DOCUMENT RESUME

ED 386 423 SP 036 171

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TITLE The Effect of the Relationship between Classroom Student Diversity and Teacher Capacity on Student Performance. Executive Summary. Conclusions and Recommendations for Educational Policy and Practice. The Strategic Management of the Classroom Learning Enterprise Research Series.

PUB DATE 95
NOTE 23p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academic Achievement; Classroom Research; Class Size; Cultural Differences; *Educational Policy; Elementary Education; Elementary School Teachers; Ethnicity; Expenditure per Student; *Instructional Effectiveness; Public Schools; Sex Role; Socioeconomic Status; *Teacher Effectiveness; *Teacher Qualifications; Teacher Salaries; Teaching Experience; Teaching Skills
IDENTIFIERS *Diversity (Student); Teacher Knowledge; *Texas

ABSTRACT

This study investigated the relationship between classroom student diversity (how students differ in their attributes, educational requirements, learning styles) and teacher capacity (skills, abilities, knowledge) to student performance in Texas public schools. Teacher ethnicity and gender, class size, and classroom per pupil expenditure were explored to determine what classroom student diversity/teacher capacity combinations could be suggested to maximize overall classroom student performance for kindergarten through sixth grade. Major findings include: (1) teacher certification and written competency exams for elementary certification do not predict teacher quality in the classroom; (2) no differences in classroom student performance exist between teachers with bachelors degrees and teachers with masters degrees; (3) teacher classroom experience is the most important source of teacher capacity; (4) 6 to 7 years of classroom experience are needed to fully develop the skills and knowledge of a teacher, and teachers peak in their classroom effectiveness after 18 to 19 years of teaching; (5) students are systematically assigned to classrooms based on a teacher's tenure, e.g., novice teachers get harder classroom student assignments while more experienced teachers receive easier assignments; (6) Hispanic and African American teachers are able to maximize student performance for classrooms where the teacher's ethnicity is dominant among the classroom student population; (7) a student's socioeconomic status continues to be a major determinant of student achievement; (8) no differences in student performance have been noted among limited English proficiency, English as a Second Language, and regular classrooms; (9) no differences in student performance have been noted between inclusion and non-inclusion classrooms; and (10) a class size of 13 is recommended to maximize gains in student performance; however to expand the use of a teacher's capacity without negative effect to gains in student performance, a class size of 22 is acceptable. Recommendations for educational policy and practices are included with each finding. (ND)

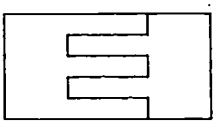
THE EFFECT OF THE RELATIONSHIP BETWEEN CLASSROOM STUDENT DIVERSITY AND TEACHER CAPACITY ON STUDENT PERFORMANCE©

Executive Summary

Conclusions and Recommendations
for Educational Policy and Practice

Spring 1995

Omar S. Lopez, Ph.D.
Educational Policy and Planning



The Strategic Management of the Classroom Learning Enterprise™
...Research Series

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Summary Highlights of the Major Findings

- Teacher certifications and teacher pencil/paper competency exams for *elementary certification* do not predict teacher quality in the classroom.

- *No* differences in classroom student performance exist between teachers with bachelors degrees and teachers with masters degrees.

- Teacher classroom experience is the *most* important source of teacher capacity in a student's learning production process.

- Six to seven years of classroom experience are needed to fully develop the skills and knowledge of a teacher; however, teachers *peak* in their ability to affect gains in student performance after 18 to 19 years of teaching, i.e., *there are limitations to how long a teacher can sustain his or her effectiveness in the classroom from year to year.*

- Students are being systematically assigned to classrooms based on a teacher's *tenure*: novice teachers get harder classroom student assignments (e.g., higher numbers of economic disadvantaged, Chapter 1, bilingual students) while more experienced teachers receive fewer, if any, of these students and more gifted students, i.e., easier classroom student assignments.

- Hispanic and African American teachers were able to maximize gains in student performance for classrooms where the teacher's *ethnicity* was dominant among the classroom student population.

- Although various student/teacher assignment strategies were found that maximize gains in student performance, a student's *social economic status* (SES) continues to be a major determinant of student achievement.

- Higher levels of district per pupil costs are associated with *lower* gains in student performance. In comparison, higher levels of classroom per pupil expenditure can result in *higher* gains in student performance; however, there exists an upper threshold with regards to this relationship: i.e., *there are limitations as to what money can buy for public school education.*

- A class size of 13 is recommended if the goal is to *maximize* gains in student performance; however, if the goal is to *expand* the use of a teacher's capacity (e.g., skills, knowledge) without negative effects to gains in student performance, then the current Texas class size policy of *22-to-1* is supported by the study.

