Lessons learned from a pilot study: Understanding the processes preservice teachers use to write lesson plans

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Abstract

An important part of any teacher preparation program is the process of planning and writing lessons. Lesson planning is important to the growth of preservice teachers, because it helps teachers think through all the necessary pieces of teaching an exemplary lesson. Knowing how preservice teachers write lesson plans will inform the support that teacher preparation programs provide. For this study, data was collected from a group of junior level STEM education preservice teachers to understand their lesson plan writing process. Specifically, we wanted to know where preservice teachers struggled in the process. To accomplish this goal, we collected the preservice teachers' lesson plans, reflections, log of their steps, and screen capture video. Because the data collection was coupled with the preservice teachers' class and we did not want to interfere with the course, we were not able to collect a full set of data from each preservice teacher. Since we did not have a full data set from each preservice teacher, we were not able to address our main research question: "What are the processes preservice teachers use when to write a lesson plan?" Despite not being able to address this question, we were able to begin to understand the challenges preservice teachers face when writing lesson plans and develop an improved protocol for data collection so that we are able to address our initial research question in future studies. This paper will describe the value in each type of data we collected, the rubric we developed to assess students' lesson plans, the challenges preservice teachers faced, and our plans for future studies based on the outcomes of this pilot study.

Introduction

Planning for instruction and writing lesson plans is an important part of being an effective teacher; however, it is a very complex and challenging process that many preservice teachers struggle with. Teachers are expected to design lessons that align with state mandated standards, utilize innovative instructional strategies, consider students' prior knowledge and interests, and assess that students have met the intended objectives[1,2]. "The goal is to affect [the students] on many levels; it must not be dry academic content, but interesting and relevant work… [the students] develop greater skill and understanding" (p. 195)[3]. With all of these complexities, lesson planning is more than simply making a list of activities. For this reason preservice teachers often struggle to include and consider all the necessary parts of lesson planning. There are numerous books that provide steps for preservice teachers to follow as they plan their lessons, where the standard model begins with defining the lesson objective followed by designing assessments and instruction that align with the objectives[2]. Despite all of the tips and steps for planning lessons, there has been little work to understand the processes preservice teachers adopt and where they struggle as they plan for instruction. In order to develop strategies to support preservice teachers as they learn to develop lesson plans, we sought to understand more about the process that preservice teachers are using when they develop lesson plans.

The research questions for our initial pilot study were 1) What are the processes that preservice teachers use to write lesson plans?, 2) What challenges do preservice teachers face when writing

a lesson plan?, and 3) What strengths do preservice teachers have when writing lesson plans? We collected four different types of data: screen capture videos, logs of the lesson planning process, the written lesson plans, and a reflection on the lesson plans. The screen capture videos and the logs aimed to answer our first research question concerning the lesson plan development process. The lesson plan and the reflection aimed to answer the second and third research questions concerning challenges and strengths. Because of the nature of our data collection for this study, we were not able to collect enough data from each preservice teacher to answer our first research question; however, the data we collected allowed us to address research question two and three and inform the data collection for our future studies that aim to answer research question one. This paper will present the results from our pilot study and describe some of the challenges we faced with data collection and how these challenges and results are being used to inform our future studies.

Methods

Context about the Course

As part of their methods course, the preservice teachers completed a field experience in a middle or high school STEM classroom. The beginning of the teaching methods course focused on writing measurable learning objectives, identifying relevant standards, developing and writing lesson plans, and using effective, research-based teaching strategies. The preservice teachers were given a template for writing lesson plans (see Appendix B), and as a class they reviewed the template and example lessons prior to writing their first lesson.

