Four Complications in Designing a Validated Survey to Gather Information on Student Reactions to Reflection Activities

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Abstract

Reflection and reflection activities are potentially valuable components of the instructional experiences educators design in order to support student learning. Published scholarship contains many allusions to students having reactions to reflection activities, but the nature of these reactions are rarely engaged in depth. In this work, we focus on four complications we have encountered while developing a survey to explore student reactions to reflection activities: complex reactions within a single student, complex patterns of reactions between students, students being differentially aware of their reactions to reflection, and students experiencing the reaction survey as a reflection activity itself. Additionally, we discuss potential implications of these complications for educators and researchers.

Introduction

Reflection can be thought of as a form of thinking that involves stepping out, thinking about, and connecting forward. In this way, reflection can be seen as a knowledge generating or learning mechanism. It is through reflecting that we create new knowledge. For example, reflecting can provide a chance to know your mind, make up your mind, and change your mind. In order for such knowledge gains to come about, one needs to engage in reflecting. You need to do it.

To help students engage in reflecting, educators design and use a variety of reflection activities. Activities such as muddiest points, exam wrappers, and portfolio construction provide students with opportunities to step out and think about different aspects of their learning, and connect forward to different parts of their futures. Informally, educators report students as having a range of reactions to reflection activities and that such reactions mediate engagement and the potential for knowledge gains. In our work, we are motivated by the research question of what types of reactions students have to reflection activities, and we have been addressing the design question of “how might we gain insight into student reactions to reflection activities?” The spirit of this "how might we" work is to create infrastructure— tools that others can use. As part of this, we have been working on the design of a validated survey that makes it possible for students to communicate their reactions and what contributes to their reactions.

In this paper, we focus on what has complicated our efforts to construct such a survey. We offer these complications because we believe they are informative to work on reflection generally and maybe even to the engineering education quest to improve pedagogy broadly. Little scholarship in engineering education seems to focus on student reactions, or student experience, although we know that experience matters and matters more for particular groups. By drawing attention to students' reactions to pedagogical practices, to the activities and instructional situations we create, we may find additional paths forward.

This paper is organized as follows. In the next section we offer three vignettes to concretize the work. We follow these vignettes with a traditional section devoted to related work. We then describe the activities that led to the findings section including (a) the context of the survey development efforts, (b) specific details of the survey development effort during a four month period, and (c) the processes that led to the findings presented in this paper. Then, after presenting the findings, we turn to discussion and implications.

Motivation

As part of our work on promoting reflection in engineering education, we have had conversations with students about challenging reflection experiences. The vignettes in Table I are inspired by such conversations with students as well as the larger context in which the student experiences might exist. These conversations provided practical motivation for this research.

TABLE I. Vignettes used to illustrate the motivation for the research

Vignette 1: Educator perspective. Having noticed that the grades on a recent exam were not what she had hoped, Dr. Jones assigned a reflection activity, called an exam wrapper, as a way to better understand the situation and help students do better on the next exam. The exam wrapper assignment asked students to think about (and share) how they prepared for the exam and identify strategies for next time. The activity seemed to work okay (the responses were specific and students thanked Dr. Jones in the hallway), but some responses were unspecific and comments made by some students suggested an undercurrent of resistance.
Vignette 2: Student perspective. John had anticipated that the exam would go poorly, but was even more disappointed when he received the grade. Activities in his personal life had made it hard for him to study, and even before the recent exam, he had been feeling like an imposter in the class. The exam wrapper activity, although it seemed well intended, just seemed to make matters worse. He could not remember details about how he had studied, and moreover did not really want to revisit the exam performance, at least not while the experience felt so recent. He recognized that he may have disappointed his instructor, but there wasn't really a way to let Dr. Jones know that specifically, given the way the exam wrapper activity was structured.
Vignette 3: Researcher perspective. Because exam wrappers have received a lot of attention as a reflection activity, a research team has been trying to study their effectiveness. While the quantitative results suggest that exam wrappers, on average, do seem to help students do better on the subsequent exams, qualitative results suggest that student experiences with exam wrapper assignments are quite diverse. Moreover, some of the qualitative results point to negative student reactions that perhaps could have been mitigated with different configurations of the exam wrapper assignment. The research team wonders, how might such diverse student reactions be more efficiently understood?

Through these vignettes, we highlight a complex situation: an educator doing their best to understand where the class is at, and a possible negative student reaction to a reflection activity that was intended to aid in student learning. This example illustrates how a reaction to a reflection activity can be based on a student's circumstances outside of the classroom context. In sharing this example, we hope to plant the seed toward developing empathy for understanding students' diverse range of reactions to reflection activities as well as empathy for educators trying to effectively design such activities.

