# Work in Progress: Development of an Instrument to Assess Smartness Beliefs Alignment in Undergraduate Engineering Students

**Mr. Spencer Johnathan Sabatino, Cornell University**

Spencer Sabatino is a PhD candidate at the Robert Frederick Smith School of Chemical and Biomolecular Engineering at Cornell University. Spencer's research interests include studying engineering students' beliefs and their effects on broader student outcomes. He earned his Bachelor of Science degree in Chemical Engineering and his Master of Science in Chemical and Biomedical Engineering from Miami University in 2022.

**Prof. Allison Godwin, Cornell University**

Allison Godwin, Ph.D. is the Dr. G. Stephen Irwin '67, '68 Professor in Engineering Education Research in the Robert Frederick Smith School of Chemical and Biomolecular Engineering at Cornell University. She is also the Associate Director of the Cornell NanoScale Science and Technology Facility and a McCormick Teaching Excellence Institute Research Fellow. Her research focuses on how identity, among other affective factors, influences diverse groups of students to choose engineering and persist in engineering. She also studies how different experiences within the practice and culture of engineering foster or hinder belonging, motivation, and identity development. Dr. Godwin graduated from Clemson University with a B.S. in Chemical Engineering and Ph.D. in Engineering and Science Education. Her research earned her a National Science Foundation CAREER Award focused on characterizing latent diversity, which includes diverse attitudes, mindsets, and approaches to learning to understand engineering students' identity development. She has won several awards for her research including the 2021 Chemical Engineering Education William H. Corcoran Award, 2022 American Educational Research Association Education in the Professions (Division I) 2021-2022 Outstanding Research Publication Award, and the 2023 AIChE Excellence in Engineering Education Research Award.

**Dr. Emily Dringenberg, The Ohio State University**

Dr. Dringenberg is an Associate Professor in the Department of Engineering Education at Ohio State University. She holds a B.S. in Mechanical Engineering (Kansas State '08), a M.S. in Industrial Engineering (Purdue '14) and a Ph.D. in Engineering Education. Her current career purpose is to learn about and reveal beliefs that are widely-held as an implicit result of our socialization within systems of oppression so that she can embolden others to reflect on their assumptions and advance equity in their own ways.

# WIP: Development of an Instrument to Assess Smartness Beliefs Alignment in Undergraduate Engineering Students

## Introduction

This is an Empirical Work-in-Progress paper. Perceptions of those who participate in engineering vary widely; some view engineers as socially awkward and nerdy, while others view engineers as innovators and samaritans [1], [2]. Across these discussions on who participates in engineering, we find that those who do participate in engineering are almost unanimously framed as being "smart" or "gifted" as a byproduct of the engineering meritocracy of difficulty [3], [4]. While the label of "smart" is not inherently bad, prior work has demonstrated how the broader phenomena of recognizing others as smart have been used to gatekeep and unfairly recognize some students over others, particularly ostracizing marginalized groups. This is seen in engineering through a toxic, high-intensity, high-difficulty curriculum that stratifies students and deems many who leave as incapable of doing engineering [5], [6], putting strain on an engineering workforce that consistently is needed to grow both in number and diversity [7]. This cultural framing of smartness in engineering has been studied previously ([3], [8] as examples), with foci on 1) how smartness identity and engineering identity can be theoretically linked [3] 2) how students in engineering describe what it means to be smart in engineering, [8] and 3) the main beliefs (smartness beliefs) that compose what it means to be smart in engineering contexts [9].

Prior qualitative research at a large, public R1 institution enumerated the most frequently discussed beliefs regarding smartness in engineering, such as the ability to apply math and science principles or a student's innate ability [9]. This study examined how these beliefs were emphasized differently across contexts, comparing how students valued these beliefs in how they personally experienced smartness in engineering, compared to what they perceived those in the first-year engineering classroom valued as smart in engineering. We posit this process as the mapping of one's personal beliefs onto the broader systematic, structural beliefs surrounding smartness in engineering. If one's own smartness beliefs align perfectly with their perception of what's smart in the field of engineering, then this mapping is "one-to-one" and perfectly aligned; otherwise, there is negotiation between these belief sets. Figure 1 below illustrates this mapping, which is critical to the framework of this study.

