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A Problematic Past: Exploring the Influence of Future Teachers' K-12 Student Assessment Past on Their Current Data Perspective

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Abstract

The purpose of this study was to understand how our sample of pre-service teachers' perceived data-driven decision-making (DDDM) and if and how their K-12 student experiences influenced those perceptions. We evaluated this as they entered into the course that addressed DDDM in this particular Educator Preparation Program (EPP), and we examined how those perceptions changed as a result of DDDM instruction within the course. Participant comments revealed that the K-12 experiences of the future teachers in this study influenced their understanding of DDDM both before and after DDDM instruction. In order to prepare future data-driven teachers, as per accreditation requirements, we must first prepare them to learn about data. This means that we must address any underlying resistance to learning more about data and how to use data to drive instruction. The current findings suggest EPP instructors may need to delve into pre-service teachers' experiences from their years as K-12 students, addressing misconceptions and misunderstandings, in order to prepare these future teachers to learn about DDDM.

Pre-Service Teachers' Past, Present, and Future with Data

The No Child Left Behind Act (NCLB, 2001) and, more recently, the Every Student Succeeds Act (ESSA, 2015) have made accountability and evidence-based practice mainstays in the United States' (US) education system. Unfortunately, data-driven decision-making (DDDM) is often something held in distain by in-service teachers and avoided (Brown, Lake, & Matters, 2011; Dunn, 2016, 2019; Dunn, Airola, & Garrison, 2013; Hoogland et al., 2016; Reeves & Chiang, 2017; Remesal, 2011; Schildkamp & Kuiper, 2010; von der Embse, Schoemann, Kilgus, Wicoff, & Bowler, 2017). Concurrently, DDDM has been endorsed by much of the professional education community, as indicated by the Interstate Teacher Assessment and Support Consortium (InTASC), the accepted standards for teacher practice and preparation (CAEP, 2014; Schifter, Natarajan, Ketelhut, & Kirchgessner, 2014; Voss, Kunter, & Baumert, 2011). Although the national accrediting body for Educator Preparation Program (EPP), Council for the Accreditation of Educator Preparation (CAEP, 2014), now mandates DDDM training as a requirement for earning accreditation, little is known about where pre-service teachers stand on the spectrum of reactions to DDDM or the origins of these perceptions and responses, which is unfortunate since students are still in an ideal setting to become data literate and data-driven teachers.

Reeves and Chiang (2017, 2019) recommend focusing on preparing pre-service teachers to learn about and one day use data to drive instructional practice by understanding and addressing data resistance in EPPs. Preparing pre-service teachers to learn about data, has a subtle, but important, differentiating connotation from the more traditional idea of preparing teachers to *use* data. The former implies they are not in an appropriate state to learn about data, and the latter implies that they are. Thus, our focus for this study was on understanding more about how EPP students perceive DDDM and where those feelings may have originated in order to prepare pre-service teachers to learn to use data. By better understanding both, we assert that we will gain insight into how to more efficiently move from preparing students to learn about data to preparing them to use data.

Thus, we sought to understand how pre-service teachers perceived DDDM and if and how their post-NCLB (2001) K-12 student experiences may have influenced their perceptions of DDDM. In addition, we sought to determine how the experience of a three week DDDM unit of an EPP course may have influenced how they came to perceive those experiences and/or DDDM. To accomplish this, we took a phenomenological approach to this qualitative study using constant comparative analysis. Postholm (2019) explained that in order to allow new descriptions, conceptualizations, and understandings to emerge from an inductive analysis of the available data, researchers must "set aside or bracket" pre-existing perspectives, theoretical perspectives, and assumptions in order to allow the data to dictate the new insights and not any extant ideologies. Thus, in our review of the literature, we focus on what DDDM is and on what is known about pre-service teachers and DDDM, and less on pre-conceived theoretical perspectives.