Related Work

This research draws on fundamental ideas about reflection as well as varied perspectives motivating a focus on student reactions.

Reflection in Engineering Education

Reflection can be understood as a three-part process that involves: *stepping out* of an activity, experience, or thought; *thinking about* those prior activities, experiences, or thoughts to make sense of them, and *connecting forward* to future action [1]. This understanding of reflection builds on Dewey and Schon's theoretical perspectives of reflection as a form of problem-solving and as central to professional practice [2], [3].

Reflection aids the learning process of students in school [2] and employees in the workplace [3]. From a broad perspective, extensive work within engineering education highlights the value, tensions, and opportunities of reflection as a metacognitive process to support engineering student learning and development [4]–[7]. Prior research has documented that there have been barriers to integrating active learning experiences, such as reflection activities, into engineering courses [8]. From our initial review of the literature, there exist few instruments to support investigation of student engagement with reflection and even fewer that focus on student reactions to reflection in engineering education. Specifically, in this research team's previous research, we have found that knowing more about students' perspectives on reflection can support engineering educators in being more effective and inclusive in how they design and use reflection activities in their classrooms [9]. Engineering students have varied practices around reflecting, felt engagements with reflection, and experience a school-life divide in relation to reflection practices [1]. Understanding student experiences by listening to them via interviews is time-consuming and there is value in exploring the "how might we" question of how to develop ways for students to communicate their reactions to reflection activities. By capturing student reactions, educators can gain insights into different student experiences that might be shaping student learning.

We also argue that for educators, reflection can be an opportunity to gain insights and empathy towards the diversity of student experiences, using reflection activities beyond a learning tool in engineering education. Capturing student reactions to reflection activities can help educators see other roles students hold such as athletes, leaders, caretakers or even parents.

Motivating the focus on student reactions to reflection activities

Resistance is a form of reaction that is of interest. If students experience resistance to reflection activities, this can lead to disengagement and a reduction in the benefits that could have been achieved. In attending to student resistance, we build on the ideas of caring and pedagogy presented in Valenzuela's book Subtractive Schooling [10]. By listening to students' experiences in the classroom and taking an authentic interest in the underlying reasons for their acts of resistance, Valenzuela proposes that the first step to making schooling an affirmative and educational experience for all students requires introducing a culture of authentic caring. Authentic caring is an act that "incorporates all members of the school community as valued and respected partners in education" [10].

Other scholars speak to the issue of resistance and the need to attend to and unpack such felt experiences. In situating a conversation about teaching to transgress, given the sociopolitical state of the apartheid south growing up, bell hooks writes "our devotion to learning, to a life of the mind, was a counter-hegemonic act, a fundamental way to resist every strategy of white racist colonization" [11]. In a later section, hooks describes a failed attempt as an educator to create a learning community with her students. hooks writes, "For reasons I cannot explain it [the class] was also full of 'resisting' students who did not want to learn new pedagogical processes, who did not want to be in a classroom that differed in any way from the norm. To these students transgressing boundaries was frightening. And although they were not the majority, their spirit of rigid resistances seemed always to be more powerful than any will to intellectual openness and pleasure in learning" [11]. Here, hooks touches on the importance of everyone in the classroom (both the educator and the learners) having a significant impact on the kind of learning environment that is created. Further, in articulating the goal of Teaching to Transgress, hooks writes, "To emphasize that the pleasure of teaching is an act of resistance countering the overwhelming boredom, uninterest, and apathy that so often characterizes the way professors and students feel about teaching and learning, about the classroom experience" [11]. From an educator perspective, hooks argues that progressive professors working to transform their curriculum such that it does not reflect biases or reinforce systems of domination, are often those willing to take risks and make "their teaching practices a site of resistance" [11].

On a broader level, research shows that educators who can empathize with their students are better prepared to understand students' different learning experiences [12]. Reading student reflections can also foster empathy in educators for their students' experiences in the learning environment, especially when teaching in a multicultural learning environment [8]. This leads us to ask, "How can understanding student reactions and resistance to reflection lead to more dialogue between students and educators to inform teaching and learning methods?"

Approach

In this section, we provide an overview of the context of the work reported in this paper (our survey development efforts) and also the methods by which we arrived at the four complications we report in the findings section.

Context: The survey development process

Our survey development process included conceptual work, item development, sustained engagement with students to understand these complications through pilot think out-louds, small scale data collection sessions, and question reduction informed by reflection experts (expert review) after a statistics consultation. The students who participated in the pilot studies and data collection were in an engineering department and included both undergraduate and graduate students. Each time changes were made to the survey, the researcher tracked these changes in memos. Significant elements of the process are shown in Figure 1.