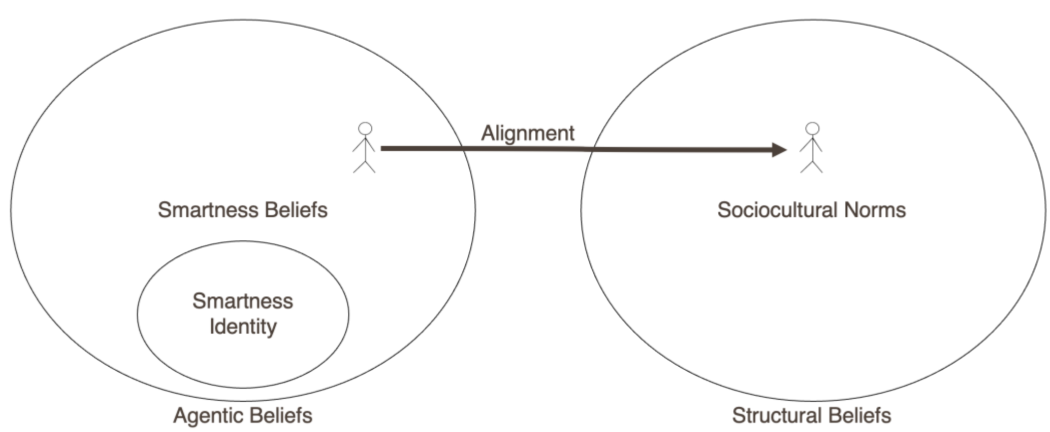


Figure 1. The process of mapping beliefs between a student's personal beliefs (agentic beliefs) and the perceived broader beliefs held by those in the field of engineering (structural beliefs).

While prior work has identified the most relevant beliefs and looked at these smartness beliefs across contexts, there is a lack of substantial quantitative work done regarding smartness beliefs, which would provide a theory-driven tool for understanding how the variation and contexts in which these beliefs are socially and culturally congruent or incongruent (i.e., alignment) may affect measurable outcomes relevant to undergraduate engineering, such as retention, belonging, and engineering role identity formation. This work explores how alignment, or lack thereof, between personal smartness beliefs and their perceptions of the beliefs most valued by those in the field of engineering can have effects on student outcomes by answering the following research questions:

- **RQ1:** To what extent do the smartness beliefs of students align with the perceived smartness beliefs held by those in the field of engineering?
- **RQ2**: How do students describe their experiences in engineering, and how is their experience influenced by the alignment of these smartness beliefs? How do these perceived smartness beliefs align with those discussed in the literature?
- **RQ3**: To what extent does the (mis)alignment of these smartness beliefs influence broader outcomes of students, such as retention and belonging?

**Theoretical Framework**

We leverage the framing of smartness as a cultural practice based on initial work from Beth Hatt [10], rooted in Holland's framing of identity and agency in a figured world [11], to frame our definition of smartness. Hatt theorized smartness as a cultural practice, a negotiation between the agency an individual brings and the norms of the system they are in, resulting in stratification based on beliefs and judgments that people hold regarding what constitutes a smart person. Smartness, rather than being some specific or measurable quantity, is a mechanism to socially hierarchize students relative to each other and is localized to the figured world or structural lens a person is observing through (e.g., smartness in engineering or smartness in mathematics classrooms) and has contributed to a broader culture of engineering that has pushed many students out due to a lack of seeing their fit with the engineering lifestyle or overwhelming coursework [6].

