

Examining Teacher Candidate Use of Data-Based Formative Assessment for Instructional Decision-Making

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Abstract: Using accounts of critical events, this study examines teacher candidate decisions to modify instruction in response to ongoing classroom interaction and assessment during student teaching. Instructional changes made by candidates who reported incidents in which students had difficulty with learning goals were explored across two years. Analysis of decision making suggested that candidates during the first year lacked variation in instructional interventions and continued presenting content to students through previously used teaching strategies and materials. In the second year, candidates improved their instructional interventions, but had difficulty using objective data to describe outcomes resulting from changes made. The discussion examines changes made to teacher education curriculum after study year one to prompt teacher candidate recognition of and accommodation for diverse student needs when making instruction and assessment decisions. The use of data in reflective practice is argued as a continued need for teacher candidate development.

Keywords: *formative assessment; data-based decision making; instructional interventions; accommodations; teacher candidates*

“For this unit, it is important to continuously assess students with formative assessments (quick writes, exit slips, and checklists). Doing this will let me know where I stand in instruction and where each student lies with mastery of content.”

—Teacher Candidate

Exploring the integration of formative assessment and its focus on student learning into the context of teacher decision making in the classroom is a crucial element for increasing achievement (Athanases & Achinstein, 2003; Gearhart et al., 2006; McMillan, 2007; Ruiz-Primo & Furtak, 2007). To explore changes across time in preservice

teachers’ formative assessment activities, this study examines decisions made by two cohorts of teacher candidates to modify their instruction in response to ongoing classroom interaction. Our first purpose was to categorize the types of changes made when candidates altered their instruction in response to diverse student needs. Our second purpose was to examine how

candidates described results of the interventions they made in terms of specific data collected. Our third (and ongoing) purpose was to track changes in decision-making patterns across time and analyze the results to modify our own instruction and mentoring of teacher candidates. Addressing these issues allows analysis of both teacher candidate effectiveness and program impact.

Theoretical Framework

Formative assessment, the monitoring of student progress during instruction that includes feedback and opportunities for improvement, offers great potential for enhancing learning. (Black & Wiliam, 1998; McMillan, 2007). Wininger and Norman (2005) review the literature and suggest two formative assessment functions for students (corrective feedback to improve learning and enhancing student motivation). They also suggest a key function for teachers: “informing teachers about student learning during instruction for the purpose of guiding and modifying instruction” (p. 24). The present study focuses on the latter element.

Special educators have long documented the use of classroom data to make such instructional adjustments (e.g., Fuchs & Fuchs, 1986). More recently, other researchers (e.g., Ruiz-Primo & Furtak, 2007; Torrance & Pryor, 1998) have explored classroom interactions in the context of developing models of formative assessment. Critical events as reported by teacher candidates have also been used to explore the types of student responses that trigger instructional changes (Green & Everington, 2007).

Recent studies, however, have also shown the difficulties in trying to systematically apply formative assessment as classroom practice to enhance student understanding relying on objective rather than subjective measures. Objectivity is paramount, especially for students at risk for failure. Teachers must develop skills for assessing growth relative to measurable

objectives rather than interpreting learning influenced by extraneous factors such as behavior. For example, Gearhart et al. (2006) describe the difficult professional development process for a group of science teachers who moved gradually from the tendency to rely on “daily impressions” (e.g., subjective measures) to interpreting student work objectively and systematically with standards-based rubrics. Similarly, Ruiz-Primo and Furtak (2007) found that teachers may have difficulty employing formative assessment processes such as making students’ thinking visible and then comparing their thinking with correct conceptions. The use of these strategies was strongly correlated with student learning, but proved difficult for teachers to develop, perhaps because of the challenge of engaging in systematic formative assessment of progress.

Examining patterns, however, can then be used to make instructional decisions; linking reflection and action in an objective, nonbiased manner; and reducing teacher subjectivity linked to characteristics such as student effort and attitude versus content knowledge (Osterman, 1990). Persisting in the endeavor to objectify achievement allows for a shared basis for understanding—a common frame of reference for comparisons across types of instruction, locales, and student characteristics.