Fig. 1. Elements of the survey development process

Conceptual model. The reactions survey is based on conceptual work in two areas. First, the core conceptual model of the work involves hypothesizing students as having *reactions* and various *factors* that contribute to the reaction. Second, the team developed a collection of potential factors, drawing on prior publications and theory. At a high level, the idea is that a reaction may be based on issues or factors such as effort, preferences about how to work, concerns about privacy, personal mindsets related to reflection ability, concerns about self-preservation, perceptions of the usefulness of the activity, situational characteristics, epistemological considerations related to reflection, issues of power when educators have students to reflection, and cultural norms related to reflection in teaching and in engineering. Some of these factors are related to specific qualities of the activity itself, while other factors have to do with the learner and/or the learning context.

Item development. In this phase of the survey development process, the team wanted to avoid the classic notion of resistance as a key reaction. Thus the team chose to focus on positive reactions and negative reactions, which ended up operationalized as "positiveness" and "negativeness." In addition, the team needed to develop items that would be used to determine the presence or absence of contributing factors. Initially, 10-15 items were developed for each of the 10 hypothesized contributing factors. Examples of these items are shown in Appendix 1.

Survey layout. Survey layout was ongoing. Figure 2 shows four versions of the survey. Figure 3 is an enlarged view of the culminating view of the survey during the time period of this work. Figure 3 showcases how the core conceptual model elements (A-reactions, B-factors hypothesized as contributing to reactions and C-clarifying the contribution of a factor) come together in the survey.

Think aloud. To gain insights about the survey's content, format, and usability , we conducted three think out-loud pilot sessions. During the sessions, the first author took notes and audio recorded each think out loud session. In listening to the participants, the research team learned which questions were confusing and what the process of filling out the survey was like. These sessions informed our first round of editing and reducing questions for clarity.

User testing. Next, to hear more perspectives from different engineering students, the research team piloted four of the 10 factors in a seminar where students were already engaging in reflection. The four factors were chosen based on relevance to the seminar content. Here, the team collected data for 10 participants on the four factors. With this set of data, the research team

received feedback from university statistics consultants for the direction of the survey development. The consultation led to two major insights: 1) Despite the extent of possible answers accounting for the yes and no, positive and negative combinations, and given the collection of data from an appropriate sample size, the research team could run factor analysis on the data and 2) Survey fatigue would be a reality of our survey, therefore there were trade offs that had to be made, between making sure there were enough questions capturing the range of possible reactions, and at the same time, maintain a survey short enough to gather data from engaged participants.