Introduction

Teachers and schools in Texas are being called upon to meet the instructional and social needs of an increasingly diverse population of students. This heterogeneity of ability and culture stems from a variety of sources, including such factors as recent immigration trends in Texas, desegregation in public schools, and increased opportunities for low-income children.

Insights from the research on teaching diverse populations suggest that variable conditions and cultures of different groups will necessitate variable adaptations in the classroom in terms of motivational techniques, social organization, socio-linguistic conventions and cognitive organization patterns that are consistent with the cultural experience and expectations of the students (Tharpe, 1988). To accomplish these adaptations, administrators and teachers must be familiar with the cultural patterns and expectations of their students, a requirement with implications for teacher training (both in-service as well as pre-service), and for teacher selection and student assignment (Smith and O'Day, 1989).

The fact that no clear strategy exists for selecting teachers and assigning them to students suggested the need for an investigation of the consequences to student performance from assigning and grouping students with specific teachers. This study directly addressed this need. *In essence, the intent of the following policy and practice recommendations is to provide guidelines for systemic restructuring at the most fundamental level of an educational organization: the classroom.*

Overview of the Study

The subject of this study was the effect of the relationship between classroom student diversity and teacher capacity on student performance in Texas public schools. Classroom student diversity refers to the ways students differ in their *attributes, unique educational requirements,* and *modes of knowledge and skill acquisition.* A teacher's capacity refers to the *skills, abilities,* and *knowledge* derived from his or her training and experiences relevant to the classroom learning enterprise.

The research design for this study was based on the educational production function operationalized by the linear additive model in linear regression. Graphical analysis, descriptive statistics, the analysis of covariance (ANCOVA) procedure, and the least square means t test were also used to explore the following data.

- The dependent variable consisted of student performance data from the Norm-referenced Assessment Program of Texas (NAPT) for a group of almost *6,000 fourth grade classroom cohorts.*
- The independent variables included two groups of data. The first group consisted of student-level classification data from the Public Education Information Management System (PEIMS) at the Texas Education Agency (TEA), and represented sources of *classroom student diversity.*
- The second group of data consisted of information collected from TEA teacher license and certification records, from PEIMS Fall 1992 data on campus staff, and from state-mandated teacher competency exams, and represented *the fourth grade teacher's capacity* brought to the classroom.

Teacher ethnicity and gender were explored as intervening factors between classroom student diversity and student performance. Classroom contextual variables were also examined, including class size and classroom per pupil expenditure. Based on the findings from the data, the following section outlines recommendations for educational policy.

Teacher Certification

Analysis related to teacher certification for the fourth grade teacher cohort indicated the following:

- No differences in NAPT student performance exist between ExCET-certified teachers and non-certified teachers; i.e., *the ExCET exam was not an effective indicator of teacher quality in the classroom.*[1]
- Within their associated classroom contexts, *no differences in NAPT student performance were found between teachers certified or not certified* in the following areas: *bilingual/ESL, special education, and gifted; the secondary reading certificate was not relevant in hetero-ability classrooms.*
- The study revealed that the average teacher was assigned students from every special population, *even though he or she did not have the proper certifications to teach such students.*

Policy Recommendations

These findings demand that the practice of conferring a Texas life-time certificate for all or elementary grade-levels (kindergarten - sixth grade) be seriously examined. A *developmental* certification system that supports continual growth of the teacher's capacity throughout his or her career life span would be a more effective means of certifying teachers.

If ExCET teacher competency exams are a desired policy instrument for teacher certification, a *general practice, comprehensive* ExCET exam that includes sections on pedagogy, on the basic subjects taught in kindergarten through the sixth grade, as well as in areas associated with early childhood development and special populations (e.g., special education) would be more relevant.[2]

For beginning teachers who have not passed the general practice ExCET exam, the state should provide teaching permits for one year, renewable up to five years, based on recommendation from the site-based decision making team and the district. *Such teachers would be required to demonstrate progress toward certification on a semester-by-semester basis.*

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[1] ExCET: Examination for the Certification of Educators in Texas.