Qualitative responses in a study by Green and Brown (2006) indicate the importance of systematic documentation with data in graphic or numerical form to guide instructional decision making. Through the process of designing and implementing action research, teacher candidates grew to realize that “collecting data” did not necessarily mean a paper/pencil test with a percentage score, but could be a rubric level or items on a checklist. Candidates also reported valuing the experience of data collection because it provided insights not accessible through less formal methods. Interestingly, little research has been conducted to examine the connections between reflective practice and assessment for student learning.

Reflective practice specifically involving data-driven formative assessment must be explored because of the significant impact formative assessment can have on student learning (Black & Wiliam, 1998; Meisels, Atkins-Burnett, Xue, & Bickel; 2003; Wiliam, Lee, Harrison, & Black, 2004).

In addition to collecting and analyzing formative assessment data, teacher candidates' ability to use a variety of instructional strategies flexibly based on such data is crucial to enhancing learning. Development of a shared knowledge base for professional mentoring of teacher candidates regarding ongoing decision making in classrooms is important for learning to teach diverse students (Athanasos & Achinstein, 2003). Additional efforts are needed to draw inferences from a range of specific cases and develop general principles that can be used to enhance effective formative assessment and subsequent instructional changes among teachers. To further explore the process of reflecting upon instructional outcomes and using formative assessment to modify instructional strategies, the present study focused on accounts of self-reported classroom events. We drew on two consecutive cohorts of teacher candidates' essay reflections about specific instances of modifying instruction in response to classroom interaction with three purposes in mind:

1. To examine teacher candidate decision making and categorize the types of changes made when altering their instruction in response to student needs.
2. To examine how candidates described results of the interventions they made in terms of specific data collected.
3. To track changes in patterns across time and analyze results to modify our own instruction and mentoring of teacher candidates.

Method

Participants

Teacher candidates (Year 1, $N = 57$; Year 2, $N = 64$) completing their student teaching in the last semester of a teacher education program at a Southeastern USA public university served as respondents for this study. The respondents represented a range of undergraduate majors with the majority (60%) having an elementary concentration. Twenty-seven percent were K-12 majors (art, music, dance, theater, physical education, and foreign languages), 12 percent secondary majors (English, mathematics, social studies, or science), and 2 percent of the participants were majors in a new middle level education program. The diversity of the candidates within the college is typical of the education field with 83 percent being female and approximate 32 percent representing a race other than Caucasian.

Data Source

The source of the data for this study was a section of the Internship Work Sample (IWS). The IWS is required of all teacher candidates during the student teaching semester and provides teacher candidates a structured experience in planning for and documenting the impact of their teaching. It is completed in one of the partner public schools in the surrounding community under the supervision of an on-campus professor as well as a university field supervisor. The IWS documents a unit plan including learning goals, lesson plans, assessments, and analysis of student learning. Although the sample consists of eight dimensions the section used for this study was dimension six, "Instructional Decision Making." Specifically, candidates were required to respond to the following prompt:

Consider at least one time that formal and informal assessment of student learning caused

you to modify or accommodate your original design for instruction. Describe what data caused you to rethink your plans, and what you did to attempt to improve student progress toward the learning goal. Be sure to focus on changes in presentation or content rather than changes in classroom management strategies. Then, describe what data you used to see if your instructional changes did actually help students learn more.

Since the IWS is submitted as a one document portfolio, the responses to dimension six were extracted served as the data source for the current research project.

Procedures

Each candidate's written submission was printed then analyzed according to the categories listed in Appendix A developed by Green and Everington (2007). The responses were filtered to spotlight those exhibiting "difficulty with learning goals." Responses in this category were chosen to focus specifically on instructional activities addressing actual content learning goals rather than other categories such as lack of background knowledge or behavior management. After filtering, 57 responses from Year 1 and 64 responses from Year 2 were chosen that related to changes made as a result of difficulty with learning goals. In Year 1 this group constituted 43.5 percent of the total sample. In Year 2 this group constituted 75.3 percent of the total sample, suggesting increased adherence to work sample directions and focus on student learning. Both authors examined the list of interventions

and developed meaningful units of classification (Spradley, 1980). In Year 2, the filtered responses were classified by both authors for types of interventions made to increase student learning in relation to the learning goal(s). A similar analysis was conducted regarding how candidates described the results of the instructional changes to enhance student learning. Agreement on categorization of all responses reached 92 percent. Disagreements were resolved through discussion.

