Learning to Teach During the COVID-19 Pandemic: Leveraging Simulated Classrooms as Practice-Based Spaces for Preservice Elementary Teachers within Online Teacher Education Courses (RAPID)

Guidelines for Using the Ordering Fractions Task

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Overview of these Guidelines

This document is intended to help you, as a teacher educator preparing to implement the Ordering Fractions simulated discussion task with preservice teachers (PSTs) enrolled in your methods course, to think through your planning for incorporating the task into your syllabus and course. We begin by providing background information describing the prior project during which the task was developed, including describing why we elected to focus on argumentation-focused discussion and what critical features of argumentation the task was designed to support. We then describe the Ordering Fractions task briefly, calling attention to the structural elements that make argumentation available to the PSTs. We then share a list of considerations we think you will want to bear in mind as you plan your instruction, followed by a detailed list of areas your PSTs may need support in as well as activities you might consider using as you prepare them and debrief/reflect with them about the learning experience. We finish by briefly describing a set of resources that are available to you online, so that you know where to look next, as this guide is really just a starting point. The considerations, ideas, and resources described here are based on feedback from teacher educators who have used these tasks in the past under similar conditions but are not intended to be a comprehensive list or to constrain your choices. Please do not hesitate to ask questions about what is possible if you have other ideas you would like to try out or resources you think would help.

The Resource Folder

This document is not drafted as a stand-alone guide, but rather is meant to be used in conjunction with a set of resources we have provided. The following items are provided in the resource folder online. These resources are not ready-to-use curricular materials. Instead, they are resource materials that you should feel free to draw on in planning your own course sessions and you should consider adapting them in whatever ways would be most useful for engaging your PSTs in argumentation-focused discussion.

- **Performance task.** Prior to the PSTs' scheduled simulated session, they will receive a copy of the full task, as written, to support them in preparing for their discussion. We provided you with an editable version of the task in case you are creating preparatory materials based on it. (Please bear in mind however that the online simulation will be of the task as written.)

- **Video examples from this task with accompanying support materials.**

  - **Videos.** We have selected four example videos, which are meant to highlight a weaker performance (video #709), a mid-level performance (video #924) and two reasonably strong performances (video #727 and #930) that differ in approach. These examples are provided both because they will give you a sense of what your PST performances may look like and because you might choose to share one or more of them (or portions of them) with your class for analysis and reflection, before and/or after your PSTs' own simulated teaching session.
  - **Scores and justification/feedback from this task.** Along with the videos, we provided our scores for each example video, along with a justification document explaining the scores. Although we are not scoring performances for the current project, you may find this information helpful in understanding why these examples were selected and what we saw in the performances relative to the scoring rubric.
  - **Transcripts.** We also provided transcripts for the example videos, which you should feel free to use in combination with or separately from the videos. Transcripts may provide an easier way to have PSTs look for specific evidence, and also allow you the freedom to edit the files for length or to make your instructional points stand out more strongly.

- **Video examples from a similar task in the simulated classroom.** We recognize that you may want to share more distal examples of what it looks like to teach in the simulated classroom with your PSTs, particularly if you are hoping to avoid initially influencing their approach to planning the assigned discussion. Therefore, we have provided a parallel set of videos, scores, transcripts, and notes for a second set of videos tied to a different performance task.
- **Scoring rubric.** We provided you with a copy of our full scoring rubric, along with a one-page summary of these dimensions. We designed the performance tasks around these five dimensions, and reading them may support your own understanding of how we conceptualized these five dimensions, or features, of high-quality argumentation-focused discussion. Students' simulated teaching performances will not be scored on this project, but we do encourage you to adapt the scoring rubric and these five dimensions for use as you prepare your PSTs for their simulated classroom discussion and help them debrief and reflect on that experience.
- **Folder for sharing assignments.** We created a sub-folder titled, "Sharable Assignment Documents," where you can place additional assignments or resources you design in the course of your planning, if you are willing to share them with other participants. You should also feel free to peruse this folder for ideas as others begin to post materials there.
- **Mursion introductory materials.** Prior to the PSTs' scheduled simulated teaching session, we will provide them with a document that introduces the PSTs to the simulated classroom and student avatars and includes a couple of short video clips for them to watch. We will also provide each PST with a document providing details about a warmup task (taking students' lunch count orders), which each PST will complete during their simulated session right before they begin their discussion. We provided you with a copy of each document so you know what will be shared with the PST prior to their simulated teaching session. *Please note that these materials are under development and this folder may not be initially populated.*

