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sufficient to be high scoring. When knowledge in all three realms is integrated, teachers approach and design their instruction differently. The activities they design for student engagement and practice with the concepts of the subject matter are well suited for the particular learners, take into account the structure of the discipline, and yield information about learner comprehension as the activity unfolds. Thus, the novice teacher, and often the students, can gauge the success of the learning activity at any given point and adjust as needed. Many of novice teachers, regardless of their CLASS scores, were aware of the demands of their classrooms and could assess whether or not they meeting the demands. High scoring novice teachers were able identify and allocate resources better than low scoring teachers. High scoring novice teachers provided their classroom communities with resources and expected students to use them as needed, an admission that the model which posits the teacher as the source of knowledge does not function in today's classes where all students are expected to meet high levels of achievement. Given that teacher education is the "whipping boy" for most, if not all, of society's ills, we were heartened to learn that at least some teacher education programs in Ohio are producing graduates whose knowledge matches what the literature identifies as best practices.

Causal Explanation. Causal explanation is the principle that cannot be studied until the analysis is further along. The main research goal for TQP is to investigate any possible causal inferences that can be identified in relationship to teacher preparation and highly effective first-year grade 4-8 reading and math teachers who were prepared for teaching in Ohio. The data collection through surveys, observations and follow-up interviews provides opportunities for analysis that will deliver numerous insights into possible causal explanations of why some first year teachers are more effective than others. The analysis is ongoing and findings are being studied. To prepare for future causal explanations, additional research questions about first-year teachers and their preparation were collected in an InService Participant Survey. It is possible that the analysis for these data will provide additional insight on the causal inferences between teacher preparation and teacher effectiveness.

Conclusions

We have found that high scoring teachers do have knowledge that is different from teachers who are not high scoring in the CLASS Domains. We have found that high scoring teachers not only have sufficient knowledge in each of the realms of knowledge identified by Darling-Hammond and Bransford (2005), but also, and probably more important, these bodies of knowledge are integrated. The characteristics of high scoring teachers can be listed: Knowledge of Teaching, including Clarity of Goals, Assessment for Instruction and Differentiation; Knowledge of Learners including Background Knowledge, Learner Independence and Learner Interdependence; and Knowledge of Subject Matter, including detailed and complex conceptions and structure of the discipline. Knowledge in one or two of the realms is necessary, but not

not relevant for this research objective. Teacher preparation programs attempt to prepare teachers to be effective in any classroom, regardless of these factors. A study linking teacher preparation to teacher effectiveness must assume such factors are irrelevant. The data described as irrelevant, however, are collected for future confirmatory analysis. It is recommended that these irrelevancies be confirmed as having no correlation to teacher effectiveness once data collection is complete.

Making discriminations. The TQP research focus is on first-year grade 4-8 math or reading teachers who completed teacher preparation training in Ohio. Results cannot be generalized to the following groups:

- Teachers with more than one year of experience
- Teachers not teaching grade 4-8 math or reading
- Teacher preparation programs in states other than Ohio

In addition, the sampling procedures do not allow the results to be generalized to specific groups such as:

- Specific school settings
- Specific content area taught
- Specific teacher gender
- Teacher preparation program characteristics

Interpolation and extrapolation. Interpolation and extrapolation to allow generalization to persons, setting, or treatments beyond the sampled range is not an option for this study. The sampled range is the first-year grade 4-8 math or reading teacher as defined by the research questions. Results cannot be generalized beyond that range.

The most significant limitation to generalization with respect to surface similarity deals with those who chose not to participate. It is possible that first-year teachers who agree to participate in the study during their first year of teaching represent a different set of first-year teachers than those that did not agree to participate. It is also possible that the participants in the case study are different from those participating in single observation study since the case study participants were recruited in the first quarter of their first year of teaching and single observation participants were recruited in their second through fourth quarter of their first year of teaching. It is recommended that data describing this population of non-participants be collected to address this limitation.

Ruling out irrelevancies. Ruling out irrelevancies involves determining any attributes of the sample that are irrelevant because they do not change a generalization. Irrelevancies for this study are as follows:

- Teacher preparation program differences
- Physical characteristics and teacher introduced characteristics of the classroom
- Grade levels
- Content areas
- School setting
- Teacher gender
- Classroom size
- Diversity in student body or faculty/staff

While prior research documents that the above list of irrelevancies can and do make a difference in classroom climate and student achievement (Wenglinsky, 2002), these effects are

The surface similarity investigation documents the prototypical as well as the variant prototypical characteristics of the sample. For external validity as it relates to surface similarity, the following variants of persons, settings or treatments are identified:

- Schools of principals or superintendents who did not give consent
- Teachers who chose not to participate
- First year teachers who do not have a grade 4-8 reading or math classroom
- First year teachers who completed teacher preparation in states other than Ohio
- First year teachers who had past experience as a long-term substitute.

Table 6 documents that the two study samples have some distinct differences but are somewhat similar given the limitation of the recruitment process since there is no control for what types of teachers will agree to participate. In addition, a difference that is not included in the table is that the case study was recruited in the first quarter of the academic year; the One Observation Study participants were recruited during the third and fourth quarters of the academic year. The two studies may have different types of participants.

The case study proportionally includes more males than either the single observation study or the state population of all teachers; the sample has a greater representation in urban and rural schools than the single observation sample or the state as well. Also, the case study sample is more heavily concentrated in grade 6 whereas the single observation sample includes the majority of its participants in the grades 4-6. The case study sample includes more math than reading whereas the single observation sample's difference between math and reading is not as large.

Grounded theory of causal generalization

Grounded theory of causal generalization by Shadish et al. (2002, p. 24) suggests five principles to be used in studying validity: (1) Surface Similarity Study; (2) Rule out irrelevancies; (3) Make discrimination; (4) Interpolate/Extrapolate; (5) Causal explanation. While it is preferable to implement the five principles when studying validity of a quasi-experimental research causal inference, it is not always feasible. At the very least surface similarity and causal explanation should be documented before generalizations of quasi-experimental studies are accepted.

Surface Similarity. Surface Similarity refers to both construct and external validity. Construct validity, as it relates to surface similarity, refers to the similarities between the sampled and target populations. For this study, the teacher classroom is a source of data collection for both the case study and the single observation study. The construct, the teacher classroom, is the same for each observation. The fact that every classroom reflects both unique physical characteristics and teacher-introduced characteristics such as decorations and room arrangement is not considered important for the purposes of this study. All data collected is from first-year teachers in grades 4-8 math and reading. All participants are graduates of an Ohio teacher preparation program. The classrooms observed represent urban, rural and suburban school buildings and districts whose superintendents and principals have given their consent to participation. The case study and the single observation participants are very similar with respect to construct validity.

Table 16 *Comparison of Participant Profiles and State of Ohio Teachers*

Descriptive	Case Study Participants n=29	Single Observation Participants 2007-08 n=84	Total First Year Teachers n=113	Statewide
Number of school buildings	22 (10 in both yrs. 4 in 07-08 only 8 in 06-07 only)	68	90	3903
Number of districts	17	55	68	614
Number of males/ females	66% female	85% female	79% female	75% female
Universities represented	13	26	28	50
Settings of districts represented	Urban - 41%	Urban - 35%	Urban – 42%	Urban – 25%
	SubU - 17%	SubU - 39%	SubU – 35%	SubU– 25%
	Rural - 41%	Rural - 22%	Rural – 23%	Rural – 50%
Grade Level	Grade 4 - 3	Grade 4 – 20	Grade 4 - 23	Not available
	Grade 5 - 4	Grade 5 – 20	Grade 5 - 24	
	Grade 6 - 10	Grade 6 – 15	Grade 6 - 25	
	Grade 7 - 4	Grade 7 – 16	Grade 7 - 20	
	Grade 8 - 5	Grade 8 - 13	Grade 8 - 18	
Subject Taught	Math – 24	Math - 47	Math – 71	Not available
	E/LA –10	E/LA - 37	E/LA - 47	

SPSS varimax rotation explained 67% of the variance in the dataset. Each component explained between 14% and 9% of the variation, indicating that none of the components were particularly indicative of the variation among preparation programs. The fact that no major components represented a substantially higher portion of the variability indicates that Ohio teacher preparation programs are relatively homogeneous. We believe NCATE requirements and other legislative requirements have guided this homogeneity. The majority of institutions locate content course work in Arts & Sciences Colleges; clinical assessments are standardized. It is interesting to note that length of the program did not load in any of the significant components; in other words, there was not enough variability in the program length across the dataset to be significant.