The lesson plan format used in this course began with the aim of the lesson, or what the preservice teachers will be teaching about, a lesson standard, and the lesson question(s), of which the students will be able to answer by the end of the lesson. Following this, the preservice teachers described the learning objectives (what students will be able to do) and the assessment for each objective. The next section prompted the preservice teachers to reflect on what the students may already know and any misconceptions they might have on the topic of the lesson. After which, the preservice teachers wrote the details for their instructional plan, which included the lesson opening, transitions, context and application, and closing. The context and application sections makes up the largest portion of the instructional plan and is where the preservice teachers described exactly what will occur as the lesson progresses. This included activities, questions, topics, and transitions between topics. The goal for the section is to have the pre-service teachers write exactly what is going to happen during lesson. They should be prepared for a few different scenarios and understand how to keep their lesson on track. Next, the preservice teachers listed all the questions the students will be asked during the lesson, beginning with knowledge questions, then application questions and finally, critical thinking questions. The preservice teachers were then prompted to think about how the lesson will proceed for the baseline population of students, and how it will be altered for both struggling and accelerated students. This is followed by the conclusion of the lesson, the homework the students will have, and the materials needed for the lesson. The purpose of this structured lesson plan is to prompt the preservice teachers to think through all aspects of their lesson while considering the various needs of their students.

Data Collection

The data for this study was from the preservice teachers' final project where they wrote and taught a 20-minute lesson on a topic of their choice. The preservice teachers planned their lessons using the recommended lesson plan format. Some documented their process by completing a written log of their steps and/or a screen capture video. After completing their lesson planning, the preservice teachers completed a reflection about the process of writing their lesson plan and presented their lesson to their peers. The purpose of the written log and screen capture video was to see the specific processes used by each preservice teacher to complete the lesson. The aim of the reflection was to gain an understanding of how the preservice teachers viewed their process of writing lesson plans. Since we did not want the data collection to interfere with the preservice teachers completing their final project, we do not have the same types of data (log, screen capture video, lesson plan, and reflection) from all of our participants (see Table 1 in the Results section for details).

Data Analysis

Each lesson plan was assessed by a rubric developed for this study. This rubric assessed each component required within the provided format on completeness, clarity, and detail. In addition to the rubric, codes were developed to describe the areas of strength and weakness. By overlaying the rubric and codes, a table was developed to compare each section of the preservice teachers' lessons. This allowed us to determine common and unique areas of strength and weakness. The analysis of the lesson plans was compared to the analysis of the screen capture video, written log, and/or reflection to gain a more detailed understanding of the processes and challenges used by the preservice teachers.

We developed codes to describe each step used to write the lesson plans and the challenges faced by the preservice teachers. These codes were developed iteratively across the written logs, screen capture video, and reflections. If screen capture video was provided, it was watched carefully in order to outline a detailed process used by the preservice teacher, making note of how the specific elements of the lesson plan were completed. The written logs were also analyzed to understand the steps used by each preservice teacher. The reflections were read and analyzed to determine where the preservice teachers felt like they struggled and/or excelled. We took the findings of this initial data analysis and looked for consistencies within the all of the lesson plans. We then reevaluated our data collection procedures to narrow down the information we were looking for to continue our study. This study was completed using an IRB approved protocol, and all participants' names were replaced with pseudonyms.

Results and Discussion

Outcomes Related to Data Collection

We aimed to collect a written log, screen capture video, lesson plan, and reflection from each preservice teacher; however, we were not able to get a complete data set from each preservice teacher (Table 1).

Table 1: Summary of data collected from each preservice teacher.

	Log	Screen Capture Video	Lesson Plan	Reflection
Preservice Teacher A	✔	✔	✔	✔
Preservice Teacher B	✔		✔	✔
Preservice Teacher C	✔	✔	✔	✔
Preservice Teacher D			✔	✔
Preservice Teacher E			✔	✔
Preservice Teacher F			✔	✔

We had two preservice teachers record a screen capture video as they were writing their lesson plan. Screen capture software allows the user of a computer to record what is happening on their screen for an extended period of time. Those preservice teachers who completed the screen capture videos used the software to record the composition of their entire lesson plan. These videos enabled us to see the exact process the preservice teachers used to write their lesson plan. We were able to see the order they completed the lesson plan, what resources they used, and how long they spent on each part of the lesson plan. Based on the screen capture videos, we made a flowchart of the steps each preservice teacher used as they wrote their lesson plan (Figure 1). The flowcharts were used to document the order in which the preservice teacher wrote their lesson plan. The flowcharts allowed us to look at the data from a visual standpoint as well as compare the lesson plans to one another. The preservice teachers that did not record a screen capture video while they were working on their lesson plan either struggled to get the software working on their computers or found the recording to be too intrusive to their writing process.