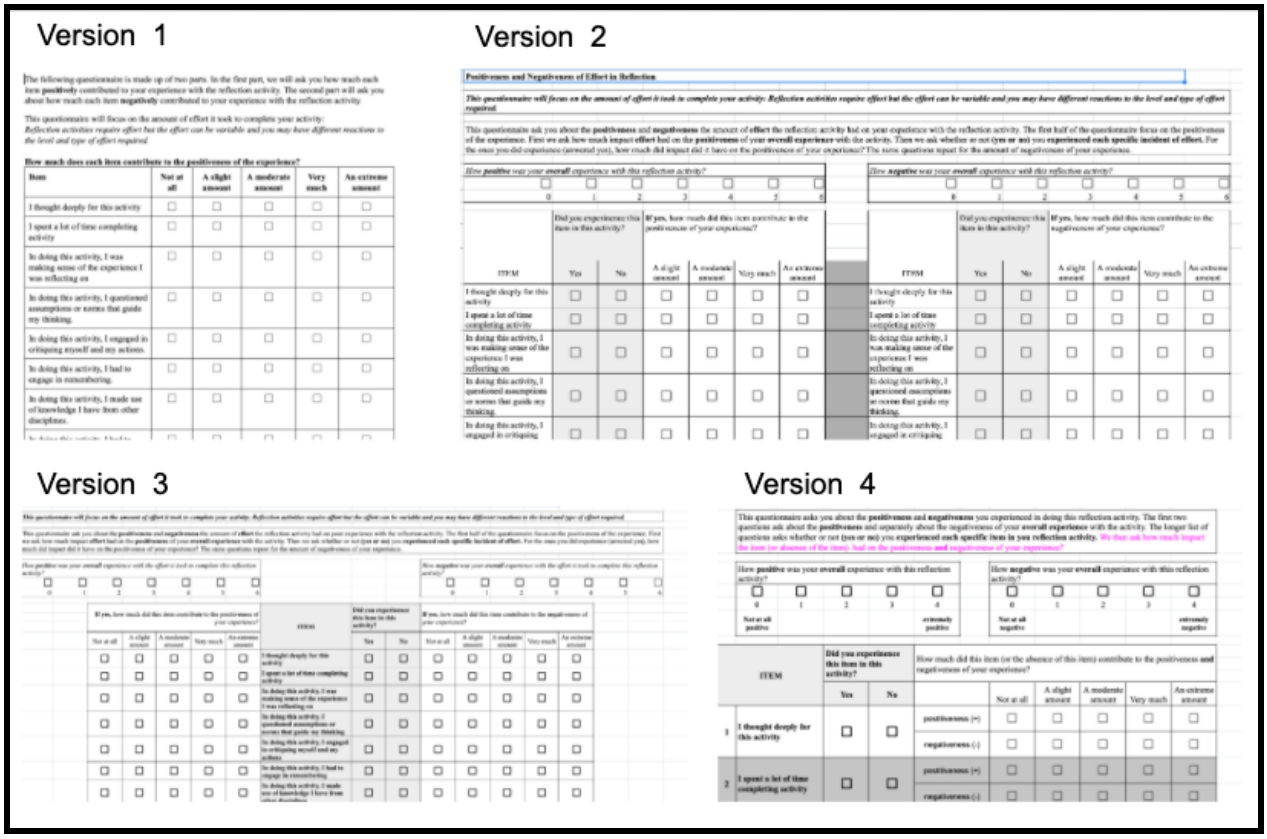

Figure 2. Four iterations of the survey

Reducing on questions. To mitigate survey fatigue, we decided to reduce the number of factor-related items by 4-7, based on the insights of reflection experts on the research team. The criteria for eliminating questions included: removing repetitive questions or questions that were confusing. To ensure peer scrutiny [14], the research team first suggested questions to cut individually and then engaged in a lengthy discussion within the research team of four. With this information in hand, we converted our survey to a digital version to run a larger scale data collection effort.

Preliminary statistical analysis. After deploying the survey with about 30 students in an engineering studio session, there was enough data to run preliminary statistical analysis, something the project had not done before for this project. This deployment was critical for our team to understand how users were filling out the survey and what their responses meant

individually and in aggregate. This data provided insights into how much variation there could be in student reactions to the same reflection activity, both within and between participants.