Sampling and the Teacher Profile

Although randomized experimental designs are preferred, the reality of large-scale field research in schools is often impractical. Sampling in TQP was purposeful. Table 16 compares the similarities between the combined case study and single observation first year teacher participants to the state population of first-year teachers. The goal is to determine if the sample population is similar enough for generalizations despite the lack of randomized sampling. In other words, if a finding is determined using the sample of first year teacher data, can the finding be assumed to be true for the state population? Both construct and external validity are important.

Table 15 *Item Analysis of Mathematics Teaching Survey.*

Mathematics Content and Process Standards	Number of Items	Percent Correct
Number and Number sense	13	77.53%
Algebra	10	73.2%
Geometry	9	53.3%
Measurement	1	60%
Data Analysis and Probability	2	88%

Program Data and Factor Analysis

Besides descriptive statistics presented in Table 3 (page 15), no further analyses were done with the IHE data. Factor analysis with the 55 program data factors yielded six clearly defined components:

1. Placement/Diversity
2. Entry Requirements for Math
3. Exit Requirements for Math
4. Entry Requirements for ELA
5. Exit Requirements for ELA
6. Other Program characteristics (cohort, induction support, semester/quarter, etc.)

Table 14 *Comparison of Average Math Content Knowledge Survey Score*

Thirteen Teachers	**Average Math Content Knowledge Score**	**Standard Deviation**
During First Year of Teaching	73.08*	14.9
Second Year of Teaching	80.42*	10.7

*Significantly different at the $\alpha = .04$ level.

The significant ($\alpha = .04$) improvement of the scores on the Content Knowledge for Mathematics Teaching Survey supports the fact that teacher increase their content knowledge as they gain experience.

From an item analysis of the Content Knowledge for Mathematics Teaching Survey in Table 15, it appears that novice teachers have the most difficulty with Geometry. Because of the scant numbers of items focusing on measurement and data analysis and probability, no further conclusions can be drawn.

ranged from 40% to 95%. Given that Ohio redesigned Middle level licensure areas to insure robust teacher content knowledge the low score is disappointing.

Table 2 *Math Content Knowledge (MCK) Survey Scores for Case Study Participants 06-08*

MCK Scores	**Value N = 25**
Mean	74.36
Median	72.73
Standard Deviation	13.89
Range	54.54
Minimum	40.91
Maximum	95.45

During the second year of data collection, 13 participants from 2006-2007 completed the survey a second time. Table 14 contains the comparison of their scores between the first and second years of teaching.

Table 13 *Student Engagement* N = 113

Hypothesis	*B*	*SE B*	$p > \|t\|$
Constant	.353	.414	.397
Emotional Support	.353	.130	.008**
Instructional Support	.015	.078	.847
Classroom Organization	.553	.104	.000**

Note. Model Significance: $F(3, 109) = 54.53$, $p = .000$, $R^2 = .600$

** Significant at $\alpha = .05$

The clear finding from these analyses involves the key role that Emotional Support plays in determining the ratings in all other Domains. If a novice teacher does not demonstrate Emotional Support, he or she will struggle with the all other Domains. This finding supports much of the literature that suggests relationships between teacher and students and between students and students are critical to academic success (Wenglinksy, 2002).

Content Knowledge for Mathematics Teaching Survey

Table 2, a repeat from page 18, contains descriptive statistics for the administration of the survey to 25 first year teachers in 2006-07. We were surprised at the range of scores. The scores

Student Engagement and Emotional Support are the only two Domains that are predictive of Classroom Organization.

Table 12 *Instructional Support* N = 113

Hypothesis	*B*	*SE B*	$p > \|t\|$
Constant	-.876	.504	.085**
Classroom Organization	.215	.142	.134
Student Engagement	.023	.118	.847
Emotional Support	.695	.151	.000**

Note. Model Significance: $F(3, 109) = 34.05$, $p = .000$, $R^2 = .484$

** Significant at $\alpha = .05$

Besides the constant, Emotional Support is the only Domain that is predictive of Instructional Support.

Table 10 *Emotional Support* N = 113

Hypothesis	*B*	*SE B*	$p > \|t\|$
Constant	1.510	.259	.000**
Classroom Organization	.235	.051	.000**
Instructional Support	.368	.076	.000**
Student Engagement	.180	.066	.008**

Note. Model Significance: F(3, 109) = 82.68, p = .000, R^2= .695

** Significant at α = .05

Three Domains are significant in the predictive model for Emotional Support. Emotional support is the one Domain that embodies the other three in a predictive model with N = 113.

Table 11 *Classroom Organization* N = 113

Hypothesis	*B*	*SE B*	$p > \|t\|$
Constant	.371	.339	.276
Student Engagement	.371	.070	.000**
Emotional Support	.485	.100	.000**
Instructional Support	.095	.063	.134

Note. Model Significance: F(3, 109) = 82.28 , p = .000, R^2= .694

** Significant at α = .05

When considering poverty levels, the Domain scores were always higher in the low poverty schools than in medium poverty schools. For Instructional Support, there were significant differences between low poverty and medium poverty, and medium poverty and high poverty. For student engagement, there was a significant difference between low poverty and medium poverty schools. It is interesting to note that none of the Domains had significant differences between high poverty and low poverty.

Many different bodies of research attest to the fact that teaching in a high poverty school is difficult. Simply stated, living in poverty takes its toll on children and families, and children of poverty arrive at kindergarten with fewer language skills and less developed memory capacity. Lareau (2003) who conducted a three-year qualitative study of 42 families spanning the economic continuum accounts for the disparity in vocabulary knowledge and intelligence test scores between the children of professional parents and the children of working poor and welfare parent by differences in parenting styles. More recent neuroscientific research attributes the lesser academic abilities of children in poverty to stress hormones that hamper brain development (Noble, Tottenham, & Casey, 2005). Our findings suggest that our novice teachers in high poverty settings were responsive to the needs of their students (Emotional Support) but less able to provide the academic rigor the students require (Instructional Support), which resulted in lower Student Engagement ratings.

CLASS Domains in Regression Analysis. Further analyses using linear regression on the Domains demonstrated that the predictive value among the Domains was not constant. Table 10 contains the model for Emotional Support; Table 11, Classroom Organization; Table 12, Instructional Support; and Table 13, Student Engagement.

homogeneous populations. The needs of rural students might be greater and require more varied responses resulting in less consistent teacher performance. An alternative explanation is that the majority of novice teachers in Ohio come from suburban settings themselves and therefore are more familiar with the needs of suburban students.

CLASS Domains and Poverty Settings. Similarly, the Domain differences among poverty levels (low, medium, and high) yielded significant differences within some domains as seen in Table 9.