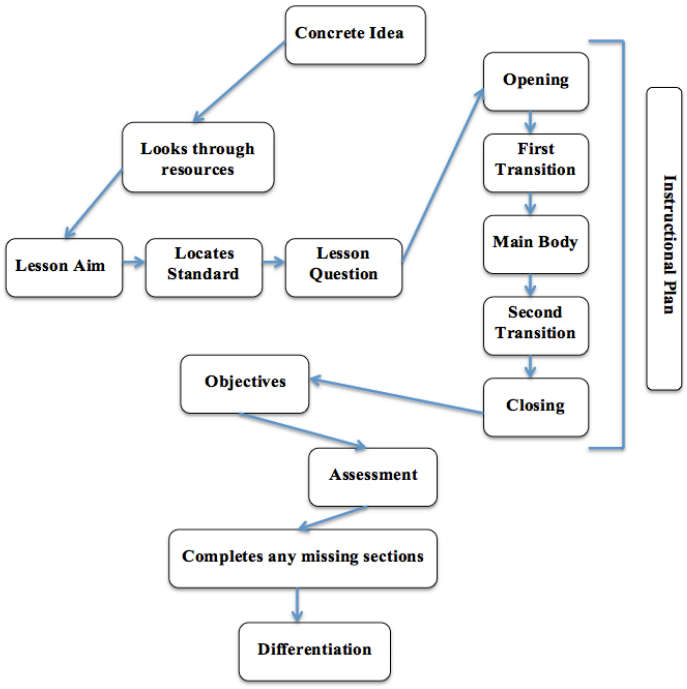

Figure 1: Sample flowchart based on Preservice Teacher A's screen capture video.

The preservice teachers were given the option to submit a screen capture video or a log with their lesson plan. We had three preservice teachers submit logs; two of these preservice teachers also submitted a screen capture video. Like the screen capture videos, the logs were also helpful in determining the process the preservice teachers used to write their lesson plans. The purpose of the log was to get a written representation of the process they used to complete their lesson plan. It was meant to replaced the screen capture video for the preservice teachers that had technical difficulties with the screen capture software or found recording their computer screen to be too intrusive; however, for this study the only preservice teachers to submit a log also submitted a screen capture video. Preservice Teacher C turned in a log that was a numbered list, outlining exactly what was completed and why. For example, their log began with the following, "1. When first starting a lesson plan I begin with the objectives. This allows me to solidify what it is I want my students to accomplish… / 2. After writing both objective[s] I move to the assessment section…"

The lesson plan was the outcome of the process we were interested in studying. By analyzing the lesson plans we were able to get an idea of the preservice teacher's strengths and weaknesses. The limitation of looking only at the lesson plans was that there was no record of the preservice teacher's process. A rubric was developed to assess all the lesson plans on the key elements of a lesson plan. The rubric (see Appendix A) allowed us to compare each preservice teacher's lesson plans and identify the sections of the lesson plan that different preservice teachers struggled and/or exceled.

Through the written reflections, we sought to understand what the preservice teachers felt like they struggled with, the areas they excelled, and the process they used to write their lesson plan. We were able to make connections between the reflections and the lesson plans to identify areas

that each preservice teacher struggled and exceled. These reflections gave us a small glimpse into the lesson plan development process of the preservice teachers, but it was not equivalent to what the screen capture videos or logs supplied. For example, Preservice Teacher B did not provide screen capture video or a log, but they did provide a reflection. From their reflection, we determined that this preservice teacher struggled to identify standards: "Being that I am still relatively new to being a teacher and writing lesson plans, I still take quite a while to search for content standards for my lessons…This process of finding just a standard took almost two hours." We would have not known that Preservice Teacher B struggled with finding standards by only looked at the lesson plan they developed.

