .005, p = .695).

Similarly, students reported that they would be more motivated following encouragement from those with more domain (ms: β = .15, p = .001; hs: β = .16, $p < .001$) and ability knowledge (ms: β = .26, $p < .001$; hs: β = .33, $p < .001$). Again, we did not find an interaction (ms: β = −.006, p = .640; hs: β = −.01, p = .334). Interestingly, however, domain and ability knowledge were highly correlated in all reported individuals ($p's < .001$; see Fig. 2C). In other words, despite asking about several different people, this more ecological study failed to probe students' reasoning about people who were high in one type of knowledge but low in the other.

Here, we found that students spontaneously considered others' domain and ability knowledge when evaluating hypothetical encouragement from real people in their lives. Taken together, results from Study 1a and b provide initial evidence that students would be most likely to seek out and be motivated by those with the knowledge overlap. However, it is unclear what specific inferences underlie this effect.

Study 1c: Confidence

Why would students be more likely to seek out and listen to encouragement from someone with higher ability and domain knowledge? Considering that encouragement is a prediction of future success, we hypothesized that students' confidence in others' predictions scales with the magnitude of others' domain knowledge and ability knowledge. Alternatively, it is also possible that students entirely discount predictions from speakers who do not have full knowledge. To test our hypothesis, we developed a 3rd-person task that parametrically varied a speaker's domain and ability knowledge and probed participants' confidence in the speaker's performance estimate.

Participants

We tested n=258 middle school students and n=400 high school students (from the same survey as Study 1a-b). Additional students were tested but excluded for failing to complete the section (n=18 ms; n=24 hs), providing the same rating for all test questions (n=39 ms; n=56 hs), or failing more than 1 check question (see Methods; n=10 ms; n=24 hs).

Methods

Participants learned that students in a classroom had taken 4 math quizzes and were about to take their 5th quiz. In each trial, participants met a unique student (e.g., "Avery") who was about to take their 5th quiz, and a unique speaker (e.g., "Lucy") who made a guess about the student's score on the quiz. Participants were shown how many of the student's previous 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 what Avery's score will be. How confident are you in Lucy's guess?" (5-point scale). Participants were not told the speaker's prediction.

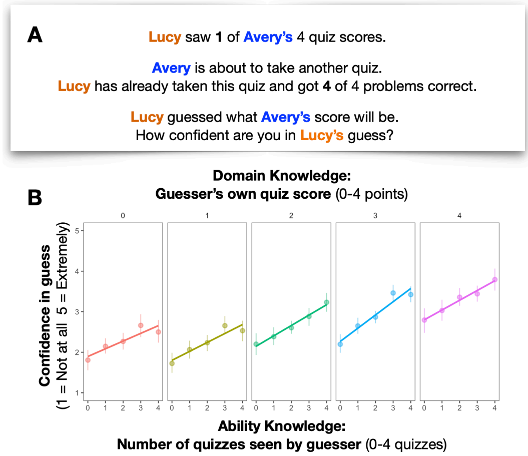

Figure 3: Example trial (A) and results (B; High School) from Study 1c. Mean confidence ratings and 95% CIs for each trial.

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. Each participant saw 5 randomly selected trials.

Results

Using the same analytical plan as Study 1a and 1b, we ran the maximal model that converged: number of quizzes seen by the speaker (0-4 quizzes) and the speaker's prior quiz score (0-4 points) as fixed effects, with an interaction term between them, and subject as a random intercept, to predict participant's confidence ratings (same model for ms and hs). We found a marginal non-significant interaction between the number of quizzes seen and the speaker's quiz score in middle school students (β = .03, p = .073) and a significant interaction in high school students (β = .03, p = .022). For both groups, we found a significant positive effect of number of previous quizzes seen (ms: β = .13, $p < .001$; hs: β = .20, $p < .001$) and prior quiz score (ms: β = .21, $p < .001$; hs: β = .22, $p < .001$) on participants' confidence ratings.

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). 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-b.