Table 9 *Comparison of Domain Scores by School Poverty Level*

Domain	**Low Poverty N = 54**	**Medium Poverty N = 20**	**High Poverty N = 39**
Emotional Support	5.29	5.12	5.34
Classroom Organization	5.23	4.91	5.35
Instructional Support	3.93^	3.80*^	4.41*
Student Engagement	5.18#	4.76#	5.26

^ # *Significantly different at the α = 0.10 level using Games-Howell and Tukey PostHoc Tests

Table 8 *Comparison of Domain Scores by School Setting*

Domain	**Rural** **N = 25**	**Urban** **N = 49**	**Suburban** **N = 39**
Emotional Support	5.02[#]	5.40	5.34[#]
Classroom Organization	4.75	5.41	5.35
Instructional Support	3.69*	4.04	4.41*
Student Engagement	4.64	5.35	5.26

[#] *Significantly different at the α = 0.09 level using Games-Howell and Tukey PostHoc Tests

Within school setting, the significant differences were for Emotional Support and Instructional Support. For Emotional Support and Instructional Support, there was a significant difference between rural and suburban districts. There are no easy explanations for these differences. All the Domains were highly correlated, leading one to believe that the differences between settings would be significant, as well. In both significantly different cases, the Domain scores for suburban settings were higher than for rural settings. Typically suburban schools have

Table 7 *Overall Domain Average Scores for all first year teachers*

Domain	**N = 113**
Emotional Support	5.40
Classroom Organization	5.34
Instructional Support	4.14
Student Engagement	5.27

CLASS Domains and District Settings. We wanted to know whether or not district setting made a difference in CLASS scores and Domain ratings. The differences within Domains among the different school settings (rural, urban, and suburban) yielded some significant differences using ANOVA in SPSS. Table 8 contains the results.

Table 6 *Correlations among Domains N = 113*

Domain	Emotional Support	Classroom Organization	Instructional Support	Student Engagement
Emotional Support	1.00			
Classroom Organization	.788*	1.00		
Instructional Support	.688*	.621*	1.00	
Student Engagement	.699*	.757*	.535*	1.00

*Significant at $\alpha = .05$

For each Domain within the sample, overall average Domain scores for the sample of 113 participants are as follows. Again our findings mirror those that Pianta (2008) and his colleagues have found in that the domain of Emotional Support tends to be rated the highest and Instructional Support tends to be rated the lowest.

for certain activities enable him to design work at his students' zone of proximal development as is indicated in the passage below:

> They were confused on the order of operation. They were not understanding that if....this is with the pyramids, not the prisms...I actually found no errors in the prisms because they are very solid at figuring out perimeter and area. They have that good foundation. The problem was they were dividing by three rather than finding what all of the dimensions multiplied together divided by three were. They were dividing the last number by three. That was the only mistake I actually saw. Typically with that class, there will be no mistakes or once in a while I'll find I have omitted something and I can go back and figure out what that is. Like I showed you with those scores, it showed me very specifically what they are lacking and like you have seen with that class, that's not much. What I try to do is pick on the little areas where they can get better. Overall, usually with that class, it's a lot of....I'll model something or I'll have them figure it out on their own. It's one or the other and a lot of the time we will do very quick little group projects. Today wasn't extremely structured but to build the bigger shapes the groups are really fast. I had them put their blocks together. I tried to get them to learn on their own sometimes as well because it's a big step with intellect is from when you go from just being hand fed everything to when you can start to self-discover and you can look things up on your own and you can tie together ideas. And I think that group of kids is, they're ready for that. I wouldn't say that all sixth graders are ready for that. But I would say that based on being around those kids and knowing their backgrounds, knowing their scores in language arts, knowing their scores in social studies and science, like talking to their teachers every day, I know that that group is just, they're ready for whatever you can give them. They can always do more and so we do a lot of extra stuff. I think I am going to do a scale model of the solar system with them. We have decided we want to do that. And we get to scale factor in the next two weeks I think I am going to start fiddling with that idea. And that is something we won't be able to do with the other classes. It's a lot of individual work. It's a lot of....one group will make a planet to scale....then you make the distances to scale. It's a lot of work and I have found a project like that I want to do. We'll see if it works.

Quantitative Findings and Discussion

CLASS Data

Table 6 contains a correlational table demonstrating the high correlation among the four Domain scores for the sample of first year teachers. All correlations are significant. The high correlation among the Domains is supported in Pianta's work (Pianta et al, 2008).

effective novice teachers have integrated these bodies of knowledge so that when they discuss classroom interaction it is difficult to label one event as Knowledge of Learners or Knowledge of Teacher. Reconsider Teacher 01 lesson in problem solving:

> I had them work with partners and work with manipulatives, interlocking cubes, and they had to show me two different ways that they could show me the answer of how they could come up with how many applesauce jars would go on each shelf and then they also had to include a picture. So they can use the hands-on, they can draw the visual and they use the actual algorithm. A lot of students were using it as, even though it's more of a division problem, they were doing it - approaching it as a multiplication problem and working kind of backwards to get to their answer.

Although we used this passage to highlight how Teacher 01 makes her formative assessments transparent, we equally could emphasized the mathematical knowledge required for her to have her students working on so many different representations of a single problem. We also could have inferred Knowledge of Learners as she is providing for the needs of many different learners—hands-on learners, visual learners, learners with more advanced levels of mathematics than other students, that is, those who use an algorithm to solve the problem or those who recognize the problem as division.

High scoring Teacher 28 also integrates his knowledge of teaching, learners, and subject matter. He is highly aware of the various developmental levels across his classes and how these influence his pedagogical strategies. It is a rich knowledge of learners—" knowing their backgrounds, knowing their scores in language arts, knowing their scores in social studies and science, like talking to their teachers every day, I know that that group is just, they're ready for whatever you can give them." He analyzes student work so he has a very detailed knowledge of their mathematical knowledge—"like I showed you with those scores, it showed me very specifically what they are lacking. His knowledge of mathematics and the mathematics required

activities with manipulatives), iconically (using pictographs or other visuals to represent concept), and finally symbolically (using formulas or other abstract notation). Teaching using Bruner's model requires teachers to have in-depth, detailed understanding of mathematical concepts. High scoring teacher 28 uses his knowledge of mathematics to help students learn conceptually and not just memorize formulas:

> What we did to construct and just to practice to get the general idea that volume means cubed we actually use centimeter cubes and we constructed four or five guided shapes where I told them what to make and we talked about width and height, and I also had them just kind of mess around make shapes however they could construct them with the volume of 24 cm. So the whole idea behind that is to them to realize why we use cubed to label volume, and also to understand that knowing the formula is important enough, to not have to use little shapes. Then we used a worksheet and the over head to talk about how to find the volume of prisms, rectangular prisms, cubes and also to find rectangular pyramids. So we went through those. We talked about the two formulas involved with those. I was hoping to tie together the construction of the shapes to the formulas. . . . I think that probably the majority of the whole class with the exception of maybe one or two could calculate volume of every shape now that we've covered today.

Low scoring Teacher 27 squanders opportunities to enhance student learning, even when student performance suggests they are ready for further learning:

> We read the story Tuesday after going over the vocabulary on Monday. I was just trying to get them through it because it's not like the most important story ever. But, just getting them to know the vocabulary words is really important, so I was amazed at how well they understood the story having only read it once in class.

Intersection of Knowledge of Teaching, Knowledge of Learners, and Knowledge of Subject Matter

As our theoretical framework suggests and the findings from our qualitative analyses confirm, for novice teachers to be successful they must have sound Knowledge of Teaching, Knowledge of Learners, and Knowledge of Subject Matter. It is our contention that the most

The high scoring teachers purposefully create learning communities, while the low scoring Teacher 32 "does" groups and group work. She does not articulate an academic or social reason for having student work together, but rather appears to mix individual and group activities in order to prevent boredom. When asked how the observed lesson went, she responds:

> It was alright. I think I've been doing a lot of group work lately, and I think it's been too much because they usually - they do really well with group work…and overall, for the most part… And Monday and Tuesday we did something with groups, and then I can't even remember last week…kind of we did…and then before Thanksgiving we were doing a lot, so I think they're getting a little bit of overkill on group work, so they were a little more antsy than I was hoping for. So, it was ok, but it could have been better.