Review of the Literature

The majority of teacher education students graduating from EPPs today began their educational experiences after NCLB was implemented nearly two decades ago (Dunn, Skutnik, Sohn, & Patti, 2019). Thus, these future teachers have a wealth of experiences related to DDDM

before they even entered their EPP. We hoped to find empirically supported insight into how future teachers' pasts with data may influence how they come to our classrooms and how they are affected by DDDM instruction. Such insights may be useful in designing effective DDDM instruction, possibly reducing resistance to DDDM, which, in turn, may help increase the likelihood these future teachers may engage in DDDM practices in support of evidence-based instructional decision-making. Our sample of pre-service teachers shared their past experiences with, their present status with, and their thoughts about their future with DDDM. While these are merely points conjecture at this time, we hope the findings of this study will assist us in determining how to best proceed to effectively study these assumptions. In what follows, we will explain how we understand DDDM based on our interpretation of the literature, and we will review the little that is known about pre-service teachers and DDDM. Next, we will further explain not only who our participants were, but also why we took our qualitative approach to this study, and precisely what we did. Finally, we conclude with our findings and our interpretations of those findings.

Data-Driven Decision-Making (DDDM)

DDDM "refers to the systematic collection of many forms of data from a myriad of sources in order to enhance student performance" (Dunn, Airola, Lo, & Garrison, 2013b, p. 87). Data include both qualitative, descriptive information and quantitative data about students. Important types of data for teachers to consider include school system behavioral data (e.g., attendance, rule violations), assessment data (e.g., chapter tests, high stakes tests), and teacher observations (e.g., student affect based on body language and facial expression, attention via eye contact and alertness). Research has repeatedly supported that data-informed instruction positively impacts student learning and achievement (Carlson, Borman, & Robinson, 2011; Evans, 2009; Schildkamp, Poortman, Luyten, & Ebbeler, 2017). The use of multiple points of student information or data helps provide teachers with a more accurate understanding of what students need from their teachers in order to maximize their potential (Herppic, Wittwer, Nuckles, & Renkl, 2014). Thus, data is "crucial in enabling teachers to judge students' progress toward [students'] goals and in helping [teachers] to adapt their instruction to the individual needs of their students" (Voss et al., 2011, p. 953).

For example, a teacher may use formative assessments to determine if students are acquiring the skills needed to succeed on a spelling test and to set concise goals to help the student improve (Eberhardt & Emberger, 2016). Teachers may use a pre-test to determine how to create effective heterogeneous collaborative groups. Teachers may use their students' end-of-year standardized assessment outcomes to identify in what areas they should seek professional development. Additionally, a teacher can look at a new year of students' prior end-of-year assessments to determine areas that may require careful remediation and reteaching before covering new, grade-level material (Fuglei, 2014). Test data are not the only information teachers should incorporate in DDDM; for example, teachers could ask parents to respond to an adverse childhood event survey to determine the number of traumatic events a child has experienced, as these experience may impact student behavior and readiness to learn. Teachers can also observe, record, and consider individual student's emotional states and peer interactions, as students' affective states and social interactions influence their academic engagement and performance (Berthelon, Bettinger, Kruger, & Montecinos-Pearce, 2019).

School cultures often resist the call to use multiple forms of student data to drive

instruction in the US (Dunn, Airola, Lo, & Garrison, 2013a; Dunn et al., 2019) and internationally (Brown et al., 2011; Remesal, 2011; Schildkamp & Kuiper, 2010). Teacher resistance to DDDM is understandable. Data should be used to empower teachers to help their students. However, all too often data has been manipulated for political purposes, used to evaluate teacher performance, to determine if contracts are renewed, to set pay raises, and to suggest the worth of a school, as measured by the degree to which the government funds the school and allows it to function autonomously (Kamenetz, 2016). Yet, we persist in supporting the preparation of data literate future teachers in EPPs, not just because it is required for accreditation, but also because it is beneficial for students, and ultimately, if the students succeed, that means the teacher has succeeded. While persistence is important, it is futile if we do not begin to better understand how pre-service and in-service teachers think and feel about data (Reeves & Chiang, 2017, 2019).

The way individuals think and feel about what they are asked to do dramatically affects their openness and readiness to learn about DDDM and to engage in DDDM practices. While there is an emerging body of literature that examines teachers' thoughts, feelings, and actions related to DDDM, a gap remains in our understanding of pre-service teachers in relation to these issues (Dunn et al., 2013; Dunn et al., 2019; Dantow & Hubbard, 2015; Reeves & Chiang, 2017, 2019). The purpose of this study was to fill one aspect of this gap; specifically, how K-12 student experiences of future teachers and their EPP data training affect their perceptions of DDDM. Dunn et al. (2013) found that these affective and cognitive variables impact the likelihood that practicing teachers will engage in data-driven instruction. Reeves and Chiang (2017, 2019) assert that these variables are equally important and more malleable in pre-service teachers, and thus, require research attention.