General Discussion

In this preregistered, large-scale survey, we investigated whose encouragement middle and high school students seek out and find motivating in academic contexts. We predicted that students would be more likely to seek out and be motivated by encouragement from a speaker with both domain knowledge (e.g., the material on a math exam) and ability knowledge (e.g., their math skills), compared to a speaker with just one or the other, or neither. Indeed, this pattern emerged when students reasoned about hypothetical classmates, whose knowledge was explicitly provided (Study 1a), and real people in their lives, whose knowledge was not provided (Study 1b). Furthermore, Study 1c suggests that confidence in others' performance predictions may be a mechanism underlying these processes: Students were more confident in performance estimates from speakers who had higher domain *and* ability knowledge.

Our work contributes to research on motivational feedback by highlighting the importance of *who* is providing feedback and what they know. Furthermore, we specifically tested students' reasoning about encouragement, a relatively understudied, yet common form of feedback. Moving beyond past work on the role of others' ability and domain knowledge (in isolation, e.g., Lutz & Keil, 2002; Asaba & Gweon, 2021) when children evaluate teaching, our findings show that students consider *both* when evaluating encouragement. Notably, we observed this effect when the speakers' relationships to the participant were controlled for (e.g., all peers; Study 1a) and when they varied (parents, teachers, peers; Study 1b). These results suggest that adolescents do not find all encouraging equally motivating; rather, they evaluate encouragement given the relevance of the speaker's knowledge.

In Study 1a, we found an effect of domain and ability knowledge, even when this knowledge was less relevant to the context (i.e., in the control scenarios). However, we found that participants provided higher ratings for each classmate (except the "knows neither" classmate) in the Test compared to the Control scenarios. Furthermore, pilot data suggests that the overall pattern does not emerge when students are asked to reason about classmates with knowledge about sports and their sports abilities (i.e., a domain that is even less relevant than English). These findings suggest that students do not treat all knowledge as equally beneficial. Nonetheless, even when others have less relevant domain or ability knowledge, students may infer that they still know something about broad aspects of the self (e.g., their study habits). Future work can investigate students' inferences about others' representations of their broad academic traits, and how this relates to their evaluations of others' encouragement.

Although we found consistent results across studies, there are important differences between them that merit closer inquiry. Specifically, Studies 1a-b told or asked participants about others' "knowledge about your math class" (or told them that the speaker had "taken the math class before"), or "knowledge about your math abilities", whereas Study 1c operationalized domain knowledge as the speaker's own performance, and ability knowledge as the speaker's prior observations of the student. Thus, it is unclear which specific aspects of domain and ability knowledge students are representing. For example, take domain knowledge: are students using test scores to infer others' broad domain knowledge, or to infer others' knowledge of task difficulty, specifically? Furthermore, while Study 1a and 1c manipulated domain and ability knowledge, Study 1b asked participants to provide ratings for each, and we found strong correlations between them. This suggests that these "types" of knowledge may be dependent on one another, or at least that they are highly overlapping in real-world contexts. Finally, Studies 1a and 1b asked about responses to encouragement, whereas Study 1c asked for confidence in performance estimates, leaving open questions about how these are related to one another. Ongoing work is building a computational model of encouragement that will help fill these gaps. The model will formalize these knowledge representations, how they are connected (or not), and how confidence in performance estimates relates to students' responses to encouragement.

This study leaves open a number of questions. First, in Studies 1a and b, we asked participants to *self-report* how likely they would be to seek out and be motivated by others' encouragement, so we do not know yet whether or how participants' actual behaviors would be affected and whether task demands influenced our results (i.e., thinking that they were supposed to consider others' knowledge; Study 1a priming their responses for 1b, etc). Ongoing work is directly measuring students' learning behaviors following encouragement in a live, experimental paradigm. Second, we tested middle and high school students given the real-world importance of their learning decisions, but the emergence of the capacities to jointly reason about others' domain and ability knowledge is not known. Recent work showed that young children attend to whether a speaker selectively vs. indiscriminately provides praise (Asaba et al., 2018), so it is possible that they can also attend to other aspects of the speaker, such as their knowledge states. Future work can explore the development of children's capacity to integrate these two types of knowledge and how it impacts their motivation.

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, 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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