Knowledge of Content/Subject Matter

Numerous studies attest that teachers should have deep knowledge of the content they teach (Grossman, Schoenfeld, & Lee, 2005). For example, a majority of studies show a positive correlation between secondary school teachers' study of mathematics and student achievement in mathematics and the number of science courses teachers take in college and their students' achievement (Floden & Meniketti, 2005). Our high scoring teachers exhibited their Knowledge of Subject Matter in their articulation of content in great detail and in their understanding of the structure of the discipline.

Structure of the Discipline. Bruner (1966) developed a teaching model, based on what he called the "structure of knowledge," which is designed to sequence learning so that knowledge is most accessible. Bruner's vision was for students to grasp, transform and transfer, which pedagogically requires new concepts to be taught first enactively (that is, hands-on

that the needs of all members of the community will be met through the commitment to work together (Bransford, Goldman, & Cocking, 1999). High scoring Teacher 01 alternates between having her students work individually and collaboratively. She recognizes the benefits and trade-offs of each strategy and plans accordingly:

> They did it a little bit individually, like I said before, they get a little bit more done sometimes if they work individually but when they struggle, I like for them to work with each other. That frees me up to walk around so they can use me as a resource as well then. I also offer to have a classroom set of books and I said if anybody wants to use the books as a resource to maybe look up the definition if you don't really know what a rhombus is you can use the book to look it up and figure out what it is and then you can apply that to what you're doing in the class.

She promotes learner independence through having resources available and learner interdependence, having students help each other and freeing her expertise to used where it is needed most. According to Shepard, Hammerness, Darling-Hammond, and Rust, (2005), the realities of today's classrooms prevent teachers having time for one-on-one tutoring and shepherding individual students through the learning process. To respond to this reality, Teacher 01 creates a learning community in which students help each other learn.

High scoring Teacher 28 acknowledges that sometimes students can best teach each other and formally encourages them to do so:

> Sometimes it's the way they word it or the way they actually show or, I think, if the learner actually sees another student doing it, they can watch exactly what they are doing. They think when I am putting something on the board, it's how the teacher does it or it's the perfect way to do it. You can show them multiple approaches of multiple different students and they are watching that, I think they can suck that information up a little better. I think that it definitely helps to have them present it. That is something I try to do once a week or once every other week. It's pretty much how I teach social studies. It's a lot of group presentations, a lot of one student explaining something, you know, maybe they look at it differently.

mediate learning. High scoring Teacher 01, when asked what resources she did not use during the lesson, but wished that she had, responded with the following:

> I think grid paper might have helped. Looking back, grid paper might have helped because when they draw the shapes--sometimes drawing the shapes helps rather than having the physical shape in front of them. I noticed some of them drawing the shapes because the trapezoid they had in their [collection of shapes] is not always what a trapezoid looks like. Drawing on [plain] paper is difficult, so if they had grid paper they could have charted it out a little better.

By carefully observing her students at work, Teacher 01 has realized that the representations provided (manipulative geometric shapes) have not supplied the information required, and students were generating their own representations (by drawing a more familiar trapezoid). Her future intention is to further support students in generating the information they need to solve the problem by providing appropriate resources, in this case, graph paper.

Low scoring Teacher 07 actively discourages her students from their desire for independent learning, as indicated by their request to read ahead of the class.

> They like it. I think it's going well. They like not bringing their book to class. But, in general, I think they like the book. Like a lot of them have asked me if they can read ahead and stuff like that. I'm trying to hold them back a little so that they're not bored in class. I think they do like it. It's not a terribly long book and so I think that's helpful that we're not jumping into a three hundred page novel, or something. And, they had experience in the past doing novels. Like in fifth grade they read a book together as a class. So, I think they were excited about it because it was a change of pace (emphasis is ours).

Learner Interdependence. The "child" code Learner Interdependence focuses on social nature of learning. Creating a learning community in one's classroom means creating the belief

Learners—Student Characteristics and Student Response—revealed that most novice teachers are aware of constructivism and actively try to employ its tenets.

Background Knowledge. Critical to cognitive and constructivist theories of learning is the background knowledge—prior knowledge is the foundation for the construction of new knowledge. High scoring novice teachers elicits their students' background knowledge and recognize the role it plays in anchoring new knowledge, as is evidenced in high scoring Teacher 01's comments about her students' performance:

> So, one big thing we're trying to work on is to try to interlink the multiplication and the division which is great because even though it was a division problem they were still approaching it as a multiplication problem. So, they know multiplication, they're getting to a point where they know it pretty well. So, it's good that there is this connection so they can build on it from there.

Contract Teacher 01's appreciation of her students' efforts with low scoring Teacher 11's assessment of her students, who do not yet know their multiplication tables:

> They won't get that motivation [to learn their multiplication tables] until I make it consequences for them and I haven't made that yet just because I know that they'd be having consequences all year. So, hopefully, I can come up with something or we can come up with something as a staff to make it worthwhile to them understand multiplication tables. Cause they certainly aren't getting that at home. I mean, when I grew up, I had to know it and everything. You know, if they don't get it here, they're not gonna get it at home.

Teacher 11 is aware that her students lack the background knowledge necessary to learn additional mathematics, as does her teacher colleagues. However, the strategy appears to be one of "blame and shame." Teacher 11 does not want to begin punishing her students for their lack of knowledge, because she believes she will have to punish them for the entire school year.

Learner Independence. According to Windschilt (2002), meaningful learning occurs when teachers provide students with the informational and physical resources necessary to

> It's not my favorite thing, but there's such a wide range of students in my classes, especially the first class I have and the last class I have....same class....not....there is a little narrower of a range...In the last class you just observed, there's kids who right now struggle with the concept of what multiplication is and then I've got kids whose parents have already taught them to solve linear functions and solve for x and y, and whose older brothers and sisters told them those things. So I've got kids who are like "Oh my gosh, this is so easy" and get it immediately, and I've got kids that the word fraction...they are not even completely positive of what it means. So its hard to do...I know you are supposed to do all of the constructivist activities that you know you are always told you are supposed to do...it's the best way to learn, it's been proven over and over it's the best way to learn. But I don't always have time to A, put those together, B have all the resources to do those things. My resources are really, really limited.

Teacher 30 knows that his students' mathematical knowledge diverges wildly, from students who have not yet master multiplication to students who know how to solve linear functions. Apparently his solution to even the playing field and to increase the knowledge of his struggling students is to have all students take notes about the mathematical concepts in the lesson. Teacher 30 admits the futility of his strategy. He clearly has been taught that the development of mathematical understanding is a constructivist endeavor, but he is overwhelmed and cannot design and implement the differentiated curriculum that a constructivist approach requires. Teacher 30 accurately accesses his situation—as a first year teacher, he does not have the time to develop materials he needs to scaffold the below-grade level students and to challenge the above-grade level students. Apparently, unlike Teacher 03, Teacher 30 does not have the human and physical resources he needs adequately support student learning in his classroom.

Knowledge of Learners

Although there are myriad constructivist theories, all of them share the central concept that learning is the active and personal construction of knowledge (de Kock, Sleegers, & Voeten, 2004). Our secondary coding of the data of the categories that comprise Knowledge of

By providing students with a variety of ways to solve the problem and demonstrate their understanding, Teacher 01 ensures that she will know if students with different abilities and learning styles are successful. Her ability to design multiple instructional activities and to recognize and interpret student strategies in problem solving also attest to the depth of her content knowledge.