Pre-Service Teachers and DDDM

As previously noted, EPPs are, in general, not adequately preparing future teachers to successfully engage in DDDM practices once they step into the classroom (Davidson & Grohbieter, 2011; Dunn et al., 2013; Mandinach & Gummer, 2013; Reeves & Chiang, 2017, 2019; Wayman & Cho, 2008) and teachers are cognizant of this lack of preparedness once they reach the classroom (Means, Padilla, DeBarger, & Bakia, 2009). Researchers have more recently begun to look to pre-service teacher education for opportunities to better prepare teachers to be data-ready (Airola & Dunn, 2011; Reeves, 2017; Reeves & Chiang, 2017, 2019; Reeves & Honig, 2015), which aligns with the 2016 full enactment of CAEP's standards for EPP accreditation. While there is growing emphasis on data training in EPPs, in both the research literature and in the accreditation process, we need to know more about pre-service teachers' experiences with DDDM and how pre-service teachers think and feel about it. By acquiring this new understanding, teacher educators will be better equipped to develop more effective, tailored DDDM curriculum, and ultimately, prepare more future teachers who are able and willing to utilize DDDM practices in their classrooms.

In this vein, Dunn (2016) reported that, much like in-service teachers, her sample of pre-service teachers were resistant to learning more about DDDM, and they believed they knew of other, more effective instructional practices. Her participants also reported being unlikely to use DDDM in their future classrooms, yet, they did not yet understand what DDDM was. Thus, Dunn's (2016) participants believed other practices were better than something they did not even understand yet, something they could not even define. Why were their minds already shut off to

how DDDM may help their future instructional practice and their future students? More recently, Dunn and her colleagues' (2019) research revealed that pre-service teachers in their study "overwhelmingly showed little interest in or outright distain for DDDM" (p. 204).

Again, why would future teachers, who have never been asked to engage in DDDM or had their instructional effectiveness assessed by data, already be resistant to one day using DDDM or to learning more about data-driven instruction? Is possible that their K-12 student experiences may, at least in part, contribute to this resistance and disdain aimed at DDDM? No research was found that explored how EPP students' K-12 student experiences may impact EPP students' receptiveness to DDDM training. If these previous experiences are informing resistance to DDDM, then exploring if resistance to DDDM begins before future teachers even matriculate into their EPPs may provide valuable insight into how to develop more persuasive training materials that move future teachers closer to one day using data to inform their instructional practice.

Methods

This phenomenological qualitative study utilized a constant comparative analysis approach to consider 87 pre-service teachers' responses prior to and following DDDM EPP training to the following prompt: "Please describe how you feel about data-driven decision-making. Please consider including your thoughts as former K-12 students who were tested as well as your future use of data in your classrooms." It is important to note that our experience teaching and training numerous other pre-service and in-service teachers revealed that for many, K-12 experiences of being tested had already contributed to their resistance to data. Further, the lead author's research that spans more than a thousand teachers revealed that for both pre-service and in-service teachers, resistance to DDDM training is somewhat ubiquitous (e.g., Dunn, 2011, Dunn et al., 2013, 2013a). In addition, the literature from which this study emerges also reports even before they have entered the teaching profession, pre-service teachers show resistance to DDDM, holding negative perceptions of DDDM (Reeves & Chiang, 2017, 2019). Thus, this prompt included the possibly biased phrase that guided them to reach back to their K-12 experiences with being tested. From the phenomenological approach, it is important to clarify any bias on the part of the researcher (Koch, 1996). However, it is also important to note that we did not qualify that participants should reflect upon bad or good experiences with K-12 testing. In fact, some participants reported enjoying testing in this study. The following section describes our participants and data analysis procedures.

Participants

This study was conducted at a large, approximately 28,000 students, mid-southern university in the US. Participants were fully-admitted teacher education students enrolled in one of six sections of a required educational psychology course for the CAEP-accredited teacher education program. All class members were required to engage in each of the study components as part of the instruction and evaluation processes, but only students who provided informed consent were included in our analyses.

Participants (n = 87) were primarily female (92%) and predominantly Caucasian (84%). The majority of the pre-service teachers were new to the teacher education program, in their first semester as a pre-service teacher (71%) and the rest in their second semester. Pre-service

participants primarily intended to teach at the elementary level (61%), and the remaining students planned to teach at the high school (32%) or middle school (7%) levels. Those students who did not identify as future elementary school teachers reported they planned to teach English (15%), Foreign Language (5%), Art (2%), Mathematics (2%), or another subject (15%).