Background Information about the Performance Tasks

The performance task that you will be integrating into your elementary methods course this semester was developed as part of an earlier NSF-funded research project (grant #1621344). In the previous project, our focus was on developing a set of simulation-based tools, which included a set of performance tasks, an upper elementary simulated classroom comprised of five student avatars, and scoring rubric, that could be used to support PSTs in learning how to facilitate argumentation-focused discussions in two content areas: mathematics and science. We studied the ways in which teacher educators integrated those tools into elementary mathematics and science method courses and how the PSTs used these experiences to develop their ability to facilitate argumentation-focused discussions. The focus on this teaching competency – facilitating argumentation-focused discussions – was purposeful as it is one that is perennially challenging for teachers to learn how to do well and is also one that PSTs typically have limited opportunity to learn how to engage in. In addition, as noted within district and state standards across the nation, argumentation is critical for student learning and promoting productive student engagement in mathematical and scientific argumentation is a hallmark of high-quality instruction. In this NSF RAPID grant, we will be using two of our previously developed performance tasks – the Ordering Fractions math task and the Mystery Powder science task – and integrating them into online or hybrid elementary method courses.

Argumentation typically involves students in knowledge generation through a social process of supporting, exchanging, comparing, and critiquing ideas. While the specific approaches and nature of the warrants used differ across mathematics and science, in both content areas engaging students in argument construction and critique is vital for supporting children's conceptual development. We designed the performance tasks to provide opportunities for the PSTs to engage the student avatars in both argument construction and argument critique as they facilitate their discussions within the simulated classroom environment. In each performance task, we provide a description of the specific mathematical

problem or scientific investigation that the students have been working on in their classroom. We also provide written work samples of student groups responding to the specific problem or investigation question for the PSTs to consider and work with as they prepare to facilitate the discussion in the simulated classroom. To ensure that there are opportunities for the PSTs to engage the student avatars in argument construction and critique during the discussion, we purposefully designed the written work so that the students' claims, answers, justifications, evidence, and/or reasoning vary. As such, this design decision means that the PST has opportunities to engage the students in argument construction and critique – should the PST take advantage of those opportunities – as they build towards consensus on key mathematical and scientific ideas during the discussion. In addition, since the focus is on an ambitious and hard-to-learn teaching competency, we purposefully decided to have student avatars who are well-behaved and provide no classroom management challenges for the PSTs to address during these discussions.

In our previous work, we drew upon empirical research and literature in mathematics and science teacher education to identify five key dimensions, or features, of this teaching competency. These dimensions include: (1) attending to student ideas, (2) facilitating a coherent and connected discussion, (3) encouraging student-to-student interactions, (4) developing students' conceptual understanding, and (5) engaging students in argumentation. In the resource folder, you will find a copy of our scoring rubric, along with a one-page summary of these five dimensions. In each of the performance tasks, you will also find a section titled, "Features of High-Quality Discussions Focused on Argumentation," which provides a list of reflection questions linked to each of these dimensions that your PSTs could use as they plan for, analyze, reflect on, and learn from the simulated teaching experience. Together, these five dimensions define the key components of this instructional practice and form the basis for the scoring rubric we use to assess the PSTs' video-recorded discussions in the simulated classrooms. On the current NSF RAPID project, we will not be scoring the video-recorded performances, although we do encourage you to adapt the scoring rubric and these five dimensions for use as you prepare your PSTs for their simulated classroom discussion and help them debrief and reflect on that experience.