We further leverage person-organization (P-O) fit [12], [13] as a broader theoretical framework to evaluate our beliefs alignment. P-O fit looks at the compatibility between an individual and a broader organization or culture, such as the figured world of smartness in our case, by evaluating the commonality of characteristics between each entity. Evaluating commonality can generally be done using different components, such as values [14], beliefs [15], or identity [16], and using different methodologies. Strong P-O fit has broadly been shown to increase feelings of belonging, performance, and retention in the context of the structure (see [12], [13] for examples with different scoping of the organizational or structural component). We consider some of these outcomes as relevant in our study, but further expand our scope to include other relevant engineering outcomes, such as engineering role identity [17], due to the direct theoretical connection between engineering role identity and smartness identity described in prior work [3], [18]. Our goal is not to advocate for students to perfectly align with the broader culture of smartness in engineering, but rather to identify the beliefs that, if not aligned, could compromise a student's identity and thus compromise their belonging or persistence in engineering.

**Proposed Methods**

We will utilize a multiphase explanatory mixed methods approach [19], [20] consisting of three stages outlined in more detail below.

*Survey Development and Deployment*

To answer RQ1, we have drafted novel items for a quantitative instrument to measure the importance of smartness beliefs in both students' personal beliefs and their perceptions of the beliefs valued by those in the field of engineering. The beliefs we focus on are drawn upon from prior literature [9], where each belief serves as a measured construct in the survey. For each overarching smartness belief, we generate a list of at least five items, relying on the prior qualitative work from [9] to guide the wording of each developed item and ensure the wording is consistent with the lived experience of participants. The first part of the survey asks these questions regarding students' personal beliefs, and the second half of the survey repeats the questions but frames them in the context of the students' perception of how these smartness beliefs are valued in the field of engineering.

This instrument will be deployed to a private university in the Northeastern United States for initial item testing and development. We will contact engineering department administrators for help with distributing the survey in each unit. Responses will be cleaned and multiple imputation methods for missing data will be used to avoid biased estimates. The intended sample size for this distribution is 300 responses to allow for testing the factor structure using a minimum residuals exploratory factor analysis (EFA; [21]. Following EFA, we will adjust the instrument as needed, including: collapsing belief constructs that have similar response patterns, removing items that do not have uniqueness (1-communality) scores <0.7, and rewording poor-performing items (factor loadings <0.3). Following the final deployment of the survey, we will evaluate the alignment of smartness beliefs by taking the difference in mean values between the personal beliefs and perceived beliefs measures. Larger differences in the mean values will suggest larger misalignment between the sets of beliefs being studied.

*Student Interviews*

At the conclusion of the survey, a question will allow students to opt in to 60-minute follow-up interviews. We will interview *n*=10 students from the pool of respondents, employing maximum variation sampling in selecting the students based on 1) notable variation in survey responses (e.g., significant differences in values of personal and perceived smartness beliefs, a strong personal emphasis on certain smartness beliefs, etc.), and 2) varying experiences and backgrounds of student respondents. The focus of these semi-structured interviews will be on discussing students' smartness beliefs through the lens of 1) their background and motivation for pursuing engineering, 2) their perceived views on engineering and their engineering identity, and 3) their survey responses and how their experience with smartness beliefs in engineering, primarily focusing on what experiences caused this emphasis measured in the quantitative findings. The interviews will undergo two rounds of coding. The first round of coding will utilize *in-vivo* coding, using direct, interpretable snippets of the students' words as code snippets [22]. The second round of coding will use axial coding to generate broad themes or patterns around students' experiences with smartness, such as why students may emphasize certain smartness beliefs in their survey responses or how these beliefs may impact their engineering identity.

*Outcome Modeling*

We will utilize our survey responses and interviews to inform our next level of modeling as part of the project and to answer RQ3. We will utilize latent profile analysis (LPA) to understand patterns across the collected survey responses to determine how smartness belief alignment can have larger impacts on broad outcomes in engineering, particularly focusing on metrics like belonging or engineering role identity. LPA will allow us to generate qualitatively distinct profiles in the student survey responses that show how alignment of smartness beliefs can affect broader outcomes in engineering.