Materials

As DDDM content in EPP courses may vary, it is important to offer some insight into the DDDM course content to which participants were exposed in order to provide readers a fuller understanding of what participants studied prior to post-training responses. Thus, the DDDM unit content is outlined in Table 1. It is further important to note that materials were developed to be persuasive. For example, in the DDDM unit's subunits or modules, video testimonials from real teachers explain how they used data to their benefit and to the benefit of their students. Many of these videos included teachers' recalling that they were once skeptical of DDDM, but had come to see the value of engaging in DDDM during their daily classroom practice. Finally, while the modules conclude with strong emphasis on understanding standardized assessments, which is only covered in this course for this program, the first two modules provide heavy emphasis on the variety of data teachers should and do use in DDDM (e.g., observation of student attentiveness, social isolation or interaction, or classroom assessment data).

Table 1

DDDM Persuasive Instructional Unit: Outline of Modules and Quizzes

Module	**Content**
Introduction to DDDM	• Introduction to what the unit contains • Brief video: What is DDDM? • Brief video: Teacher testimonials of how DDDM helps teachers and students

Data-Driven Decision-Making: "What is it!?!"	• DDDM was defined, emphasizing that data includes more than standardized tests
	• Overview of how teachers use data to evaluate themselves, help students, and work with parents
	• Covered ethical issues, including Family Educational Rights and Privacy Act of 1974
	• Brief videos from teachers who turned around a struggling school by using data:
	  ○ To guiding instructional decisions
	  ○ To motivate students by setting goals and seeing achievements
	  ○ As an objective tool for parent-teacher communication

Overview of Assessment	• Covered basic forms of assessments • Classroom and standardized • Formative, interim, and summative • Reliability, validity, error, and bias
Classroom Assessment	• Informal, traditional, and performance assessments • Portfolio assessments • Norm-referenced and criteria-referenced grading • Tips for developing classroom assessments
Standardized Assessment	• Historical perspective on K-12 standardized testing • Criterion-referenced scores and interpretations • Norm-referenced scores and interpretations • Standard error and confidence intervals • Interactive video developed by instructional team to walk students through an interpretation of a reading standardized assessment
State Value Added Assessment System	• Explanation of how teachers are evaluated • Ways schools may use value added data • Five videos provided by the state department of education explaining the system

Data Collection and Analysis

Data were collected from students during the first week of their semester-long applied educational psychology course. Responding to the surveys was required as part of the course curriculum; however, students were asked to provide consent for their data to be included in this study, as per our approved human subjects research protocol. The participation rate was 97%. Students responded to the research prompt in an online survey program. Response length was not limited by the software. Two researchers were instructors for the course from which the convenience sample was taken. The third researcher was not a part of the instructional team in order to provide outside insight.

As previously noted, our purpose in this study was to better understand if and how past K-12 student experiences of DDDM that affected them (e.g., completing standardized tests) influenced pre-service teachers' perspectives of DDDM. We also sought to discover if persuasively designed DDDM instruction may change these relatively underinformed, from a professional educator stance, perspectives. We did not wish to prove any relationships or make predictions, we simply sought to understand the experiences and perspectives of entering EPP students (in their first or second semester as a pre-service teacher), as this may help inform more effective DDDM instructional practice.

Hammarberg, Kirkman, and de Lacey (2016) support that qualitative methods are ideal for this type of research purpose in which the data are "not amenable to counting or measuring" but instead are helpful in building new understandings of phenomena (p. 499). Specifically, they noted that "qualitative methods are used to answer questions about experience, meaning and perspective, most often from the standpoint of the participant" (p. 499). This was precisely our purpose.

A phenomenological approach was taken in this study, as we tried to understand participants' shared experience of being future teachers whose K-12 student experience was influenced by DDDM policies and practices. We also used this approach to seek to understand participants' shared experience and any perspective shifts related to completing our EPP course's persuasive DDDM training. More specifically, we approached this as a phenomenological study in which our goal was to interpret the participants' lived experiences (Postholm, 2019). Key to this approach is the use of participants' past lived experiences to interpret present experiences (Gadamer, 1989), which aligns with our approach of examining K-12 student experiences with DDDM on our current pre-service teachers' experience of DDDM training. Further, a foundational premise of phenomenology is that people are self-interpreting, and thus, they engage in a process to understand what is important and real for them in order to create their own construction of reality (Koch, 1996). In addition, changes in these self-interpreted understandings experiences or reality are explored over time; in this study, we examined changes in our participants from before and after instruction. We sought to explore these self-interpreted understandings of how our participants have come to understand DDDM through past and present experiences.