Results and Discussion

Results are presented in relation to each of our three purposes. The discussion has been included as part of the results in order to illustrate how program changes were based upon objective data found in the study.

Instructional Changes Made by Teacher Candidates

Our first purpose was to examine teacher candidate decision making and categorize the types of changes made when altering instruction in response to formative assessment. Table 1 presents the changes made in the first column followed by the frequency of candidates utilizing the described change in each year. The frequency is larger than the actual participant number because some candidates described more than one change made. The last column illustrates examples of the described change.

Table 1
Changes Made to Instruction to Increase Student Learning

Change made	Frequency		Examples
	Year 1	Year 2	
Go over content again	25	30	<ul style="list-style-type: none"> ▪ Present material to class again with more explanation ▪ Give students feedback regarding assessment performance ▪ Provide more information to students ▪ Have a class discussion about the assessment ▪ Provide more time for review

Utilize different teaching materials/strategy	24	41	<ul style="list-style-type: none"> ▪ Integrate technology ▪ Utilize lighter and larger balls to master volleyball serve ▪ Display graphic organizer while teaching ▪ Use small groups to master certain content then teach others ▪ Integrate content into another subject area ▪ Utilize music and art to teach concept ▪ Have students kinesthetically show content (use bodies to show different kinds of angles)
Provide additional practice/examples	13	12	<ul style="list-style-type: none"> ▪ Add practice problems to morning work ▪ Provide students with teacher-made examples ▪ Go over assessment with the class
Change assessment	8	3	<ul style="list-style-type: none"> ▪ Reword questions ▪ Eliminate questions/problems
Provide study guide	5	1	<ul style="list-style-type: none"> ▪ Provide teacher-made guide to prepare for unit test
Other	2	0	<ul style="list-style-type: none"> • Change student desk arrangement • Assist students in memorizing content

As seen in Table 1, the change suggested most by teacher candidates during Year 1 was to go over the content again (25 of 78 described changes or 32 percent). This category was superseded in Year 2 by the category “utilize different material/strategy” with 41 out of 87 or 47 percent. “Go over content again” remained steady at 34.5 percent; however, half of those implementing this intervention in Year 2 combined it with different strategies or different materials to support the reteaching. For example, one participant stated, “I had to review and reinforce the concept of what causes day and night on Earth.” This was coded as “go over content again.” However this statement was followed later by an intervention using different materials, “I reinforced the concept by reading books.... I decided to do different thinking maps on the sun, moon, and other concepts we were learning.” Other examples of variation in strategy/material included hands-on activities (e.g., role play, touch-points in math), scaffolding content (discussing word parts to learn vocabulary), and using small group rather than whole class instruction (or vice versa). In both years, an average of 20 percent of the candidates presented students with more content related to the assessment such as providing a study guide or providing additional

examples. This was obvious in participants’ writing with phrases such as, “provided more examples during the next Powerpoint,” “gave students extra practice,” and “wrote up a new study guide for the students.” The number of candidates making changes to the assessment to make it easier (e.g., “I had to modify my questions in order for students to feel successful.”) decreased from eight in Year 1 to only three in Year 2.

Documenting Outcomes

Our second purpose was to examine how candidates reflected upon and described results of the interventions they made after formative assessment caused them to modify their instruction in terms of specific data collected to assess the objectivity with which candidates were making decisions. As seen in Table 2, the methods for documenting student outcomes that resulted from the instructional changes were general in nature with little, if any, reference to data-based, objective student performance.