**Progress to Date**

At the current stage of the project, we have developed drafts for both the survey questions and interview protocol to be used in the first two stages of the study. The survey questions have been piloted in cognitive interviews with undergraduate engineering students to determine appropriate wording and alignment with the intended smartness belief. The initial draft of the survey questions and interview protocol is attached in the supplementary information in Appendix 1 and 2, respectively. IRB approval has been obtained for this study earlier in the term, and initial deployment of the survey to undergraduate departments is currently planned for the Spring 2026 term.

**References**


[1] R. McCord, "Bazinga! You're an engineer…you're___! A Qualitative Study on the Media and Perceptions of Engineers," in *2013 ASEE Annual Conference & Exposition Proceedings*, Atlanta, Georgia: ASEE Conferences, Jun. 2013, p. 23.240.1-23.240.20. doi: 10.18260/1-2--19254.

[2] N. Sochacka, J. Walther, J. Wilson, and M. Brewer, "Stories 'Told' about engineering in the Media: Implications for attracting diverse groups to the profession," in *2014 IEEE Frontiers in Education Conference (FIE) Proceedings*, Madrid, Spain: IEEE, Oct. 2014, pp. 1–9. doi: 10.1109/FIE.2014.7044009.

[3] B. Braaten, E. Dringenberg, A. Kramer, and R. Kajfez, "You're an Engineer? You Must Be Really Smart! A Theoretical Discussion of the Need to Integrate 'Smart' into Engineering Identity Research," *Studies in Engineering Education*, vol. 4, no. 2, pp. 22–37, Aug. 2023, doi: 10.21061/see.86.

[4] R. Stevens, D. Amos, A. Jocuns, and L. Garrison, "Engineering As Lifestyle And A Meritocracy Of Difficulty: Two Pervasive Beliefs Among Engineering Students And Their Possible Effects," in *2007 Annual Conference & Exposition Proceedings*, Honolulu, Hawaii: ASEE Conferences, Jun. 2007, p. 12.618.1-12.618.17. doi: 10.18260/1-2--2791.

[5] L. Fleming, K. Engerman, and D. Williams, "Why Students Leave Engineering: The Unexpected Bond," in *2006 Annual Conference & Exposition Proceedings*, Chicago, Illinois: ASEE Conferences, Jun. 2006, p. 11.1451.1-11.1451.7. doi: 10.18260/1-2--375.

[6] H. Thiry, T. J. Weston, R. P. Harper, D. G. Holland, A. K. Koch, and B. M. Drake, *Talking about Leaving Revisited: Persistence, Relocation, and Loss in Undergraduate STEM Education*. Springer International Publishing, 2019. doi: 10.1007/978-3-030-25304-2.

[7] National Science Board, "National Science Board: Vision 2030," *NSB-2020-5*, 2020.