Typically, this type of study has three to 25 participants; thus, our sample size (n = 87) is relatively large (Creswell, 2013; Postholm, 2019) However, our focus for this study was very narrow, making a larger sample size more manageable. This also allowed for greater diversity of perspectives and data saturation (Creswell, 2013; Creswell & Creswell, 2018).

Postholm (2019) described the data in qualitative research as, "comprehensive, where the analytical process is often about gaining a workable overview of these materials". Through this

meaning-making process of rich, complex data, a deeper understanding of an issue or phenomenon may emerge. For this phenomenological study, we utilized constant comparative analysis in our pursuit of "meaning-making". Corbin and Strauss (2008) developed the constant comparative analysis method as an appropriate and effective means of analyzing written participant responses and other forms of text.

Using the constant comparative method of analysis, three of the researchers developed and revised codes, and subsequently, examined those codes to determine if any higher order themes emerged (Charmaz, 2000; Fram, 2013). According to Hall and Jurow (2015) comparative analysis is an appropriate and efficient method for determining and understanding beliefs as they change. As we sought to not only understand the K-12 student experience of post NCLB (2001) K-12 graduates, but also to understand how the EPP course's DDDM training may have created a shared change experience, constant comparative analysis was deemed most appropriate for our purposes.

Over a period of one month, the three researchers independently coded ten participants' pre- and post-responses, and then, the researchers met to establish agreement about an initial coding scheme through discussion and consensus (Saldãna, 2013). Responses were subsequently coded 10 participants at a time, followed by a discussion, and culminating in an agreement regarding the coding across the three researchers. To ensure the validity of the process, the final product was evaluated by the fourth researcher who possessed expertise with this topic and this class (Creswell & Creswell, 2018)

Findings

Through this iterative constant comparative analysis process, five codes emerged from our data. These five codes culminated into one agreed upon theme. The codes are described below and listed here. Pre-instruction codes included "Did They Even Use My Data?" and "The Standardized Misconception". Post-instruction codes included the following, "Why Didn't They Use Data," "Frustration," and "Modeled Assessment Animosity." Subsequent to identifying and agreeing upon these codes, the researchers collaborated and discussed what these codes shared in common. From this discussion and the aforementioned five codes, one dominant theme emerged, which we titled— What we experienced in K-12: "I always wondered why".

The What I Experienced in K-12: "I Always Wondered Why" theme encompassed this sample of pre-service teachers' feelings toward DDDM as it related to their K-12 student experiences. This theme comprised pre- and post-training self-reported pre-service teachers' perceptions of what they believed their K-12 teachers did or did not do with data, and participants' frustration with their past teachers' perceived actions or inactions related to data, and their dislike of having to take standardized assessments. While pre-service teachers noted a few specific ways, they assumed their former teachers used data (e.g., placements), most emphasized they did not believe their teachers engaged in classroom level or in day-to-day DDDM. It should be clarified that this does not necessitate that our participants' K-12 teachers did or did not use data, but it does tell us how pre-service teachers, at least in this sample, perceived their past teachers' data-use. Some noted if teachers did use data, they were not aware of it. Participants proposed ways teachers could have used data to make their K-12 experiences better.

Pre-Instruction Perceptions

Did they even use my data? Prior to completing the course's DDDM training, pre-service teachers did not know how their teachers used data, or in some cases, did not believe their teachers used data at all. Pre-service teachers' comments reflected a general sense of uncertainty related to their past K-12 teachers' data collection and application processes; this comprised the first code— *Did They Even Use My Data?* Many students (*n* = 39) noted they did not believe their teachers used any assessment data, standardized or classroom assessments. For example, one student stated,

> I think I would have appreciated knowing that my course work and all was the result of data-driven-decision making. It would have made me feel more confident in my teacher as well because it would show that they care about the information they are presenting to the class as well as how they're presenting it. They just used my chapter tests for a score. Take the test, and forget it. That's what it means to me, a bunch of pointless tests that no one really uses.