Overall, the data we collection for this preliminary study did not provide us with all the information we needed to analyze the processes the preservice teachers used when writing a lesson plan. We are missing data that helps us fully understand the lesson planning process. This lack of data was because of the small sample size and voluntary nature of providing the different data sources. Although we are unable to analyze the processes the preservice teachers used when writing a lesson plan, this preliminary study helped us strengthen our data collection process and begin to understand where preservice teachers struggle and excel when writing a lesson plan. We have modified our data collection process to capture the data we need in order to analyze the processes preservice teachers use to write a lesson plan and answer our first research question more completely (see Limitations and Future Work).

Data Analysis

All of the lesson plans were assessed using a rubric that evaluated each aspect of the lesson plan (see Appendix A). Each portion of the lesson plan was assigned a score between 4 and 0 with 4 being excellent and including all necessary parts and 0 being completely missing from the lesson plan. A table was developed to compare the scores that were assigned to each section of the lesson plan (Table 2). This allowed us to identify areas where individual preservice teachers excelled and struggled, as well as where some preservice teachers exceled but others struggled.

Table 2: Results of lesson plan analysis using our formulated rubric.

	Preservice Teacher A	*Preservice Teacher B*	Preservice Teacher C	Preservice Teacher D	Preservice Teacher E	Preservice Teacher F
Topic/Focus/Aim	4	2	4	3	3	3
Standards	4	4	3	0	0	4
Objectives	4	2	4	3	3	3
Instructional Plan	4	3	3	3	2	3
Lesson Questions	4	3	4	4	3	4
Closure	3	4	3	2	3	2
Differentiation	3	2	4	3	0	3
Total Score	**26/28 - 93**	**20/28 - 71**	**25/28 - 89**	**18/28 - 64**	**14/28 - 50**	**22/28 - 79**

We identified that there are inconsistencies in the quality of the lesson plans within the areas of standards, differentiation, and closure. As we can see from Table 2, Preservice Teachers D and E did not identity standards to go along with their lesson. In addition, the four other preservice teachers also struggled with standards; however, it is not apparent by only looking at Table 2. This is because these preservice teachers struggled in the beginning of their lesson planning

process to identify standards. They were eventually able to identify appropriate standards, but they reported in their reflections that is took a lot of time is was something they found difficult. In their reflection, Preservice Teacher B explains how they struggled to identify an appropriate standard:

> The most challenging part of making this lesson plan was finding a content standard to go with it. Being that I am still relatively new to being a teacher and writing lesson plans, I still take quite a while to search for content standards for my lessons. Searching for standards was especially difficult for this lesson, because most of the standard sources that I usually use did not have a standard that applied to the lesson…This process of finding just a standard took almost two hours.

It is not surprising that all the preservice teachers struggled with standards for their lesson in some way or another. Preservice teachers of this stage in their education are still removed from the day-to-day curriculum of a classroom. This is reflected in the disjointedness between standards they should be comfortable with and the way they use them in their lesson plans. These preservice teachers spend 2 to 3 days a week in a classroom and rotate between different grade levels and classes. This removes them from familiarity with the overall curriculum, standards, and strategies.

Aligning the lesson components to the standard is an important skill for all teachers to have, and it is evident that some of our preservice teachers struggled with this skill. The idea of forming an entire lesson around appropriate standards is something that takes time and practice. A full-time teacher would likely follow the curriculum of given standards. As a teacher is forming their lesson plan, they are basing their plans off the curriculum therefore connected to standards is easier. When a preservice teacher writes an isolated lesson plan, they have to pull a majority of the lesson from different sources rather than a curriculum, which makes choosing and aligning to standards a bit more difficult. In future work, we plan to identify ways in which teacher preparation programs can help students grasp a more solid understanding of the standards they are using and how to appropriately apply the standards in a variety of settings.