[8] E. Dringenberg, A. Kramer, and A. R. Betz, “Smartness in engineering: Beliefs of undergraduate engineering students,” *J of Engineering Edu*, vol. 111, no. 3, pp. 575–594, Jul. 2022, doi: 10.1002/jee.20463.
[9] A. Kramer, R. L. Kajfez, and E. Dringenberg, “Ways of Being Smart in Engineering: Beliefs, Values, and Introductory Engineering Experiences,” *Int. J. Eng. Ped.*, vol. 14, no. 1, pp. 129–148, Jan. 2024, doi: 10.3991/ijep.v14i1.41633.
[10] B. Hatt, “Smartness as a Cultural Practice in Schools,” *American Educational Research Journal*, vol. 49, no. 3, pp. 438–460, Jun. 2012, doi: 10.3102/0002831211415661.
[11] D. C. Holland, W. Lachiotte Jr, D. Skinner, and C. Cain, Eds., *Identity and agency in cultural worlds*, 1. Harvard Univ. Press paperback ed., 2. print. Cambridge, Mass.: Harvard Univ. Press, 1998.
[12] A. Kristof, “Person-Organization Fit: An Intergrative Review of Its Conceptualizations, Measurement, and Implications,” *Personnel Psychology*, vol. 49, no. 1, pp. 1–49, 1996.
[13] A. Kristof-Brown, B. Schneider, and R. Su, “Person-organization fit theory and research: Conundrums, conclusions, and calls to action,” *Personnel Psychology*, vol. 76, no. 2, pp. 375–412, Jun. 2023, doi: 10.1111/peps.12581.
[14] J. Grifski and E. Dringenberg, “Tangible Approaches to Improving Value Congruence Between Undergraduate Computer Science Students and Their Institutions,” in *2025 IEEE Frontiers in Education Conference (FIE)*, Nashville, TN, USA: IEEE, Nov. 2025, pp. 1–7. doi: 10.1109/FIE63693.2025.11328725.
[15] J. D. Stolk, “Learning Beliefs of Engineering Faculty and Their Students: How Might Alignments and Misalignments Affect Educational Change Initiatives?,” in *2024 IEEE Frontiers in Education Conference (FIE)*, Washington, DC, USA: IEEE, Oct. 2024, pp. 1–9. doi: 10.1109/FIE61694.2024.10893016.
[16] B. Miller, M. Tsugawa, J. Chestnut, H. Perkins, C. Cass, and A. Kirn, “The Influence of Perceived Identity Fit on Engineering Doctoral Student Motivation and Performance,” in *2017 ASEE Annual Conference & Exposition Proceedings*, Columbus, Ohio: ASEE Conferences, Jun. 2017, p. 28982. doi: 10.18260/1-2--28982.
[17] A. Godwin, “The Development of a Measure of Engineering Identity,” in *2016 ASEE Annual Conference & Exposition Proceedings*, New Orleans, Louisiana: ASEE Conferences, Jun. 2016, p. 26122. doi: 10.18260/p.26122.
[18] C. Wallwey, E. Dringenberg, B. Braaten, Y. Li, and R. Kajfez, “Engineering Identity and Smartness Identity as They Relate to Women’s Participation in Engineering,” *IEEE Trans. Educ.*, vol. 67, no. 2, pp. 306–316, Apr. 2024, doi: 10.1109/TE.2024.3359534.
[19] R. B. Johnson and A. J. Onwuegbuzie, “Mixed Methods Research: A Research Paradigm Whose Time Has Come,” *Educational Researcher*, vol. 33, no. 7, pp. 14–26, Oct. 2004, doi: 10.3102/0013189X033007014.
[20] J. W. Creswell and V. L. Plano Clark, *Designing and Conducting Mixed Methods Research*, 3rd ed. SAGE Publ, 2018.
[21] D. J. Mundfrom, D. G. Shaw, and T. L. Ke, “Minimum Sample Size Recommendations for Conducting Factor Analyses,” *International Journal of Testing*, vol. 5, no. 2, pp. 159–168, Jun. 2005, doi: 10.1207/s15327574ijt0502_4.
[22] J. Saldaña, *The coding manual for qualitative researchers*, 5th ed. Los Angeles: SAGE, 2025.

## Appendix A: Survey Questions

Survey Questions

Question scale: 5-point anchored numeric scale (From 1/Strongly Disagree to 5/Strongly Agree)

Prompt: **Please indicate your agreement with the following statements:**

I believe that… (PT 1)

Others in the field of engineering believe that… (PT 2)

**Achievement with little effort**

…You don't need to try very hard if you're smart

…Smart engineers understand course concepts/topics the first time around.

…Smart engineers come up with the correct answer without iteration

…Smart engineers look at problems and instantly know how to solve them

…Smart engineers leave lectures/workshops with a solid understanding of the taught material

…Smart engineers leave labs/hands-on learning experiences with a solid understanding of the taught material.

## Applying math and science

…A smart engineer can reduce any problem to fundamental math and science principles
…A smart engineer relies on math and science more than intuition.
…Smart engineers turn fundamental STEM knowledge into solutions for larger problems
…Smart engineers can apply new STEM knowledge to solve problems
…Smart engineers apply their science skills to solve problems rather than memorize formulas or facts.