Another student added,

> I guess I just don't get the point of all the tests we took at the end of the year. My teachers never talked about them other than, 'Hey, study this…you have to do well for me and for the school.' Ya know, no pressure there, but what was all the pressure for if I never benefited from all that? How exactly did it benefit me or any other student?

A third student simply shared,

> I can't think of a single example of a teacher using my tests scores for anything other than giving me a grade. Since I've been in college, I've had teachers that will use tests to remediate us where we have gaps in learning, but never in high school or whatever.

In addition, (*n* = 26) several student comments more implicitly captured participants' sense that teachers did not use standardized assessment data nor did they explain the purpose of standardized tests. For example, one participant noted,

> When I reflect back to K-12th grade, I do not find that data-driven decision making ever affected me in any way except having to take [*sic*] an end of the year test, sometimes I remember never even seeing the score I received on the tests.

Another participant added,

> No one ever really explained what the purpose of the end of year tests were. I know that once they were done we did not have to do JACK else for like a month. As, a future teacher that seems like such a waste. I guess I need you to tell me some reason that the things should be valuable because my teachers didn't tell me or show me why there was value to the things. They just sucked.

The standardized misconception. This emphasis on standardized tests was a common thread throughout participant responses. The second code, *The Standardized Misconception,* captured the very common misconception across this sample of participants that DDDM only references standardized tests (n = 34). Participants were primarily focused on the common misconception of DDDM as entirely focused on state-mandated end-of-year-assessments with one pre-service teacher recognizing, "Standardized tests or data-driven decision-making? It was just something else that I had to do every year…test, test, test, shade the bubble, shade the bubble, shade the bubble. Dumb." Prior to engaging with the instructional materials, another pre-service teacher shared the following, "It is all about end of year standardized tests (*sic*). A big waste of everyone's time." The comments related to DDDM pertaining to only standardized assessment were often very simple and straightforward and frequently presented with a negative tone, such as, "DDDM to me is standardized tests, which are a nightmare." Another participant stated, "DDDM is nothing but state tests, which are nothing but a stress fest for everyone involved. Those tests can't tell you who a student is or what they really know." These past experiences during our pre-service teacher participants' K-12 years appeared to have impacted pre-service teachers' perceptions of DDDM.

Post-Instruction Reflections

Why didn't they use my data? After completing the DDDM instructional unit, pre-service teacher responses (n = 51) continued to indicate that as K-12 students, participants did not believe anyone explained to them why they were tested or how their teachers used data to guide instruction (*Code 3: Why Didn't They Use Data?)*. For example, one student stated, "I did not see the real benefits of data in the classroom because I never experienced it as a student" and another who "thought they [assessments] were just busy work." Another student shared, "I just don't think they used the data from any of my hours of assessment work. I mean, why didn't they use my data?" Yet another student added, "Being tested as a K-12 student was frustrating because I was not, at the time aware of the benefits; therefore, as a future teacher, I plan to explain the use and importance of such testing and how it can create a better learning environment." From the last statement, it appears that this student was beginning to see the value of DDDM, and even standardized testing; however, the focus was still on standardized testing. Another student acknowledged, "Maybe my teacher used my data, but I sure did not see it. I mostly remember it being all about how they'd look if I didn't do well."

These participants cannot verify what their former teachers did or did not do with data, but participants perceived their K-12 teachers did not use data to guide their instruction nor did they explain to students why they were being tested. This was illustrated when one pre-service teacher reflected, "I had never heard of data-driven decision-making," "I never knew my teachers to do that," and "When I was the one taking the tests, I was unsure as to why we actually needed to do them." Participants felt that if their teachers had engaged in DDDM more explicitly, an improved classroom experience may have emerged. For example, one student shared, "I think back to many of my classes and remember how the environment of the class would have been made better if we had worked as a team to assess our class data and set goals."

Post-instruction student responses reflected a growing value for engagement in DDDM. One student stated,

As a former K-12 student, I always wondered why we always had to take exams. What

> information could they possibly gain? What was the point of all those assessments, but now I am in the position of a future educator, and have clearly seen why teachers should use assessment and data.

This statement is representative the perceived impact of these K-12 experiences on these pre-service teachers. Moreover, it intimates the impact a relatively brief training DDDM unit can have on seemingly negative perceptions of DDDM that pre-service teachers may bring with them from their K-12 experiences.