The Ordering Fractions Mathematics Task

In the Ordering Fractions mathematics task, the purpose of the discussion is for the students to evaluate, justify, compare, and contrast strategies for ordering fractions with different numerators and different denominators. Prior to the discussion, the students worked in small groups to generate a strategy, use it to order three given fractions: $\frac{3}{10}, \frac{9}{10}, \frac{3}{4}$, explain their strategy, and formulate a claim about whether the strategy would always work. Prior to facilitating the discussion in the simulated classroom, the PST can review each student group's written work. One student (Mina) uses whole number reasoning, considering the numerators and denominators separately, to arrive at an answer that is partially incorrect and coincidentally partially correct. This is a typical way elementary students reason incorrectly about fractions, and part of what this strategy makes available to the PST is the opportunity to consider both issues: the incorrect part of the answer and the correct part based on erroneous reasoning. The second group (Will and Jayla) uses a number line approach to order the fractions correctly and claims that the approach will always work, a claim that others in the class will disagree with, noting the practical limitations of the approach. The last group (Emily and Carlos) uses an ad-hoc combination of benchmark comparison and reasoning about the size of the missing fractional parts to arrive at a correct ordering, and correctly concludes that their strategy might not always work. This variation across the students' claims, evidence, and reasoning provides opportunities for the PSTs to engage the student avatars in justification of their strategies and generality claims, as well as in critiquing the arguments other groups have made and working toward consensus around ordering fractions in accurate and consistent ways. It also presents the PST with the challenge of responding to the methods that the students have generated, and resisting the temptation to instead present a new, teacher-driven approach.

In prior work, we have noted that PSTs often struggle to know how to help Mina understand not just that her answer is wrong but why, and that they often accept the part of her answer that is correct without question. Strong approaches we have seen include prompting Will and Jayla to illustrate to Mina that her answer is wrong via their visual representation, which helps her see that her answer is incorrect, and prompting Emily and Carlos to discuss the size of the pieces of the fractions as a way of helping her see why her answer is wrong. Another common but less productive approach that PSTs will sometimes take is to sketch their own visual representation (generally a circle model, sometimes rectangles) as a way of re-teaching Mina; however, this approach does not draw on the student ideas available to them. We have also seen a number of cases of PSTs spending little time on the students' work and instead instructing them to use a common denominators approach. Another set of challenges can come in with respect to the generalization claims, and PSTs often demonstrate discomfort with the lack of consensus or seem unsure whether or how they should attempt to resolve it. Strong moves including posing or eliciting new fraction examples from students that push the boundaries of the given strategies in illustrative ways.

Important Planning Considerations

In this section, we share some broad considerations that we believe are worth bearing in mind as you begin to get to know the performance task and think about how to productively integrate it into your syllabus and course.

Getting to know the task for yourself. Just as any teacher would immerse themselves in the task they will be asking their students to do in advance of assigning it, we imagine you are thinking about how to get to know the performance task in advance of using it and anticipate your PSTs experience of it, which is a bit more difficult to do for a performance task that is quite new to you. We have provided a number of resources in the resource folder to help with building your own understanding of the task, including recorded examples of past discussions, and we recommend spending some time with these resources as a way of anticipating what it will feel like for your PSTs to prepare for and complete this simulated teaching assignment.

Your PSTs' content backgrounds. While we provide some support within the task materials in understanding the student-level content, our prior experience indicates that this can still be a challenge for PSTs. It is worth considering whether they might need additional support in building their own understanding of the relevant content ahead of their scheduled discussions.

Fit to your course. Like any rich instructional task, the performance task could be used to support a number of different instructional goals, and there are many productive ways to integrate it into the course. Depending on the timing, as well as how you see this fitting into your overall goals, you might think of it as a culminating experience, with smaller exercises designed to build up lesson planning and/or discussion skills earlier in the semester. In contrast, you might think of it as an opportunity to generate teaching artifacts early on that can be used throughout the rest of the semester as objects for reflection. You might also see it fitting somewhere between these purposes. You also have full control over the nature and amount of support you give your PSTs, including what you would like them to have done ahead of time, and how much scaffolding you would like to provide to support their preparation and discussion planning. Additionally, while the simulated discussions are conducted individually, you might choose to make any of the preparation and debrief/reflection activities around the discussion collective. In short, you have a great deal of flexibility around how you use the performance task, and we encourage you to reach out and ask if you have an idea and are not sure it is possible.

Tailoring the task goals to your instructional goals. As described in the background section, the prior work in which the performance task was developed had a strong focus on argumentation-focused discussion and used a five-dimension scoring rubric to evaluate the features of

high-quality argumentation-focused discussions. You may or may not feel that all five dimensions are of equal importance for your instructional goals, or you might feel that it is just too much for a single assignment. These types of decisions are also completely flexible. Your PSTs will not see our scoring rubric (unless you share it or the one-page summary with them) and you can provide them with support in focusing on one or more dimensions in the ways that make sense for you.