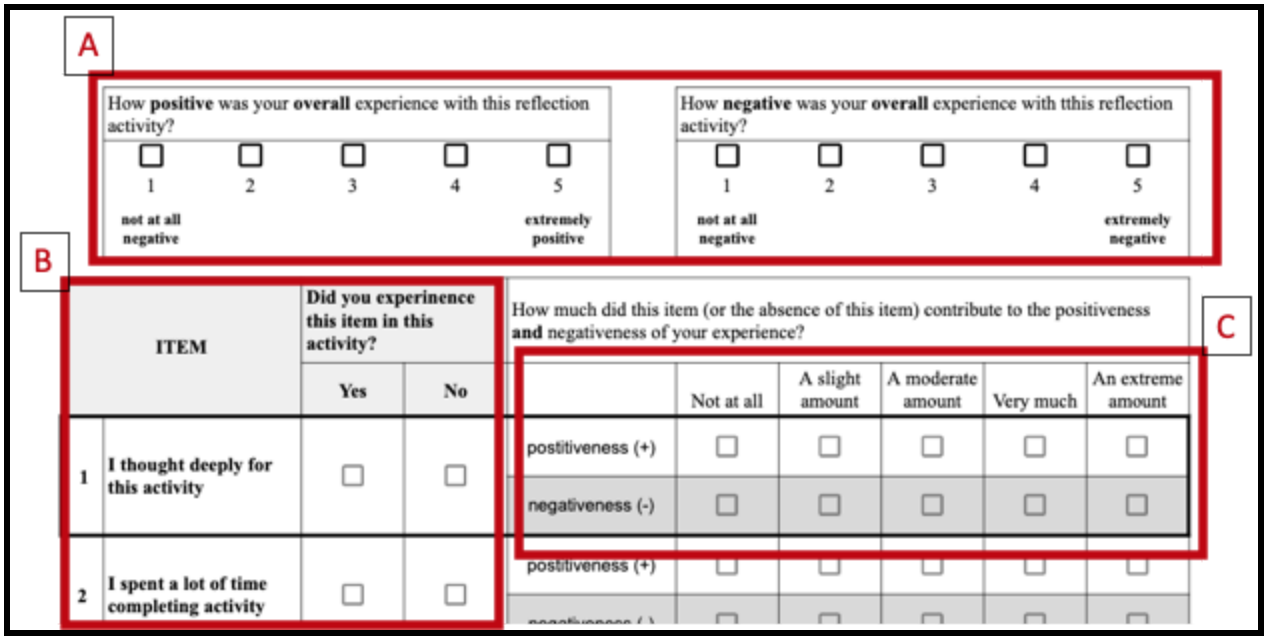

Fig. 3. The final survey format used in the work described in this paper

This paper: Surfacing the complications

The focus of this paper is on the complications we encountered during the process of developing the survey. To identify the complications presented in the next section, the team engaged in three activities. First, the team revisited the iterations of the survey focusing on the changes between subsequent iterations and the rationale for the changes. Second, the team revisited feedback received during pilot testing efforts with particular attention on information that had surprised us at the time. Finally, the team reviewed meeting notes to identify points of tension and debate. Following the spirit of grounded theory, we worked iteratively to understand our phenomenon of interest, i.e., the complications in our process.

Findings

This section describes four complications encountered during our survey development process.

Nuance within a single student

Initially, we anticipated that factors would contribute to either the negativeness or the positiveness of an activity. However, during our think out-loud process, we were able to confirm that students could actually perceive that the same factor contributed to different reactions (in this case, to the positiveness and the negativeness). For example, as participants shared their thought process and commented on why the factor “I thought deeply for this activity” had contributed to their positive or negative reaction, it was clear that, although thinking deeply for an activity was effortful, there was also learning beyond the experience that resulted from thinking deeply. This learning contributed to the positive feelings towards the reflection activity.

This complication continued to be confirmed in subsequent pilots, where students appreciated being able to think of a particular factor contributing to both positive and negative reactions. Having students indicate the contribution of a factor to their positiveness reaction and their negativeness reaction separately became critical to the design of our survey. Collecting data on the two contributions was important, despite the possibility of a time intensive data entry process and added complexity to the data analysis.

Although some suggested using a spectrum from negative to positive, other participants stated that such a spectrum would not capture the nuance of their reaction. In subsequent data collection efforts, we noted many instances of respondents indicating that a factor contributed to both their positive reaction and their negative reaction. Although such additional data collection did result in more data, advice from a statistics consultant confirmed that subsequent statistical analysis would be possible.

Nuance between students

Some evidence suggests that students in the same learning experience can have very different reactions to the same reflection activity [15]. This not only has to do with how students react to an activity (positive or negative), but also, how they perceive different factors as contributing to their reactions. For example, one of our hypothesized factors is *effort*. To explore the factor of effort and its contribution to the overall reaction, we identified multiple items such as the following: “I thought deeply for this activity,” “I spent a lot of time on the activity,” and “ I had to use critical thinking skills.” The survey design then involved students indicating whether the item was true (i.e., whether or not they experienced the item during the activity) and also the extent to which the item contributed to their reactions (with the option of answering “not at all”).

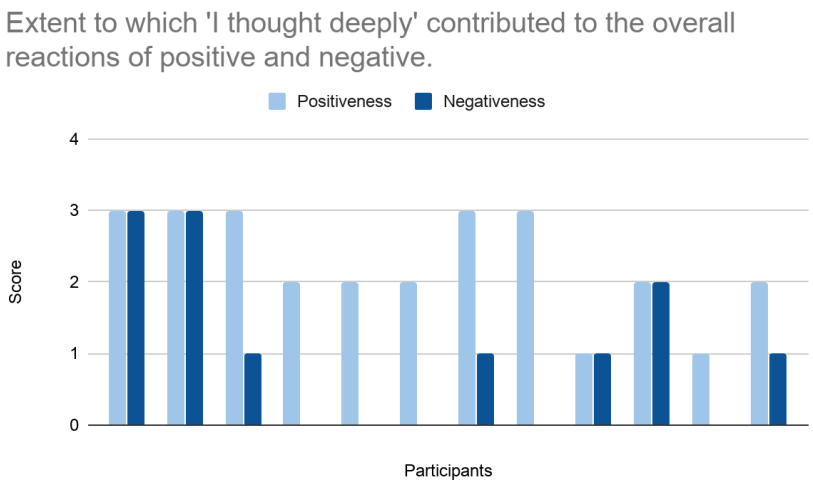

Fig. 3. Extent to which 'I thought deeply' contributed to the overall reactions of positive and negative shows the variation of positive and negative reaction by participant

Initially, the survey was designed for students to rate the contribution of an item only if they had experienced that item. From the think out-loud pilot, participants asked questions such as “*what*

if it did happen but was not positive" or *"if it did **not** happen but it was positive."* Comments such as these led to the scale for capturing the contribution to the reaction to start with "not at all" given that students could be ambivalent to the presence of an item. From one of the two instances of small data collection, preliminary results showed that students were seeing the same characteristic of an activity as contributing to both their positive and negative reactions. Fig. 3 shows data related to the factor of effort. In the figure, we see that some students saw the factor as contributing to both negativeness and positiveness while some students saw the factor as contributing primarily to positiveness.