Differentiation. Differentiated instruction is an acknowledgement that it is no longer possible to teach the fourth grade—one must teach the students who are in fourth grade whose developmental levels, academic abilities and background knowledge, and diversity range widely. While increasingly curriculum is leveled to meet the needs of below-grade, at-grade, and above-grade level students, effective teachers continue to create, share, and "steal" materials to promote the learning of all students, as indicated in high scoring Teacher 03's comment on the materials she used in her observed lesson:

> The resources I used with the [book] and [book] group came from, actually, our gifted group coordinator. She makes sets of higher-order thinking questions to go along with each story and other activities that you can do. That is what I used for those two groups and also with the [book] and [book] group, I used the cards, the discussion cards, that I saw the presenter use at a conference I went to on Tuesday. So I got that idea and stole that and used that because they like to pull a card. If the discussion's not going well, they're having trouble talking about something, that is a good thing to do. I thought it went pretty well.

Teacher 03 ensures that her above-grade level students are challenged by seeking assistance from the gifted coordinator, and she scaffolds her below-grade level learners with the use of question cards.

Contrast her efforts with those of Teacher 30. The field researcher asked Teacher 30 what his thinking was when he had his math students take notes.

obviously their facial expressions." Relying solely on body language to gauge the nature of student understanding is risky at best. While common sense tells us that the expressions on students' faces do communicate, our high scoring novice teachers looked for additional evidence, as is revealed in the response of Teacher 28 when asked, "What led you to understand that they were having problems?":

> With that group, usually if there's three or four hands, you can get a feel. Mostly the type of questions I was getting from the type of kid they were coming from. A lot of those kids in there are very . . . very good at picking up new math skills. So, just based on the writing question, some of the kids in the classroom weren't picking up on it but they won't ask questions either because they are shy or they are not paying attention. Usually the ones that are right on task and on point were having a lot of struggle so that is why I kept following it and reteaching it. Presenting it a little bit of a different way. There are only so many ways you can improve on that. But, just basically the questioning and the looks of confusion and the types of question.

Teacher 28 does use facial expressions as indications of student learning, but he also consider the types of questions students asks as additional evidence.

Some of our high scoring teachers purposefully designed lessons so that the mechanisms of formative assessment were transparent to both the students and to the teachers themselves. Teacher 01's response illustrates how she used the instructional activities to make the degrees of student understanding visible. She has planned, as evidence of their comprehension, for students to be able to demonstrate the mathematical concept of the lesson in three different ways.

> I had them work with partners and work with manipulatives, interlocking cubes, and they had to show me two different ways that they could show me the answer of how they could come up with how many applesauce jars would go on each shelf and then they also had to include a picture. So they can use the hands-on, they can draw the visual and they use the actual algorithm. A lot of students were using it as, even though it's more of a division problem, they were doing it - approaching it as a multiplication problem and working kind of backwards to get to their answer.

Her goals for student outcomes are so vague that many reading her response will not be able to guess the content she taught. Most readers guess mathematics when, in fact, she was teaching a reading lesson.

Research in the writing, and hence conceptualizing, of instructional goals and objectives has moved from the behaviorist dictum of prescribing student outcomes in terms of observable student behaviors performed under identified conditions that meet specified criteria (Mager, 1975) to more cognitive objectives that address high levels of learning and identify sample behaviors as evidence of student attainment of the objectives (Gronlund, 2004). Popham (2005), a former proponent of precise behavioral objectives, now advises teachers to create learning goals that are "truly salient, broad, yet measurable" (p. 104). High scoring teachers in our study were very clear and intentional about the concepts and processes they wanted students to learn. Our high scoring teachers articulate clear educational outcomes for their students.

Assessment for Instruction. Countless professional development workshops are occurring across the country to promote teacher learning in the difference between assessment of learning and assessment for learning. Current research suggests that effective teachers engage in formative assessment, that is, continuous assessment during the instructional process to improve student learning and teaching (Stiggins, 2008). Our interview protocol specifically asked teachers whether or not students had achieved the instructional goals set for the observed lesson. A follow-up question asked the novice teachers how they knew whether or not students were learning what was intended. Invariably, low scoring teachers would respond, when asked how they could tell if their students were achieving the instructional goals, as Teacher 11 did, "Well,

Clarity of Instructional Goals. The "child" code Clarity of Instructional Goals was identified as we found marked differences in the ways novice teachers talked about their instructional goals for the observed lessons. After the identification of the child code, we connected Clarity of Instructional Goals to the fact that the state of Ohio, in which all participating teachers attended teacher education programs, has adopted the PRAXIS III assessment as the means for determining whether a novice teacher is worthy to move from a provisional license to a professional license. One of the criteria of the PRAXIS III assessment is "the articulation of clear learning goals." Inasmuch as Title II in Ohio requires the reporting of PRAXIS III pass rates of graduates for each institution of higher education, we are confident that "the articulation of clear learning goals" is a component of all teacher preparation programs and of common assessments across the state. Therefore, it was somewhat surprising that we found such differences in the clarity of novice teachers' instructional goals.

The high scoring Teacher 31 specifically identifies what mathematical insights he wants his students to realize as a result of the instructional activities:

> Yesterday they had ten designs that they had to find the area and perimeter. So today it had to deal with what they did yesterday. I had them look at [design G], one of the first activities where it was 11 square units, and they had to keep the 11 square units, but think of different designs or different perimeters that would result in different designs, so they can see, "Oh, I still have 11 square units, but I can get 12 as my perimeter or I can get 15 as my perimeter."

Contrast low scoring Teacher 27's description of the instructional aims of her observed lesson:

> I think [the lesson] went really well, the focus was just to make sure they understood the parts that are going to be on that test on Tuesday. And asking each other questions that I gave them and getting them quick, too. It's not just about being able to figure it out, it's doing it multiple times and understanding, going quicker and quicker, knowing the answers rather than discussing them.

Knowledge of Teaching

In the American Education Research Association report on research and teacher education, Grossman (2005), editor of the chapter on pedagogical approaches in teacher education, identifies two broad areas in the literature: classroom instruction and interaction and tasks and assignments. Classroom instruction and interaction include the relational aspects of teaching and learning and particular strategies, such as case studies, simulations, and role playing (p. 426). Tasks and assignments, she argues, "represent crucial ingredients in the pedagogy of teacher education as they focus students' attention on particular problems . . . and introduce them to ways of reasoning or performing" (p. 426). Although Grossman is referring to pedagogical approaches in teacher education, we find her distinctions useful for our research, because we chose to observe classroom instruction using CLASS, an instrument to assess the quality of interaction and the nature of instruction, rather than using means, such as participant observation or video-taping, to describe instruction and instructor-student interaction. Our interview protocol focuses on specific aspects of the observed lesson in order to prompt novice teachers to articulate their practice. While we strongly believe that all nature of relationships in the classroom are critical to student achievement, the structure of our research questions and the types of data we collected focus more on tasks and assignments, which can be seen and talked about more concretely than relationships.

Our analyses of the data contained in the initial code Instruction resulted in the identification of the "child" codes Clarity of Instructional Goals, Assessment for Instruction, and Differentiation.

- 80% require candidates to complete a designated course in technology.
- 85% require candidates to complete a designated course in special education.
- 10% require candidates to take a designated course on English Language Learning (ELL).

2. Student Teaching
    - 95% have a capstone project. Of those, 40% require a portfolio.
    - 90% have a mid-point benchmark.
    - 90% require students to complete placements at more than one school setting.
    - 80% require students to complete placements in more than one grade level.

Qualitative Findings and Discussion

The interview data from ten first-year teachers comprise these findings. The ten teachers were classified as either "high scoring" or "low scoring," according to quartile rankings of CLASS domain means. To be identified as "high scoring," teachers had to be in the highest quartiles in emotional support, instructional support, and in at least one other domain and be "medium scoring" in the remaining domain (n= 5). To be identified as "low scoring," teachers had to be in the lowest quartiles in emotional support, instructional support, and in at least one other domain, and be "medium scoring" in the remaining domain (n=5). We identified the data for these ten teachers in the areas of Knowledge for Teaching, Knowledge of Learners, and Knowledge of Content.