Anticipating PST anxiety. The simulated teaching feels remarkably real, and if your PSTs have not led instruction before they may feel as anxious as if it were the real thing. They may also feel uncomfortable about being video recorded. You may wish to consider preparing them for this simulated teaching experience similarly to how you would if they were stepping into a real classroom. They may also feel uncomfortable with the idea of others' viewing their discussions if this is not a common practice at your institution. Sharing can be a very powerful tool for collective reflection, but if you plan to have them share their videos with each other we would suggest thinking carefully about how you will communicate the expectation and scaffold their experience in order to head off any strong negative reactions.

Preparation and Debrief/Reflection

Engaging in preparation and a debrief/reflection activity are each required for study participation, but how you do that is entirely up to you. We have some suggestions listed below, based on prior experience from teacher educators using these tasks in their courses. However, the list is neither exhaustive nor should it be thought of as prescriptive. Your obligation of active, in-class time to the research project need be no more than an hour or so to prepare and an hour or so to debrief/reflect afterward, but we put no limits on what you may choose to do. You may prepare in any way you think appropriate, including preparing across multiple sessions/assignments. You may have your PSTs debrief/reflect in any way you think appropriate, including across multiple sessions/assignments. The simulated teaching exercise can be as central a part of your instruction as makes sense for you. If you wish to try something you might need our support to do, we encourage you to reach out and ask us, as we will try to accommodate as much as we reasonably can. Suggested activities to consider in your planning are listed below.

Preparation

Past experience has shown us that PSTs may need support in advance of enacting these tasks in a number of areas, including the following:
- Understanding the mathematics or science content that is the focus of the task
- Unpacking the written student work that is provided within the task and thinking through how the available student understandings and misunderstandings create opportunity for productive discussion
- Knowing how to organize the discussion
- Thinking about balancing the content goal of addressing student misconceptions with the practice goal of encouraging argumentation-focused discussion
- Understanding that student-led discussions involve teachers in directly encouraging and prompting meaningful

Some preparatory assignments/activities you might consider using:
- Engaging PSTs in class conversations about the key dimensions, or features, of argumentation-focused discussions on which you have decided to focus, including conversations about what they mean and why they matter
- Engaging PSTs in class conversations about the mathematics or science content that is the focus of the task
- Analyzing videos and/or transcripts of example performances (see resources folder) individually or collectively
- Having PSTs complete the student level problem or investigation themselves, individually or as a class
- Having PSTs brainstorm different solution methods or approaches they think students might take

student-to-student dialogue and involve less teacher mediation or direct instruction • Understanding what argumentation is, why it is important, and how to engage students in it during a discussion	• Analyzing the provided student work samples • Providing structured supports for planning for the discussion, which could include activities such as using a planning template, brainstorming ideas with classmates, writing and revising plans after sharing plans with classmates or with you for critique and revision • Having PSTs practice facilitating the same discussion with their peers acting as the students • Modeling how to facilitate a student-led discussion using a similar mathematics problem or science investigation data with your PSTs • Modeling your own performance in the simulated classroom by pre-recording your own video and then sharing with your PSTs • Other. We look forward to learning about what tools you use, adapt, and develop.

Debrief/Reflection

Past experience has shown us that PSTs may need support in knowing what to take away from the experience and how to make sense of their video records. Areas in which PSTs may need support when they debrief and reflect upon the simulated teaching experience include the following: • Understanding how to evaluate the video-recorded performances with respect to both strengths and weaknesses • Connecting the outcomes they see to the teaching moves they made • Understanding how the discussion might have played out differently if approached differently • Recognizing the five features of high-quality argumentation-discussion in the context of a particular performance video	Some debrief/reflection assignments/activities you might consider using: • Assigning written reflection assignments, open-ended or in response to specific prompts (for example, the reflection prompts on p. 13 of the task or your own prompts). Reflections might be assigned in closer or farther proximity to enacting the task, before or after viewing the video, or as a series of assignments • Holding a class discussion about what they noticed, where they struggled, where they succeeded, potentially linked to the PSTs' written reflections and/or to the five rubric dimensions • Inviting PSTs to select and share portions of their video recorded performance with peers for feedback or suggestions, and/or to evaluate one another's performances using a rubric • Inviting PSTs to analyze and examine their videos and/or transcripts individually or collectively • (Re)enacting portions of the simulation together in class after deciding how you might enact it differently • Having PSTs record a short reflection video using Flipgrid or another video tool about the strengths and areas of growth evident from their videos, or about what they learned from the simulated teaching experience • Other. We look forward to learning about what tools you use, adapt, and develop.