Students are differentially aware of their reactions to reflection

Through our think out-loud pilot studies and conversations within the research team, it became evident that students are differentially aware of why they are reacting in specific ways. The level of awareness varies from student to student. This was seen in discussion around the survey, in conversations about why respondents had answered in particular ways. Some examples of the comments we heard include,

- "I never thought about this but now that it is here" (is aware)
- "I can't tell you why i'm frustrated, I just am" (not aware)

Here, this individual was talking about knowing their reaction to an activity but not being confident that they knew why they had that particular reaction. This pointed to the importance of having more ways to express a reaction beyond the positive and negative contributions. This finding generated discussions about what range of emotions an individual could feel towards a reflection activity and including the "why" to the reaction.

Completing the reaction survey is a reflection activity

From each pilot with students including the think out-loud, the small-scale deployment of our survey prototype, and the data analysis from these deployments, we have noticed that the act of taking the survey is a reflection activity in and of itself. From the think out loud, we heard participants say:

- *"Should I be thinking just about the activity or the activity and the outcomes of the activity in terms of overall positiveness?"*
- "*When you say class time does it mean a 2 hour period or the entire quarter?"*
- *"These are things that did not cross my mind!"*
- *"I didn't think about [this quality] DURING the reflection activity…*."

When thinking of reflection as "stepping out and thinking about," this phenomena makes sense. As students take the survey, they are reflecting on a given reflection activity. For example, if this survey is given to students after doing an exam wrapper, the reactions captured on the survey to the exam wrapper is directly tied to the reactions to the experience with the exam. Even though this was not considered in the initial design of the survey, it has contributed to many discussions about the type of data that is being collected and what the results could suggest.

Discussion

In our effort to develop the survey, we encountered four complications: nuance within a single student, nuance between students, students as differentially aware of their reactions to reflection, and completing the reaction survey is a reflection activity itself. At a high level, these results point to a general notion that the phenomenon we are seeking to understand (student reactions to a reflection activity) is an unstable phenomenon. We also note that our process was peppered with a tension between simplification (i.e., reducing items, reducing options) and wanting to ensure students could communicate complex experiences through our instrument. Finally, our process reinforces that surveys are just one way to be in dialogue with students about their reactions to reflection activities. These three high level observations along with the four complications from the findings come together in the sections below where we identify implications for educators and researchers.

Implications for educators

For educators, these four complications point to three implications: a novel way of receiving student feedback, a method to gain insight into student experiences, and finally, another opportunity for students to learn with the notion of "learning after the reflection activity."

Student reactions as feedback. Understanding student reactions to reflection can act as a form of student feedback to reflection activities, giving educators a way to evaluate the activities they have created. Current ways of receiving feedback on one's teaching include mid-term and end of the course teaching evaluations. Exams, problem sets, and other deliverables also function as a way of measuring student learning. The tool being developed is a survey that captures student reactions and thus the affective state of students. Reflection activities help scaffold students to dialogue with educators about their emotional, affective, and reaction states. As educators, it can be difficult to find the time to create new activities without being able to know whether the activity actually helped student learning. By getting a glimpse into student reaction to reflection activities, educators might be able to receive feedback more quickly on the activity's impact on student learning. Although it will be helpful to receive quick feedback, it will be important to keep each of the four complications in mind— one student with two different reactions to the same aspect of the activity, two students, opposing reactions to the same aspect of a reflection activity, differentially aware students, and the survey as an extension of learning through reflection. One concern that arises is that educators might use this data to iterate on reflection activities, based on the average student reaction. This in itself is not an issue. The problem arises when the nuances that result in opposing reactions are lost in the data. This points to our second implication related to student identity and culture in learning.

Student reactions as insights to student identities. The complexity of one student, two reactions makes sense given related work on complexity points to other phenomena found in the literature, related to choice and conflict in individual student identity [16]. As classrooms become more diverse, it is critical educators have tools to better gauge student learning and experience in the classroom. This also points to the fact that in general, humans experience events differently, based on their cultural perspectives and ways of being. In theory, we have seen that people have

complex reactions, but it is the backstory that helps us understand why people have both positive and negative reactions to the same quality of an activity. At times, the logical move can be to continue using a specific reflection activity given the, on average, positive reaction from students. From the findings, we highlight the importance of remaining reflexive and critical when interpreting student reactions. Given that engineering as a field has underrepresentation of minoritized students, it is easy for their opinion and concerns to get lost in the interpretation of descriptive statistics.