7.	Religious or non-religious affiliation	2006	US News	58% of Ohio IHEs are religiously affiliated; 42% are not.
8.	Urban, Rural or Suburban location	2006	US News	30% of Ohio IHEs are in urban areas; 40% are in suburban areas and 28% are in rural areas.
9.	In top 100 regional ranked IHE?	2006	US News	38% of Ohio IHEs are in the top 100 ranked regionally.
10.	Average high school GPA of accepted students	2006	US News	The average GPA for applicants ranges from 2.5 to 3.8, with the average of 3.29.
11.	Freshman retention rate	2006	US News	The freshman retention rate ranges from 52% to 92%, with an average of 75%.
12.	Diversity	2006	US News	66% of Ohio IHEs are not considered diverse.

Program Data. Forty-three (43) Ohio IHEs responded to the online survey about AYA Math and MCE Reading/Math programs. Most notable descriptors are as follows:

1. Course Work:
    - 80% report that content knowledge is taught in the College of Arts and Sciences.
    - 93% have a required general sequence of courses that ALL candidates complete for education (aside from Gen Ed).
    - 40% require students to complete a designated course on classroom management.
    - 40% require candidates to complete a designated course in assessment.
    - 76% require candidates to complete a designated course in diversity.

Institution and Unit Data. Most notable statistics are included in the table below:

Table 5 *Descriptives from IHE dataset*

	Description	Year	Source	Major Finding
1.	Private or Public System	2003-04	ODE	74% of the IHEs in Ohio are private.
2.	Total Undergraduate students enrolled	2003-04	ODE	The number of undergraduates in Ohio IHEs ranges from 171 to 44,518. The average number of undergraduates at an Ohio IHE is 6621. 76% of the IHEs in Ohio have 5600 students or less.
3.	Total Graduate students enrolled	2003-04	ODE	In Ohio IHEs, the range of graduate students enrolled is 10 to 10,571, with the average of 1827. 65% of those graduate students are in IHEs with 1500 or less students.
4.	Size Label (S, M, L, XL)	2006	US News	24% of Ohio IHEs are considered Large and Extra Large. 36% are considered medium and 36% are considered small.
5.	Year IHE started	2006	US News	72% of Ohio IHEs were founded before 1900.
6.	AGE of IHE	2006	US News	The ages of Ohio IHEs ranges from 21 years to 210.

numbers of districts in each of the seven categories. The data were aggregated to three school settings and three poverty levels. The translation for these groups was as follows: Rural = State typologies 1,2,3; Urban = State typologies 4,5; and Suburban = State typologies 6,7. For poverty levels the translation was as follows: Low poverty = State typologies 6,7; Medium poverty = State typologies 2, 3; High poverty = State typologies 1, 4, 5. Tables 3 and 4 report the percents represented in the sample of 113 by school setting and poverty levels.

Table 3 *Percent of Ohio Districts that are Urban, Suburban and Rural*

Setting of District	**N=113**	**State wide**
Urban	42%	25%
Suburban	35%	25%
Rural	23%	50%

Source: Ohio Department of Education (ODE), based on 2000 census data, updated in 2004

Table 4 *Percent of Ohio Districts that are Low, Medium and High Poverty*

Poverty Level of District	**N=113**	**State wide**
Low Poverty	48%	%
Medium Poverty	27%	%
High Poverty	38%	%

Source: ODE, based on 2000 census data, updated in 2004

reanalyzed by code and teacher ranking. Distinct differences were found in the interview data depending on whether a teacher was a "high scoring" teacher or a "low scoring" teacher.

Quantitative Data.

Summary descriptives from the various quantitative data sources are organized by dataset as follows:

Content Knowledge for Mathematics Teaching Survey. Participants in the case study completed a Content Knowledge for Mathematics Teaching Survey (MCK) during each year of participation. Table 2 contains the MCK scores from the 2006-07 case study participants.

Table 2 *Math Content Knowledge (MCK) Survey Scores for Case Study Participants 06-08*

MCK Scores	Value N = 25
Mean	74.36
Median	72.73
Standard Deviation	13.89
Range	54.54
Minimum	40.91
Maximum	95.45

District Typology. Our sample population of 113 represented 90 of the 3903 buildings in the state of Ohio. Sixty-eight of the 614 districts were represented. Table 1 (page 15) includes the

determine some of the coding categories used before the open coding of transcribed interviews began.

Initial analysis of two years of post-observation interviews resulted in the identification of fourteen codes: Administration, Classroom Context, Content/Subject Matter, Curriculum, Instruction, Parents, Planning, Professional Learning, Resources, School Context, Standardized Testing, Student Characteristics, Student Response, and Teacher Characteristics. Researchers then examined four codes that contained much of the data: Student Characteristics and Student Response, Instruction, and Content/Subject Matter. Within the codes Student Characteristics and Student Response, three "child codes" (an NVivo software term) were identified: Learner Background, Learner Independence, and Learner Interdependence. Within the code Instruction, three "child codes" were identified: Instructional Goals, Differentiation and Assessment for Instruction. This configuration of codes prompted researchers to return to the work of Darling-Hammond & Bransford (2005), who identify the three realms of teacher knowledge: teaching, learners, and content. Our initial codes Student Characteristics and Student Response align with Knowledge of Learners. Our initial code Instruction aligns with Knowledge of Teaching. The initial codes Content/Subject Matter and Curriculum align with Knowledge of Subject.

The qualitative data were further analyzed by a ranking of the teachers in their first year of teaching (N=29; N=21 in 2006-07 and N=8 in 2007-08) based on their CLASS scores. Means were determined for each teacher in each domain. The mean scores were divided into quartiles, and the teachers in the highest quartile were identified as "high scoring," teachers in the lowest quartile as "low scoring" and the remainder as "medium scoring." The qualitative data were then

source is the annual ranking by U.S. News and World Report of America's best colleges. These data include such constructs as size, selectivity, faculty productivity, and financial aid.

Program Survey. A web-based survey about licensure program characteristics for Adolescent/Young Adult mathematics (grades 7 through 12) and Middle Childhood Mathematics and English Language Arts (grades 4 through 9) was conducted during September through November 2008. Forty-one institutions responded. The survey collected data about program structure, content requirements, and field experiences.

Data Analysis

Qualitative Data

The post-observation interview data were transcribed and analyzed using widely accepted qualitative data analysis techniques: identifying codes; marking segments of texts with codes; and organizing coded data to determine themes or patterns at more abstract levels of interpretation (Miles & Huberman, 1994; Ryan & Bernard, 2000). Researchers agreed that the text segments to be coded were a complete turn—the entire text of a question posed by the field researcher and the corresponding teacher participant response. By coding an entire turn, researchers preserved prompts, contextual data, and other information that would help with interpretation. Each turn could have multiple codes. Codes were post-defined (not specified before or during data collection), a method recommended by many scholars (Anfara, Brown, & Mangione, 2002; Patton, 1990). It should be noted, however, that the research purpose and theories guiding the development of the project, including the interview questions, helped to

7. Urban/Suburban – very high median income, very low poverty. These districts also surround major urban centers. They are distinguished by very high income levels and almost no poverty. A very high percentage of the adult population has a college degree, and a similarly high percentage works in professional/administrative occupations. Approximate total ADM=240,000.

Table 1 *District Typology for the samples and for the state of Ohio*

District Type	Case Study Sample	Single Observation Sample	State of Ohio
1	3%	5%	16%
2	10%	7%	26%
3	28%	10%	13%
4	31%	33%	17%
5	10%	2%	2%
6	10%	18%	18%
7	7%	21%	8%

Institution and Unit Data. Data describing the 50 institutions of higher education with teacher preparation programs in Ohio were collected primarily through two sources. Teacher education programs in Ohio annually submit data to the state as required Title II. These data include program requirements, student diversity, faculty diversity and workloads. The second

2. Rural/agricultural – small student population, low poverty, low to moderate median income**.** These tend to be small, very rural districts outside of Appalachia. They have an adult population that is similar to districts in Group 1 in terms of education level, but their median income level is higher and their poverty rates are much lower. Approximate total ADM=220,000.