Differentiation is another area where the preservice teachers struggled. The lesson plan format these preservice teachers were using included three separate differentiation sections; one for baseline preforming students, one for accelerated students, and one for struggling students. Two of the preservice teachers had missing components to their differentiation sections. The remaining four completed their differentiation sections, but only one of these four really established a strong plan for differentiating their lesson for varying abilities. Preservice Teacher C presented the most complete differentiation by assuring to help a range of students using strategies such as peer instruction, direct teacher reteach, and differentiated outcomes. The remaining preservice teachers discussed adequate baseline statements within their differentiation sections, but did not successfully describe ways in which different piece of the lesson plan would be differentiated for varying abilities. For example, Preservice Teacher D described how the assessment would be different for the different ability groups, but left out how they would teach in a differentiated way. This discrepancy was very similar to the remaining three preservice teachers who fully completed the differentiation section. It is important to assure all aspects of

the lesson can be differentiated in a way that all students can advance and be prepared to build on the learned knowledge in future lesson. Preservice Teacher B describes some of the challenges that they faced with developing the differentiation plan within their reflection:

> The section that I had most difficulty with was probably the differentiation portion of the lesson. I was very confused how I should write the advanced portion and also the struggling section. I'm not sure how I should assist struggling students other than to physically address any questions they had verbally and instruct them to the point where they are with the baseline students.

From this statement, it seems that the preservice teacher is not considering specific challenges or strengths students might have for the particular lesson they are teaching. More instructions within the college classroom is needed to explain how to determine appropriate differentiation within specific contexts. This is also an aspect that will become less challenging as the preservice teachers get to know the students that are in their class and can differentiate towards specific challenges they have had in the past.

Many of the preservice teachers struggled with the closure portion of their lesson plans. The closure section is one of the most important parts to a lesson plan because it allows the teacher to recap the things they wanted their students to learn, as well as assess whether or not the students took away what they wanted them to. The lesson closure should not simply state what was completed or what tomorrow's lesson will entail. The lesson closure is the last chance to reinforce the lesson's focus. All the preservice teachers completed the lesson closure section of their lesson plan. The best lesson plan closure comparative to the others was Preservice Teacher B's. They used the strategy of an 'exit ticket' or a question assessing the lesson and asking students to apply the new knowledge and hand in before 'exiting' or finishing the lesson. This presented an opportunity to recap and apply knowledge in a way that is assessable. All the other preservice teacher's closure sections were average. Some recapped the lesson's ideas and some used questions similar to the lesson questions they asked throughout the lesson. Overall, the preservice teachers could use work with the different strategies of lesson closure to allow for a better end to their lessons.

Conclusions

Our results suggest that most preservice teachers will need support and practice locating and understanding standards. The course that these preservice teachers were part of included familiarizing themselves with the standards that they would be using throughout the semester. Within the teacher preparation program we studied, the preservice teachers were asked to read the standards and do a few in-class activities framed around applying the standards to begin to learn and become familiar with the them. Based on our work more support may be needed for preservice teachers to help them become familiar with and comfortable connecting standards to lesson plans. We also believe that this is a skill the preservice teachers will develop with time in the same K-12 school and classroom. Additionally, within the teacher preparation program, giving students example lesson plans that include relevant standards and showing them example curriculums that incorporate a range of standards may help preservice teachers gain a more complete understanding of the standards and how to connect their lessons to them.

The challenges of writing measurable learning objectives, aligning assessment to their objectives, and providing detail within the lesson plan were faced by some of the other preservice teachers in the class. Based on these results, it is important to help preservice teachers understand the purpose of lesson planning and the value of aligning objectives, assessments, and instruction. More work needs to be done to understand the processes the preservice teachers used and if some of the differences are attributed to specific challenges that can be addressed within a course.

We found that the most helpful piece of data collected was the screen capture videos. Although these videos lacked audio, they provided us with holistic evidence of the process these preservice teachers used to write their lesson plans. The reflections also helped us gain an understanding of how the preservice teachers felt about their lesson plans. The results of this exploratory study contribute to our knowledge about the struggles faced by preservice teachers as they develop lesson plans. Additionally, this study contributes to our understanding of how to study the processes preservice teachers use as they develop lesson plans, providing specific methods that can be used to further explore our research questions.