The brief training also appears to have this sample of pre-service teachers thinking about not just how their former teachers did not seem engaged in DDDM, but also how these participants wished their teachers had used data and how they want to use data to positively impact their instructional practice and students learning. For example, several pre-service teachers focused on how they planned to help their future students understand various forms of assessment, especially those that sometimes felt arbitrary to them as K-12 students (*i.e.,* state-mandated tests). One such teacher stated,

> I want my students to know why I am using a formative assessment, what it does, and how giving their full effort on their standardized tests can help them. I also want them to know that we aren't going to 'study for the test' for a month, the standardized test checks to see if we are on track. Them and me. So, technically, we will have prepared for those things all year long.

Some shared that they planned to work with students to "to set goals for learning and to monitor progress" and "to allow students to play a role in parent-teacher conferences" by using their data.

Participant comments seemed to indicate a new sense of frustration as they (n = 33) reflected upon their perception of former teachers' DDDM, or lack of DDDM, after having learned more about DDDM in the EPP course (*Code 4: Frustration*). One participant noted, "I remember taking standardized tests in grade school but it never seemed like the teachers did anything with the results. It is a little frustrating." Another participant shared,

> When I was the one taking the tests, I was unsure as to why we actually needed to do them. They only seemed to stress us out. What was the point, just to give me a panic attack? What a waste of time and money. I think it can and should be handled better.

One participant shared that,

> It seems like if my teachers had known about data, they could have used it to help their evaluations, but it's like they were so stressed out they melted down and no one got anything out of all those tests.

Participants' (n = 16) commentary also captured their perception of their former teachers' feelings about data (*Code 5: Modeled Assessment Animosity*). For example, one student shared "I had heard my teachers complain about the process of DDDM." Another student noted, "I didn't know much about data, but I definitely knew my teachers hated it." These statements tended to be brief and straightforward like, "My teachers hated DDDM and testing" and "It was pretty clear they all thought DDDM was NOT a good thing."

Findings Summary

From pre- to post-instruction commentary, pre-service teachers clearly provided information that suggested to us that their K-12 experiences may well have contributed to their perceptions of data as they entered the EPP court. After completing the DDDM training curriculum, participants seemed to have experienced a shift toward valuing DDDM, or at least, seeing some benefit of DDDM for their future students. After training, their comments seemed to intimate that they planned to use data to help their future students have better, less stressful, more meaningful experiences with testing and DDDM. Moreover, our participants reported the DDDM training unit helped them to "see the real benefits of using data in the classroom" as opposed to becoming "teachers [that] complain about the process."

While we cannot validate if our participants' K-12 teachers did or did not use data, did or did not like DDDM, we can support that our group of pre-service teachers did not believe teachers used nor liked DDDM, and this was something they wished to improve upon. Moreover, this sample of pre-service teachers reported they wanted more training related to DDDM in order to help better guide their instruction and ensure positive learning outcomes for their future students through meaningful data use.

Discussion

The findings of this study, especially the finding that pre-service teachers' K-12 experiences influence their perceptions of DDDM as they entered their EPP training, are unique and useful as they can help teacher educators better understand how to facilitate a conceptual shift through EPP curriculum. These findings may serve as an anchor for the development of EPP DDDM, as it may be that in order to prepare pre-service teachers to learn about data, we must address these K-12 experiences and the subsequent perceptions and misunderstandings that arose from them. By uncovering pre-service teachers' K-12 experiences related to DDDM, both the good and the bad and how to improve the next generation of K-12 students' experiences, we may begin to decode the path to take us closer to the goal of graduating more data literate teachers. This partially addresses Dantow and Hubbard's (2015) call for "reform in teacher education to place a much higher priority on developing these skills in teachers' pre-service years" (p. 20). Because, as Reeves and Chiang (2017, 2019) suggest, we must first understand how to prepare our EPP students to learn about data.

There were two key findings from this study in alignment with this purpose. First, our sample of pre-service teachers' initial perceptions of what DDDM is began long before they ever enter teacher education. Hord, Rutherford, Huling-Austin, and Hall (2005) explained that in- and pre-service teachers' thoughts, beliefs, and preoccupations regarding an innovation itself and the perceived impact and interaction of that innovation with the individual, students, school, and colleagues strongly influence the probability that the individual will use the innovation. Our finding suggests that, for our sample of pre-service teachers, K-12 experiences informed their perceptions of DDDM negatively, and they, ultimately, did not believe their K-12 teachers used data, perceived DDDM as being all about standardized tests, believed standardized tests were "pointless" and a "nightmare", and perceived DDDM as stressful for "everyone involved." This sample of students was not ready to learn about DDDM, and it is clear that we need to follow Reeves and Chiang's (2017, 2019) suggestion to first prepare them to learn by addressing these misconceptions. We suggest that future researchers should explore to see if our findings can be

replicated in EPP students in other areas of the country to verify if this finding is applicable to other EPP students or if it was unique to our sample.