3. Rural/Small Town – moderate to high median income **.** These districts tend to be small towns located in rural areas of the state outside of Appalachia. The districts tend to have median income levels similar to Group 6 suburban districts but with lower rates of both college attendance and managerial/professional occupations among adults. Their poverty percentage is also below average. ADM =130,000.

4. Urban – low median income, high poverty. This category includes urban (i.e. high population density) districts that encompass small or medium size towns and cities. They are characterized by low median incomes and very high poverty rates. Approximate total ADM=290,000.

5. Major Urban – very high poverty. This group of districts includes all of the six largest core cities and other urban districts that encompass major cities. Population densities are very high. The districts all have very high poverty rates and typically have a very high percentage of minority students. Approximate total ADM=360,000.

6. Urban/Suburban – high median income. These districts typically surround major urban centers. While their poverty levels range from low to above average, they are more generally characterized as communities with high median incomes and high percentages of college completers and professional/administrative workforce. Approximate total ADM=420,000.

considerations: 1) Sensitivity to teacher time constraints, both in terms of their roles as classroom teachers and as participants in our study; 2) TQP instrument included mathematics content across as much of the grades four through eight curriculum that our participants would be teaching as possible; 3) The instrument would be taken by teachers who had either an Ohio Middle Childhood license (4 to 9 with two content areas) or an Ohio Adolescent/Young Adult (7-12 with a major or its equivalent in the content area. The resulting instrument measured content knowledge for teaching in the areas of number and number sense, algebra, geometry, measurement, data analysis and probability. Items did not simply measure mathematical knowledge, but included items that addressed student understandings and student errors. A total of 25 case study teachers took the Math Content Survey as first-year teachers. Thirteen participants retook the Math Content Survey during their second year of teaching.

District Typology. The location and population demographics of a school district has an impact on student achievement. The Ohio Department of Education has developed a classification system of school districts in order to provide a rational basis for making data-driven comparisons of groups of districts, last revised in 2004. The classification system identifies seven types of K-12 districts in the state:

1. Rural/agricultural – high poverty, low median income These districts are rural agricultural districts and tend to be located in the Appalachian area of Ohio. As a group they have higher-than-average poverty, the lowest average median income level, and the lowest percent of population with college degree or higher compared to all of the groups. Approximate total Average Daily Membership (ADM) =160,000.

researcher repeats this 20/10 cycle three to four times in one visit. At the end of a research year, 12 to 16 scores for each dimension for each novice teacher in the case study have been obtained. The 84 teachers who were not participating in the case studies were observed on a single occasion resulting in 3 scores for each dimension. The 21 case study teachers in 2006-07 and the 23 case study teachers in 2007-08 were observed and assessed using CLASS four times during the academic year.

Post-observation Interview. The post-observation interview is conducted with case study teachers after each of the four CLASS observations. The interview is a semi-structured recorded interview that prompts the teacher to consider a lesson taught during a CLASS observation segment. Specifically, the teacher was asked about his or her thoughts on the lesson; the student response(s) to the lesson; preparation for the lesson; and decisions made during the lesson, including use of resources. The questions are consistent across all interviews, but the researcher was permitted to follow a participant response with secondary questions and probes, seeking elaboration when necessary.

Content Knowledge for Mathematics Teaching Survey. The Content Knowledge for Mathematics Teaching Survey, used by permission of the School of Education, University of Michigan, comprises items developed by the UM Study for Instructional Improvement, Learning Mathematics for Teaching (LMT), and the Consortium for Policy Research in Education (Hill & Ball, 2005). LMT staff provided training for the use of their instruments. Two TQP mathematics teacher educators compiled the survey instrument. To meet the needs of the project, the instrument developers chose not to use the full LMT instruments made available by the University of Michigan group and instead chose to compile an instrument to meet specifically the needs of the TQP studies. The TQP instrument was designed based on the following

Data Collection Instruments and Data Collection Schedule

Numerous data were collected about the teacher participants, features of their preparation programs and institutions of higher education, the school in which they taught, and their classroom interaction with their students. The following instruments were used to collect the data for the findings presented in this paper.

Teacher Profile. The teacher profile instrument collected the following data on every participant: gender, race, license type, highest degree earned, degree-granting institution, name and typology of school, grade level(s), and subject(s) taught.

CLASS. Teachers were observed and assessed using Classroom Assessment Scoring System (CLASS), an instrument developed by Pianta and his colleagues at the University of Virginia (Pianta, La Paro, & Hamre, 2008), designed to assess teacher-student interaction in four domains. The first domain is Emotional Support and focuses on positive classroom climate, teacher sensitivity, and regard for student perspective. The domain Classroom Organization focuses on behavior management, productivity, and instructional learning formats. The domain Instructional Support focuses on procedures and skills, content understanding, analysis and problem solving, and quality of feedback. The domain Student Outcomes focuses on student engagement. Researchers received training using the CLASS instrument and received a score of 80% or better on a reliability protocol.

During a CLASS observation, the researcher observes 20-minute segments of a lesson, making note of evidence related to each dimension. The next 10 minutes are spent assigning a score of 1 to 7 to each dimension. A low rating is indicated by a score of 1 or 2; a mid rating is indicated by a score of 3, 4, or 5; and a high rating is indicated by a score of 6 or 7. The

and be teaching math and/or reading in grades four through eight. (The subject matter and grade level restrictions are the result of the state of Ohio's implementation of the district and school accountability plan, which tests students' achievement in reading and math near the end of the school year in grades three through eight. Participants were sought for two components of the Novice Teacher Study: 1) teachers who would receive one observation and 2) teachers about whom case studies would be constructed.

Due to changes in personnel in the research team, very few single observation participants were recruited the initial year. However, 21 case study teachers were recruited in 2006-07. Permission from the first-year teacher's superintendent and principal was required before the first-year teacher were contacted. Once a potential teacher was identified, he or she was contacted by the case study office with an invitation to participate. Field researchers would follow up with a building visit, and if the teacher agreed to participate, he or she was given informed consent information sheet outlining the study and measures to ensure confidentiality and human subjects' protection. Before data collection began, teachers were asked to sign two consent forms, one for each component of the study (single observation and case study). During the next year of data collection (2007-08), 23 case study teachers participated, 15 of whom chose to participate a second year.

Recruitment for the single observation component of the study during the 2007-08 academic year was more productive than the previous year. The state of Ohio provided TQP with information about all first teachers by sending the list of teachers enrolled in the state mandated Entry Year Program, a mentoring and induction program. Permission from the first-year teacher's superintendent and principal was attained before the first-year teacher was contacted. Eighty-four first year teachers participated.

the data collected at the district level, the building level, and the building grade level has been accurately reported. However, given the complexities of today's instructional practices, where students transfer and are pulled out of the classrooms to receive individual instruction, state officials estimate the value-added ratings at the teacher level to be, at best, 40% accurate (Cohen, 2008). Nevertheless, we have collected data with which to answer these questions and will explain our assumptions throughout the paper. Currently we are using the Classroom Assessment Scoring System (CLASS), an instrument developed by Pianta and his colleagues at the University of Virginia (Pianta, La Paro, & Hamre, 2006), to distinguish between "high scoring" and "low scoring" teachers.

1. Do High Value-Adding Teachers (HVATs) have instructional practices that differ from other teachers along the value-added continuum?

2. Do HVATs have teacher knowledge that differs from other teachers along the value-added continuum?

3. Do HVATs have interactions with their students that differ from other teachers along the value-added continuum?

4. Have HVATs had teacher preparation program experiences that differ from other teachers along the value-added continuum?