Limitations and Future Work

This exploratory study analyzed the lesson plans, written logs, screen capture video, and reflections from preservice teachers who developed a lesson plan as part of their final class project. This data only gave us a limited view of the struggles and challenges faced when developing lesson plans. Future work will include a larger study sample, a designated computer that has the screen capture software installed, and a semi-structured interview after they write their lesson plan.

Our goal with future work is to recruit students from different majors and years so that we can begin to understand the challenges and strengths of preservice teachers at different stages in their program. We want to high number of participants so that we can easily compare the similarities and differences. This larger sample size will allow us to provide deeper understanding of the lesson planning process. Furthermore, this will allow us to identify ways to support preservice teachers' development throughout their teacher preparation programs.

In our future studies, the participants will write their lesson plans within a controlled setting that has a computer and microphone for them to use. As the participants write their lesson plans, they will be asked to do a think aloud to record their process. We will also have screen capture software running in the background of the designated computer to record what they are doing on the computer as they write their lesson plan. The data collection will also not be tied to any of the preservice teachers' classes. We hope this will help them feel more comfortable recording their computer screen and doing a think aloud as their write their lesson plan. Additionally, having the audio connected to the video clips will give us a better idea of what is going on in the preservice teachers' minds as they are writing their lesson plan.

In addition to completing a lesson plan with video and audio, the preservice teachers will be interviewed after they finish writing their lesson plan. We will ask more in-depth questions such as, "What did you parts did you struggle with?" "What parts did you find easy?", and "How do you combat your struggles?" We were also able to decide what parts of the lesson plan development process we are looking to focus on based on the consistent struggles the preservice

teachers in the preliminary study had. All of the data and outcomes created a solid foundation for our future work.

References

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Appendix B: Lesson plan format preservice teachers used

Title: _____ Unit #____ Lesson #_____ Day # _____

Aim/Focus Question
Aim/Focus Question: *Write out the "Big" Content Objective from the Unit Plan*

Learning Objectives (SWBAT) with Standards Codes	**Assessment(s)**
How will you assess the students' understanding of the learning objectives? Include on-going formative assessments and any summative assessment.	
***Daily* Content Objectives:**	
"Big" Skill Objectives:	

Student Understandings/Misunderstandings/Misconceptions
What do you anticipate your students already know going into this lesson, misunderstanding, and having misconceptions of?

Beginning (Do Now/Opening/Hook)

Your beginning should engage students in the material for the day and be related to the objectives above. It is good to make your beginning relevant to the students' lives and to make an overt connection between the beginning and the objectives for the day.

Opening:

Transition *Explicitly connect the discussion of the "Opening" to the day's "Aim" and then to the first "Activity."*	**Transition:**

Middle – Context/Application (Mini Lesson, Activity, Guided Practice)

Be sure that your middle section includes a balance of instructional time and time for application.
*Include **transitions** (in italics) when moving to another topic/activity.*
*Make sure that all activities have **clear instructions** for the students (written down and delivered) and that you **model** activities for the students, when needed. It is useful to **list/outline** the instructions.*

Instructions: (Add more rows to the table below as needed)

What I will be doing:	What the students will be doing:	Materials/Pre-planning I will need to have ready:	Approximate Time (including transitions):

SAMPLE QUESTIONS **What questions will I ask during the activity/ lesson? Include anticipated student answers in parentheses. Above, write where in the instructions the question will**	**Knowledge Questions:**
	Application Questions:

go, using parentheses (ex. Q1).	**Critical Thinking Questions:**

Differentiation

Struggling	**Baseline**	**Accelerated**

Transition *Connect the "Application" with the "Conclusion."*	**Transition:**

End /Conclusion of the Lesson

End each lesson together as a class to sum up the material for the day and bring the class back to the "Learning Objectives" and "Aim" for the day.

Homework

What is the students' homework to help them apply the knowledge they have learned from the day's lesson?

Materials

List any materials you need for the lesson.