## Being born with innate ability

…Engineering ability is fixed at birth and can't change.
…The difference between an engineering student and a smart engineering student is something that cannot be taught
…Smart engineers don't have to study much to understand a concept
…Smart engineers have an innate ability for engineering
…Smart engineers have engineering skills that come naturally to them
…Smart engineers take less time to develop skills or solve problems than other engineers
…Smart engineers just "get it" right away
…Smart engineers are gifted when it comes to solving engineering problems
…Smart engineers are born to be engineers

## Communicating well in teams

…Smart engineers know when to speak up and when to listen in a team setting.
…Smart engineers listen actively in group discussions
…Smart engineers actively adapt their communication skills depending on the context
…Smart engineers adjust their communication skills when talking to a superior (e.g., a boss, professor, etc.).
…Smart engineers adjust their communication skills when talking to peers or subordinates.

…Smart engineers emphasize clear and timely communication when working on tasks

…Smart engineers effectively communicate ideas in terms that any person could understand

…Smart engineers work through disagreements in team settings.

**Getting good grades**

…Getting good grades is a strong indicator of someone's competence in engineering

…You can't be smart without a good GPA

…Smart engineers consistently get high grades

…Smart engineers can easily be identified by their grades

…Smart engineers succeed academically.

**Helping others/making the world better**

…Smart engineers think about how their work affects other people

…Smart engineers prioritize ethical responsibilities to society

…Smart engineers see how their work fits into solving global challenges

…Smart engineers think about how their work will affect the world

…Smart engineers value sustainable solutions.

**Showing initiative**

…Smart engineers look for ways to improve their work, even if it's not required

…Smart engineers take initiative and don't wait to be told to do something

…Smart engineers are self-motivated

…Smart engineers take the lead on identifying problems and solutions for a project

…Smart engineers take ownership of their work, including any flaws or shortcomings

**Solving complex problems**

…Smart engineers can break down a complex problem into its core components

…Smart engineers can make connections between concepts and topics effectively

…Smart engineers can work through any problem

…Smart engineers think of a problem more broadly to solve it in new ways

…Smart engineers can analyze/critique solutions to problems

### Thinking creatively

…Smart engineers can solve problems in multiple distinct ways.

…Smart engineers challenge traditional problem-solving approaches with new ideas.

…Smart engineers innovate when solving problems.

…Smart engineers use their imagination.

…Smart engineers can think creatively.

…Smart engineers think outside the box.

### Working efficiently

…Smart engineers can identify and utilize patterns to more effectively solve problems

…Smart engineers prioritize studying efficiently over studying more

…Smart engineers streamline problem-solving

…Smart engineers make the most of their limited resources.

…Smart engineers prioritize optimization and efficiency.

### Working hard

…Smart engineers persist even when the task is tough

…Smart engineers maintain focus and discipline throughout their work

…Smart engineers are willing to invest additional time in their work if needed.

…Smart engineers show effort and dedication throughout arduous tasks

…Smart engineers work effortlessly to improve themselves

…Smart engineers spend all the time they need on a problem, even if it takes all night.

## Appendix B: Interview Protocol Draft

### Background Information

1. Can you tell me a bit about yourself, such as your name, major, and year at [institution]?
2. How did you get into engineering?

    a. What factors influenced this decision?
    b. Has anyone in your life had an impact on your decision to pursue engineering? If so, could you tell me who and how?
3. What are your goals following your degree? Do you know where you would want to work or what you would work with?

**Student Identity**

1. Tell me about yourself as a student.
    a. [if needed] What is your approach to your classes and education?
2. What are your values as a student?
    a. [if needed]
3. From your position, what does it mean to be a ‘good’ student?

**Engineering Identity**

1. What is an engineer?
    a. How does this compare to how your peers may view an engineer?
        i. What about your institution via your instructors or other professionals you’ve interacted with?
    b. When looking at how you define an engineer, are there aspects of engineering that you feel are underemphasized or overemphasized?
        i. Follow-up: These could be skills, topics, ideas, etc. Anything that you hold valuable is appreciated.
        ii. Why these skills?
2. Do you see yourself as an engineer? Why or why not?
    a. If yes, can you give me some examples of how you see yourself as an engineer?
        i. These could be traits, interest in topics/skills, etc.
    b. If no, why not? What would help you see yourself as an engineer?
3. What engineering experiences, if any, have you had outside of the classroom?