Our second finding was that a relatively brief, persuasive DDDM training unit may help facilitate a conceptual change related to the beneficial nature of DDDM. This shift represents a key element of the paradigm shift we believe is necessary in order to increase data use in K-12 public education. However, data were not analyzed until the end of the semester, as per our institutionally approved research protocol. Thus, it should be noted that persuasive materials may have been more impactful had we addressed our students' K-12 experiences with DDDM. Future research should explore if taking a more targeted approach to address pre-service teachers' K-12 student experiences with DDDM would differently impact student perceptions of DDDM.

These findings, especially the finding that pre-service teachers' K-12 experiences influenced openness to and understanding of DDDM, were unique and useful as they highlighted issues teacher educators may need to understand and address in order to facilitate a conceptual shift throughout future teachers' preparation. The decoding of pre-service teachers' K-12 experiences, feelings, and perceptions of data may help EPPs not only meet accreditations standards for DDDM, but also help EPPs graduate more data-literature teachers for our K-12 schools.

Limitations and Future Research

The findings of this study provide insight into why pre-service teachers may be resistant to DDDM without having any professional experience with it. However, we would be remiss to not discuss the limitations of this study. First, our study was limited by the use of a convenience sample. While our sample was relatively large for our methodology, all participants came from one midsouthern university. The majority of participants came from the state in which the campus was located. Thus, state-specific policies could underly the experience of our students while students in other states may have had significantly different experiences than pre-service teachers in other states. Future research should explore the influence of K-12 experiences on pre-service teachers' perceptions of DDDM, if it is found that pre-service teachers in other EPPs around the country have similar experiences to our sample that inform how receptive they are to DDDM training, it may be important to begin to study how to create effective, persuasive DDDM in our EPPs.

In addition, this study took only two snapshots of how these pre-service teachers felt and thought about DDDM, and did not examine the progression of change over the course of training nor follow participants to see if these changes were temporary in nature. Finally, while our sample was representative of what many teacher education programs look like (i.e., primarily Caucasian females with a focus on elementary education), the relative homogeneity of the sample is a limitation of our study, and future researchers should explore how other groups feel and think about data. While exploring male and post-elementary school pre-service teacher perspectives regarding DDDM are important, exploring minority teachers' perspectives on DDDM, particularly those in low socioeconomic schools with high free-and-reduced lunch populations may be more critical. For example, one African American participant shared, "I felt targeted by 'data', but worse, I feel that my students will be targeted and hurt by data. Thanks to NCLB, things get better for the white privileged schools, and far worse for us." This idea may be shared by other African American pre-service teachers, but this could not be determined from this singular comment.

This participants' reflections are supported by the research on NCLB (2001). For example, Smith (2010) found that NCLB "focuses on subgroups of school populations that are negatively affected by NCLB, specifically students from low socioeconomic backgrounds, minorities, students with special needs, and second-language learners." Thus, many aspects of diversity may significantly impact the experiences current pre-service teachers had with testing and DDDM, and ultimately, impact their readiness to learn about DDDM in their EPPs. Thus, it is critical to better understand how data-based practices and policies affects these schools, how to improve upon that, and how to help these teachers to overcome their biases against DDDM in order to beat the system that appears stacked against them.

Conclusion

Improving teacher data use is an uphill battle even after large scale, expensive efforts to create a data-literate K-12 faculty in the US, but it can be won. However, DDDM must be taught on two fronts for all teachers. These efforts must begin while these future teachers are in the pre-service teacher classroom and continue into their in-service professional development. Moreover, the results of this study suggest that at this juncture of our history, teacher educators must also address underlying resistance and counterproductive perceptions about DDDM that may begin when pre-service teachers were still K-12 students. Through this comprehensive approach to preparing data-literate faculty, we may address resistance to DDDM from the pre-service to in-service stages, prepare pre-service teachers to be ready to begin to use data in the classroom, and continue effective professional development into the in-service years to refine and improve teacher data use.

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