Methodology

Recruitment

In order to be eligible for participation in the study, individuals must have graduated recently from an approved teacher education program in Ohio, be in their first year of teaching,

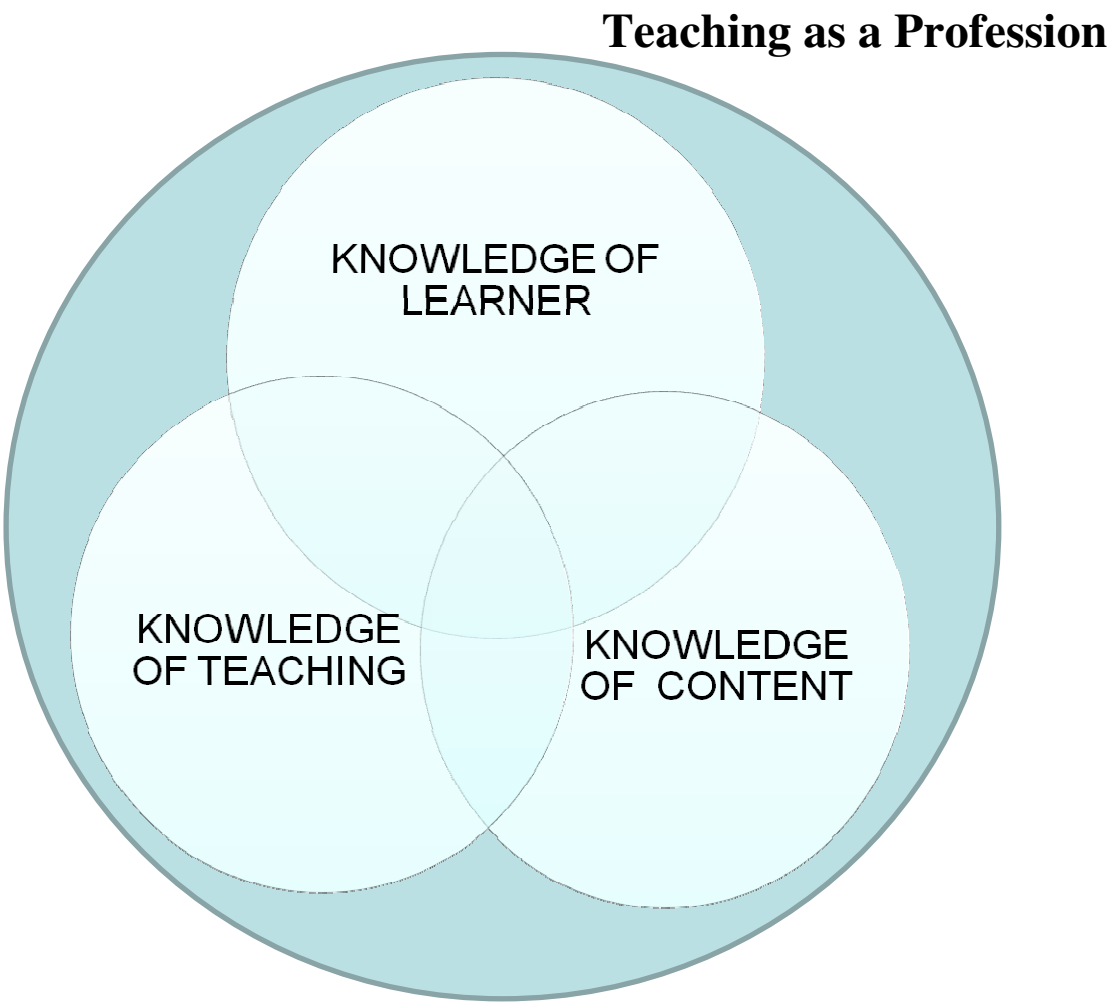

Figure 1. Conceptual Framework: Circles of Knowledge

Research Questions

This longitudinal, multi-faceted study was based on a single dependent variable: the value-added ratings at the individual, participating novice teacher level. To date, we have been unable to obtain the value-added ratings of individual teachers because the state of Ohio is not satisfied that the data collected at the teacher level is accurate. The state of Ohio is confident that

opportunities, building leadership and culture, and other factors. We agree that the three intersecting circles of teacher knowledge are Knowledge of Teaching, Knowledge of Learners, and Knowledge of Subject Matter. Perhaps not surprisingly, our novice teachers have defined the specifics of their knowledge in each realm somewhat differently than Darling-Hammond and Bransford have identified what should be contained in each realm. Our contribution to the conceptual framework is our finding that the most effective novice teachers work from the intersection of the three circles of knowledge. When our high performing teachers (criteria explained elsewhere) articulated their practice, knowledge about teaching, learners, and subject matter were so highly integrated that teasing the three categories apart would have been difficult. In contrast, novice teachers who possessed a lot of knowledge in only one or two areas were not high scoring and, we believe, less effective.

Conceptual framework

Circles of knowledge comprise our theoretical framework, so that increasing numbers of system elements can contribute to a richer understanding of the relationships among the characteristics, training, practices and professional learning contexts of teachers in relationship to teaching practice and student performance. At the core is the conception of the teaching profession from Darling-Hammond and Bransford's *Teachers For a Changing World: What Teachers Should Know and Be Able To Do* (2005). We selected this framework for a number of reasons. The framework is predicated on the work of the National Research Council *How People Learn: Brain, Mind, Experience, and School* (Bransford, Brown, & Cocking, 1999). The assumption that learning to teach is based on the same principles as all human learning, including school students, makes good sense. The model is grounded in seminal research over the last few decades. The model is simple, yet able to accommodate a wealth of information. Although all of us were familiar with the model and had used it in different circumstances, our formal adoption of the model arose from the analyses and organization of our data. Specifically our analysis of the qualitative data—interviews after observed lessons—aligned itself extremely well.

While Darling-Hammond and Bransford (2005) use the graphic to describe teacher education (see Figure 1), we used it to characterize the professional learning, the specific bodies of knowledge, and the teaching contexts of our individual novice teachers. For our purposes, the large encompassing circle represents the broader contexts that have influenced the novice teacher and his or her practice. These contexts include the teacher education program and institution from which he or she graduated and the school context in which the novice teacher is teaching, including students demographic and individual characteristics, professional development

The Relationships Among Teacher Preparation, Teacher Practice and Student Performance

Introduction

Improving teacher quality as a means of improving student achievement has been the agenda of educational reform efforts for the last fifty years. Research findings support this reform strategy inasmuch as it is widely agreed that teachers have a significant impact—if not the most significant—of all factors contributing to students' academic success (Cochran-Smith & Zeichner, 2005). The purpose of this paper is to present findings from an ongoing, statewide longitudinal study that examines the characteristics, training, and classroom practices of novice teachers in relationship to student performance. This research is a component of the Teacher Quality Partnership (TQP), a consortium of the 50 institutions of higher education that prepare teachers, the Ohio Department of Education, the Ohio Board of Regents, and other educational agencies in the state of Ohio. TQP was formed as a response to the Title II accountability measures required in the 1998 Reauthorization of the Higher Education Act. Ohio's education deans and department chairs wanted to be held accountable, and they wanted to be held accountable to standards that made a difference in the lives of children. Measures such as passing state licensing tests were known not to equate with effective classroom teaching. Therefore, the core mission of the collaborative was to determine what aspects of teacher education, if any, had an impact on teaching practices and student achievement. This paper reports the findings to date of the Novice Teacher Studies. There are two components of the Novice Teacher Studies: teachers who participated in case studies and teachers who were observed once and had a smaller amount of data collected about them.

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M. Suzanne Franco

Wright State University

Martha S. Hendricks

Wilmington College

Katie Kinnucan-Welsch

University of Dayton