Table 2
Outcomes of Changes Made as Described by Teacher Candidates

Outcome described	Frequency		Examples
	Year 1	Year 2	
Reference to general understanding	35	43	<ul style="list-style-type: none"> ▪ “students really did <i>understand</i>” ▪ “helped students <i>make connections</i>” ▪ “students <i>knew content</i>” ▪ “<i>majority</i> of the students got it” ▪ “<i>most</i> students made a gain” ▪ “<i>all</i> students improved”
No outcomes described	15	13	
Numerical data provided	4	8	<ul style="list-style-type: none"> ▪ “5/21 students did not master” ▪ “17/18 students showed improvement” ▪ “improved student self-esteem”
No connection to learning goal(s)	3	1	<ul style="list-style-type: none"> ▪ “students appeared engaged” ▪ “students guided each other”

Although the number of candidates providing numerical data after formative assessment and subsequent intervention increased from Year 1 to Year 2, the percentage of total responses remained low at only 12 percent in Year 2 (up from 7 percent from Year 1). The majority (61 percent in Year 1; 66 percent in Year 2) of candidates provided general responses including range of performance (“most students made a gain”), general understanding (“students really did understand”), and general outcomes (“more thoughtful answers”). These three categories accounted for more than half of the outcomes described in both years. The number of candidates not reflecting on outcomes (either by omission or lack of connection to learning goal) decreased from Year 1 to Year 2 (31.6 percent to 21.5 percent). While this represented increased attention to work sample directions, it remains one-fifth of the candidate pool.

Using Patterns to Modify and Mentor

Our third and perhaps most practical purpose in conducting this research was to discover patterns in candidate responses for use in mentoring teacher candidates to focus more on student needs related to mastery of learning

goals through the use of formative assessment. Setting up a system of data collection across cohort years provided opportunities to examine candidate actions, make program changes, and then analyze the impact on the next cohort. Although causality cannot indisputably be attributed to program alterations, the trends in patterns of cohort responses have provided important data for reflection by program faculty.

Categorization of candidate responses to the prompt suggested one important trend. During the first year, only 43.5 percent of the candidates actually addressed the difficulty with the learning goal category described in Appendix A. In Year 2, this percentage increased to 75.3 percent. Each year, faculty members gather to discuss program changes needed in order to increase candidate attention to learning needs. When we shared data illustrating that less than half of the candidates actually were addressing difficulty with learning goals as directed in the prompt, conversations about the purpose of formative assessment analysis began. In addition, faculty used model candidate responses to the work sample prompt as a guide for the following year’s candidates. Without devaluing the importance of other categories, candidates were explicitly taught to

understand the distinctions between behavior needs, logistical issues, and learning needs.

A second pattern revealed an almost equal number of candidates going over the content again and using different materials/strategy after formative assessment in the first year. This was a concern, as 25 candidates were obviously using a “more of the same” approach and lacked the ability to vary instructional approaches based upon the diverse needs of students. The “action” component of the reflections regarding how to enhance learning after formative assessment needed attention. Our charge was to mentor candidates to use more varied interventions rather than simply presenting content again. Prior to the internship semester, faculty created hypothetical PK-12 students. As shown by the example in Appendix B, demographic characteristics and individual learning needs were provided for each student. This information was coupled with results from formative assessments based upon learning goals for specific content areas. Candidates were given an assignment to use the information to collaboratively reflect and design interventions related to the learning goals to meet diverse educational needs, working to build a toolbox of responses. As illustrated in Table 2, the utilization of different materials/strategies after formative assessment increased from 31 percent to 47 percent in Year 2. Although the percentage of candidates presenting content again remained constant from Year 1 to Year 2, half of those in Year 2 combined this intervention with another strategy. Guiding candidates’ analysis to examine specific skills students were lacking in reference to the content prompted action geared more toward specific student needs rather than repetitive strategies.