**Smartness Beliefs and Identity**

My focus in research is on understanding smartness beliefs present in undergraduate engineering and what they mean to them. There is no “right” or “wrong” answer to any of these questions, and I want to ensure I understand your opinions, beliefs, and understanding.

1. In your own words, what does it mean to be smart? This can be in general, but I would like to focus on how this emerges primarily in your engineering discipline.
    a. **Probe:** How, if at all, has your definition of smartness changed since the beginning of your undergraduate degree? If so, was there a specific moment when this happened at?

b. How have prior experiences or people shaped your perceptions of smartness? These could be educational experiences, interactions with people, or even from your own reflection.
c. How would your definition of what is means to be smart in engineering compare with your peers at [institution]?

2. Do you see yourself as smart? Why or why not?
    a. If yes, can you give me examples of how you see yourself as smart? These could be experiences, traits, qualities, beliefs, etc.
    b. If no, why not? What would help you feel smarter in engineering?
        i. If you don't feel smart, are there any aspects of yourself that might affect how you see yourself? These could be experiences, traits, qualities, beliefs, etc.
    c. Could you tell me about a moment in your life when you didn't feel smart?
        i. After this moment, how did you react?
        ii. After this moment, did your broader framing of smartness change?
3. **Elicitation**: I want you to think of the three smartest people you know. What makes each of them smart? How did you decide that they were smart?
    a. **Probe:** It sounds like you believe parts of smartness to mean [insert what they said here], is there anything else you'd want to add to this?
    b. **Probe:** How long have you held this belief as a way for someone to be smart?

**Reflection on Survey Results**

Let's go over your survey results. I have a copy of your submission *provide the participant with a copy of their results*. If anything has changed between your responses marked here and your current beliefs, we can discuss this throughout the interview.

1. On your survey, you had weighted ***insert highest ranked belief here* as your most valued smartness belief. Is this still true?
    a. Could you tell me why you rank this the highest amongst the other beliefs?
        i. **Probe:** Is there anything from your past experiences that promoted this belief? It could be prior mentors, family members, societal expectations, etc.
    b. How has this prioritized belief influenced your engineering experience?
        i. **Probe:** This can be any aspect of your engineering experience, whether direct effects in coursework or how you perceive yourself or others in the context.
    c. How has this belief influenced your behavior in the engineering classroom?
    d. How has this behavior influenced your interactions within your engineering major?
        i. **Probe:** This could be with faculty members, fellow students, peers, or even job recruiters/internships.
2. When looking at this belief, I noticed that you weighted your emphasis of this belief ***insert weighting relative to personal ranking*** in engineering,

   a. Could you tell me more about why you perceive this?
      i. **Follow-Up:** Is there anything from your past experiences that promoted this belief? It could be prior mentors, family members, societal expectations, etc.
   b. How has this lack of emphasis on the belief influenced your engineering experience?
      i. **Probe:** This could be any aspect from your engineering experience, whether direct effects in coursework or self-perceptions, perceptions of others, etc.
   c. How has this belief influenced your behavior in the engineering classroom?
   d. How has this behavior influenced your interactions within your engineering major?
      i. **Probe**: This could be with faculty members, fellow students, peers, or even job recruiters/internship interactions.
3. The beliefs I highlighted in this survey are ones discussed in previous work, but are there any additional beliefs that you hold that aren't covered in that survey?
   a. **Probe:** These beliefs do not have to be well-polished or common.
   b. How would you rank this smartness belief relative to the others you ranked? *Provide students with their ranking and allow them to place it relative to the others*

Open-Ended Exit Question

1. Thank you for participating in this interview. The goal of this interview was to reflect on your personal smartness beliefs in engineering and how they may align with your perception of the field of engineering's smartness beliefs. Is there anything else you would like to add that wasn't explicitly discussed in the interview?