Survey on reactions may extend learning. Finally, as educators, we argue toward extending the notion of "learning outside the classroom" toward "learning after the reflection activity." By this we aim to bring to light the phenomenon we have been *noticing* of students taking the survey and feeling like they were reflecting in the process of taking the survey. Students say things like "this is meta" or "I felt that by taking the survey I changed my mind about how I felt toward the activity." From our experiences designing and deploying our reflection survey thus far, we believe meaningful aspects of knowledge development can come from reflecting on the reflection activity but we note it is critical to scaffold students in doing so.

Implications for Researchers

The four complications identified here have three overall implications for researchers as well, related to measuring affect, appropriate timing for giving out the survey on reactions, and methods in general. Although reflection as a teaching and learning tool has long been shown to be successful, there is less research on student reactions to reflection. The four complications create interesting, yet difficult problems for researchers to solve.

Measuring affect. As we measure affective reactions in a traditionally positivist discipline, researchers will have to find ways to consistently "measure" student reactions. And once reactions are captured, researchers will have to find ways to help educators make sense of student reactions that are situated in diverse cultural backgrounds. The survey as a tool is intended to help researchers understand reactions to reflection better, and eventually to aid educators in evaluating their classroom reflection activities. Because of this, we argue educators and researchers using the survey or subsets of the survey should remain conscious of potential biases that could arise in the data. As more research is conducted to measure student reactions, it is critical that researchers develop supporting material to help educators and the community as a whole understand student identity and culture in learning implications.

Timing of survey. These findings also suggest that it is important for student reactions to be captured close to the reflection activity because perspectives change as people continue with their lives and experience new things. This phenomena also creates the possibility to craft the conditions under which the survey is taken, in order to maximize student experience. When comparing reactions to reflection, it is important to account for the fact that reflection activities have different scales, in terms of intricacy and duration. Therefore the distance from the time reactions are captured from the end of the activity impact the student's understanding of their experience with the reflection activity. When comparing reflection activities, researchers must note the similarities and differences between reflection activities across different dimensions, including time.

Research methods. For this future work specifically, there are methodological implications about the structure and design of the survey and the method for data analysis. In order to understand classroom or context specific quantitative data, then it would be helpful to collect qualitative data that could simply be a few students sharing both positive and negative perspectives. It is easy to be discouraged by comments like "I don't like this, " but it is important to know that there can be an unlimited number of reasons why someone would not like an activity.

Limitations

One limitation of our work is connected to the population we have predominantly been engaged with in this research thus far. The students and instructors we have worked with come from prior academic connections with the researchers and are individuals we have departmental access to. Given the situatedness of our department culture and our academic relationship this might influence both the kind of reactions we recieved to taking the survey and from the data outputted from the survey. Another limitation we have found is that, as students take the survey, they struggle to remember certain aspects of the reflection activity which in turn influences how they remember their reaction. Part of this is because our pilots have required students to think about any reflection that had happened in the past two quarters. This points to the need for students to take the survey soon after completing the reflection activity. In future work, we plan on deploying our survey to institutions with a broad range of student population, departments with varying engineering and design cultures, and professors with different approaches to the design of reflection activities.

Conclusion

Through this survey development process, we have been able to identify four complications that arise when trying to understand student reactions to reflection. Through understanding student experiences, we can find ways to improve reflection activities and at the same time empathize with students as we learn how properties of reflection can cause diversity of reactions from students. Understanding student reactions to reflection is a promising route to not only understand more about student learning but also learn more about the student experience and reasons why two students can have opposing reactions to the same activity, why one student can dread doing a type of reflection activity but also appreciate it for the insights it provides, students may be differentially aware of their reactions, and as we continue to develop this instrument, we can continue to consider how the survey itself is a reflection and learning opportunity. Understanding student reactions to reflection is a promising approach to discover insights on teaching and learning in engineering education.

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Appendix. Items explored as the basis for reactions to reflection activities.