The final pattern eliciting faculty intervention was candidate data analysis related to the outcomes of their formative assessment. During Year 1, an alarming 93 percent of candidates *did not* use data to describe outcomes, although explicitly directed to do so by the work

sample directions. These findings thus suggested more subjective than objective instructional decision-making. Because the percentage decreased only to 88 percent in Year 2, there remains a cause for concern. As with the first two patterns, faculty members discussed the issue and integrated activities involving data use and interpretation into their courses. Candidates practiced and were successful at in-class activities that involved calculating, reporting, and analyzing data connected to the demographic table in Appendix B. The continued lack of data describing the impact of their instructional changes after formative assessment on actual internship students, however, suggests a more basic problem: Candidates appear to lack confidence in their ability to use numerical data as part of their ongoing instruction or in their reflective writing. They seem to avoid using data as a useful source for examining patterns of student responses (Green & Johnson, 2009). Reflections on results of interventions based on formative assessment remained subjective and general, with the concurrent potential for misinterpretation or overlooking problems.

Conclusion

To summarize, this study used trends across two years to examine patterns of decision making based upon formative assessment during student teaching. After intervention by faculty, candidates used a wider range of teaching strategies and materials as their interventions following formative assessment increased. However, efforts to encourage use of numerical data as a tool to objectively examine the impact of such interventions during analysis appeared less successful. These results suggest that monitoring specific actions and analyses of teacher candidates across cohorts can provide important information for improving teacher education programs. Expanding the data collection to classroom observations of formative assessment implementation is a

logical and necessary next step in future research.

One of the most difficult problems with the use of formative assessment is the provision of appropriate strategies to help close the gap between where students are and where they need to be when problems in understanding do surface, especially with students deemed “at risk” for failure (Stecker, Fuchs, & Fuchs, 2005). Interventions from Year 1 to Year 2 focused on using new teaching strategies or materials increased from 31 percent to 47 percent, signifying a capability to implement innovative instructional strategies based upon analysis of formative classroom assessment. Our experience revealed that teacher candidates need explicit engagement in deliberate analysis that focuses on student learning. The present findings support this conclusion and suggest that teacher education courses can begin to address this problem directly using simulated classrooms and examples from actual teacher candidates’ lessons.

Another noteworthy finding of the present study was that student learning outcomes described by candidates as a result of their instructional interventions were lacking in objective, data-based content. An average of 90 percent of candidates over both years did not use specific data to measure the effectiveness of the changes they implemented after formative assessment, even though such data were requested in the prompt. Understanding the problems that can arise with faulty conclusions or casual, subjective assumptions made when data are not collected systematically must be addressed explicitly. Improving teacher candidates’ skills in designing efficient, brief formative assessments that yield practical results for guiding instruction is also necessary. In addition to integrating the reporting and interpretation of data into other courses, we have suggested a more dramatic program change involving the creation of a classroom assessment course. This course will explore a variety of issues related to classroom assessment

including designing valid items aligned with learning goals for formative as well as summative assessment, and using patterns of data from such assessments as an integral step in data-based reflection on practice to enhance student learning.

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Appendix A: Categories Related to Using Student Responses to Modify Instruction