Effort

- I thought deeply for this activity
- I spent a lot of time completing activity
- In doing this activity, I was making sense of the experience I was reflecting on
- In doing this activity, I questioned assumptions or norms that guide my thinking
- In doing this activity, I engaged in critiquing myself and my actions
- In doing this activity, I had to engage in remembering
- In doing this activity, I made use of knowledge I have from other contexts
- In doing this activity, I had to clarify what I was being asked to do
- In doing this activity, I worked hard in order to answer the questions that were posed
- In doing this activity, I made connections to other parts of my life
- In doing this activity, I spent time looking ahead and/or making plans

Preference

- This activity required me to write
- This activity allowed me to present my thinking in more than just a written format
- This activity caused me to go out of my comfort zone
- This activity was completed in small groups
- This activity required me to work individually
- This reflection felt pretty structured
- This activity required me to use skills that I do not normally use
- This activity allowed me to express my reflection using my personal strengths in communication

Privacy

- I had to share my experiences with educators for this reflection activity
- I had to share my experiences with peers for this reflection activity
- I had to share my emotions with educators for this reflection activity
- I had to share my emotions with peers for this reflection activity
- I had to share private information with educators for this reflection activity
- I had to share my private information with peers for this reflection activity
- I was given the choice of submitting this project
- I had to share work that I was not ready to share

Mindset

- I am bad at reflection
- I wish I was better at reflecting
- I can improve my reflective practices
- Reflection is not as important in the classroom as it is in my personal life
- I am a reflective person
- I am good at reflecting
- I can always get better at reflecting
- I can't change my skill level with reflection
- I can always significantly change my reflection practices
- I can always change how much reflection I do
- Reflection is critical to my engineering education

Self preservation

- This reflection activity made me feel unsettled
- This reflection activity made me question assumptions I was not ready to question
- This reflection activity prompted me to wonder if I'm a good person
- This reflection activity led me down a spiral of thoughts
- This reflection activity made me feel uncomfortable
- This reflection activity allowed me to re-evaluate how I take care of myself
- This reflection activity made me feel shame
- This reflection activity made me feel exposed
- This reflection activity made me question aspects of my identity
- This reflection activity left me in a place where I needed to heal

Usefulness

- This reflection activity was a good chance for me to do better on the next class milestone
- This reflection activity felt like a waste of time
- This reflection activity helped me make progress towards my goals (academic, professional, personal)
- This reflection activity helped me sort through my thoughts
- This reflection activity gave me a chance to think about complex things
- This reflection activity made the things I want to accomplish easier to get done
- This reflection activity helped me be more effective in my study strategies
- This reflection activity helped me be more productive
- This reflection activity helped me prepare for an upcoming milestone
- This reflection activity helped me prepare for an upcoming milestone
- This reflection activity helped me come up with questions about the course I could not previously articulate

Situation

- When completing this reflection activity, I felt we could have been doing something more important during class
- This reflection activity was given at a time that I felt like I was in a good place with my assignments
- This reflection activity was given when I was particularly stressed because of a life event
- I had the option to complete this reflection activity when I felt it best fit my schedule
- I would have liked to spend more time reflecting but I was stressed about an upcoming school requirement
- I had to complete this reflection activity at the same time that I had many other life commitments.
- I had to complete this reflection activity on an appropriate day of the week
- I had to complete this reflection activity at a time when I was particularly worried about passing this class
- I had to do this reflection activity after we had just completed a big milestone in class
- I completed this reflection activity when I was feeling particularly proud of my academic achievements
- I was able to complete this reflection outside of the classroom

Epistemological

- I don't think knowledge comes from reflection
- I gain insights through reflection
- Reflection insights are more meaningful than insights from other academic activities
- Reflection does not require as much critical thinking as other assignments do
- I believe my educators are the most important source of knowledge in higher education
- I believe lots of things can be true
- I believe there is no truth
- I believe truth is relative
- I believe reflection produces knowledge that is good for school.
- I believe reflection produces knowledge that is good for me as a person.
- I believe knowledge about the things I do not know is valuable.

Power

- This activity caused me to think the educator used their power to push me to think deeply
- The educator provided a clear sense of explanation of why they wanted to do this reflection activity
- The evaluation for the reflection activity helped me understand what the educator wanted me to do
- This reflection activity gave me a sense of power
- My educator forced me to do this reflection activity but I recognize it is because it was a part of the course they did not have control over
- In this activity, my educator gave me a chance to make some choices in how I went about completing the activity.

- For this reflection activity, I understand how I am being graded
- I had the choice to do this reflection
- I feel the educator pushed me into a situation that I did not want to be in.
- I felt it was not appropriate for the educator to make me reflect

Culture

- Engineering as a field sees reflection as critical
- My department sees reflection as fundamental to learning
- This class frames reflection as something valuable
- My family's culture is a very reflective one
- This class' culture makes the activity seem like something we do to meet standards
- My peer group sees reflection as important
- Engineers do not need to reflect to be good at engineering
- This activity caused me to think about how I reflect on my personal life often
- I have reflected in non-engineering courses
- My professor is an advocate for reflection