BACKGROUND GAP	<p>Teacher discovers basic misconception or gap in background knowledge. Assumes they would know something that was needed before they could do the current unit appropriately. Remedy: Provides background knowledge, more practice with basic skills. Category relates to content students should already know, not mere overload or difficulty with unit concepts. (20)</p> <p>Examples: can't read map because they don't know where the water is. Don't understand that people can't stand on clouds. Difficulty comprehending (general) vocabulary so switched to an easier book.</p> <p>Non-examples: Overload. Students have trouble keeping up with notes so provide note-taking guide; or difficulty with material directly related to learning goal; e.g., knowing which philosopher emphasized which ideas; difficulty comprehending vocabulary specific to the lesson.</p>
LACK OF INTEREST	<p>Evidence of boredom, restlessness, student interest in something not directly pertinent to the lesson. Remedy: Switch teaching strategy or content.</p> <p>Examples: They were bored with my instruction so I gave a lesson on popular WWII songs. (In dance class,) students were restless so I interspersed movement and content on culture. Lost interest when passing fabric around so I had them sit in a different pattern and only did two at a time. (10)</p> <p>Non-examples: things that only deal with classroom management not content: e.g., I started praising them instead reprimanding them when off task. I set the mats farther apart because they were talking too much to each other.</p>
OVERLOAD	<p>Teacher finds s/he is giving too much material at once or expected too much for the timeframe. Remedy: slow down, decrease academic demands, make the task easier or break it down into smaller pieces, give better or shorter directions.</p> <p>Examples: when they couldn't sing their parts together, I separated the sopranos from the altos so they wouldn't distract each other. Provide note taking guide when learned they were having trouble keeping up with the notes. (12)</p> <p>Non-examples: Focus in on one element of learning goals they are having trouble with. E.g., Worked on identifying quadrilaterals again. Or gap in background knowledge, something teacher assumed they should have known already.</p>
UNANTICIPATED UNDERSTANDING	<p>Students caught on faster than anticipated, had good insights, or already knew content to be taught. Remedy: covered new material or went into more depth, expected independence or complexity. (15)</p> <p>Examples: Changed the content of the webquest to what they didn't know. Taught < and > as well as fractions. Did the task individually rather than as a whole class.</p> <p>Non-examples: Anything unrelated to students surprising teacher with their high level of understanding.</p>
DIFFICULTY WITH LEARNING GOALS.	<p>Focus on one part of lesson related to learning goals that students were having difficulty with. Remedy: Expand on that part of the lesson, provide more practice, reteach, abandon.</p> <p>Examples: Difficulty comprehending lesson vocabulary, e.g., rights vs. responsibilities. Didn't understand purpose of image folders so generated themes through class discussion to address. Webquest didn't yield basic info so read a book about Pearl Harbor together. Students had trouble analyzing a quote so arranged more in-class practice and quizzes. After instruction didn't understand the difference between a spider and an insect so retaught. (51)</p> <p>Non-examples: Overload: too much material at once. Prior knowledge problems: missing some background information not related to the lesson.</p>
NONCONTENT DIFFICULTIES	<p>Addresses issues <i>not</i> related to academic content or instruction, such as classroom management, running out of time, difficulty handling materials related to the lesson, or following student preferences. (14)</p> <p>Examples: I gave students positive reinforcement for doing the right thing rather than reprimanding those doing the wrong thing. Students didn't want to eat food prepared by other students at home, so I made the activity extra credit. Missed out on rehearsal time so adapted lesson. Thought singing of simple songs (Row, Row, Row Your Boat) was childish, so played it on my clarinet for next group. Kids wanted to do a skit so I let them. Chart too high to write on so I moved it to the floor.</p> <p>Non-examples: Overload: Too much material at once. Lack of interest: (In dance class,) students were restless so I interspersed movement and content on culture.</p>

Appendix B: Hypothetical Students with Demographic Characteristics

ID #	Gender	Ethnicity	Race	ParentStatus	SES / LunchStatus	ReadingLevel	MathLevel	Exceptionality	Other
1	M	American	Black	Married	Regular	Low	Low	SLD (Reading) Visually Impaired	
2	F	American	White	Married	Regular	Average	High		
3	M	American	White	Divorced	Reduced	Average	Average		
4	M	Hispanic	Mestizo	Married	Regular	Low	Low	ESOL	
5	F	Asian	Mixed	Married	Regular	High	High		
6	F	American	Black	Separated	Free	Low	Average	SLD (Reading)	Retained in 1 st gr.
7	M	American	White	Married	Regular	Average	Average		
8	M	English	White	Married	Regular	High	Average		
9	F	American	Black	Divorced	Reduced	Average	Low		
10	M	American	White	Divorced	Free	Low	Average	SLD (Reading)	
11	M	American	Black	Married	Regular	High	High	Gifted and Talented	
12	F	American	White	Divorced	Reduced	High	High		
13	M	German	Black	Married	Regular	Average	Average		
14	F	American	White	Married	Regular	Average	High		
15	M	American	Mixed	Divorced	Reduced	Low	Average		
16	M	American	Black	Single Mother	Free	Low	Low	SLD (Reading and Math)	
17	F	American	White	Married	Regular	Average	Average		
18	M	American	Native Amer.	Married	Regular	Average	Average		
19	F	Hispanic	Mestizo	Married	Reduced	Average	Average		
20	F	American	White	Married	Regular	Average	High		

*SLD = Specific Learning Disability

**ELL = English Language Learner