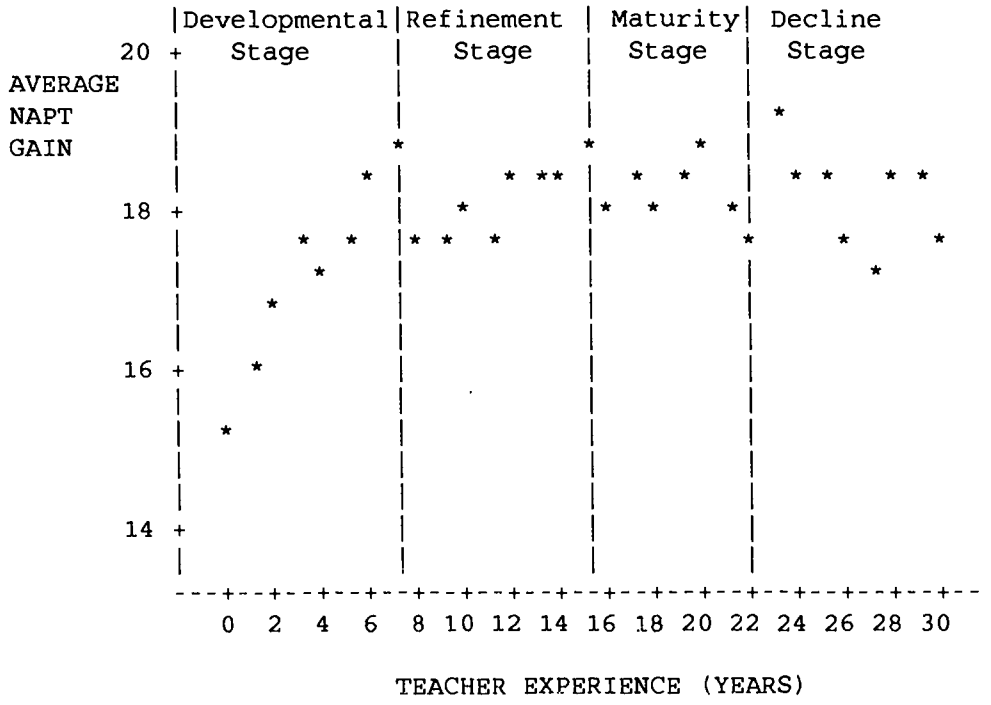
[2] The ExCET program could also serve as a means of holding teacher preparation programs (i.e., universities, alternative certification programs) accountable in training beginning teachers, but should not be used strictly for qualifying teachers as "competent" in the classroom – as the study showed, experience was the primary factor correlated to competency in the classroom.

Teacher Training and Development

The data indicated that no differences in classroom student performance exist between teachers with bachelors degrees and teachers with masters degrees. In comparison, Graph 1 shows the following relationships between teacher experience and average gains in NAPT student performance:

- Six to seven years of classroom experience are needed to fully develop the skills and knowledge of a teacher.
- Teachers *peak* in their ability to affect gains in student performance after 18 to 19 years of teaching; i.e., *there are limitations to how long a teacher can sustain his or her effectiveness in the classroom from year to year.*

Graph 1. Average NAPT Gain by Teacher Experience Stage (n=5997)



Furthermore, the study found that students are being systematically assigned to classrooms based on a teacher's *tenure*: novice teachers get harder classroom student assignments (e.g., higher numbers of economic disadvantaged, Chapter 1, bilingual students) while more experienced teachers receive fewer, if any, of these students and more gifted students, i.e., easier classroom student assignments. After controlling for these differences in assigned students, however, *differences in NAPT student performance persisted,* which suggests that there is no substitute for actual classroom experience.

Policy Recommendations

The findings strongly advocate a more equitable and rational financial incentive system – one that discourages such teacher-student assignment behavior among educational decision makers as described above. Such a pay system would be supported by a *teacher-student assignment scheme* that progressively and systematically assigns to novice teachers more difficult students as they progress through the Developmental Stage (0-7 years).

Special student population assignments could be accelerated for certified teachers, but *only* after they have had, for example, two or three years of classroom teaching experience.

Moreover, class size restrictions would apply: a *13-to-1 student/teacher ratio* for teachers with five or less years of experience and a *22-to-1 student/teacher ratio* for those with more than five years of experience.

Training programs should be provided: (a) to reduce the amount of time needed to create a proficient, capacitated teacher[3]; and (b) to extend the maximum potential to affect gains in student achievement.

These findings also state unequivocally that teacher preparation programs (undergraduate and graduate level) that are more *field-based* (experiential) would be more effective in preparing a teacher for the classroom than programs that are based primarily on textbook/classroom lecture and/or a limited teaching internship.

[3] Such efforts might consist of a program where young people can begin supervised student-teaching as a high school senior or entering college freshman; student-teaching would continue through the entire four years of college.

Teacher Background

Hispanic and African American teachers were able to maximize gains in NAPT student performance in classrooms where *the teacher's ethnicity was dominant among the classroom student population*. By gender, female teachers produced *higher gains in NAPT student performance* than male teachers.

Policy Recommendations

These findings clearly demand that *proactive, more effective* efforts should be directed at recruiting and retaining minority teachers.

An ExCET assessment program that provides *open registration* to any individual interested in taking a qualifying exam would support the minority recruitment effort, i.e., *the ExCET program should not be used as a gatekeeper in the process of qualifying new teachers for the classroom.*

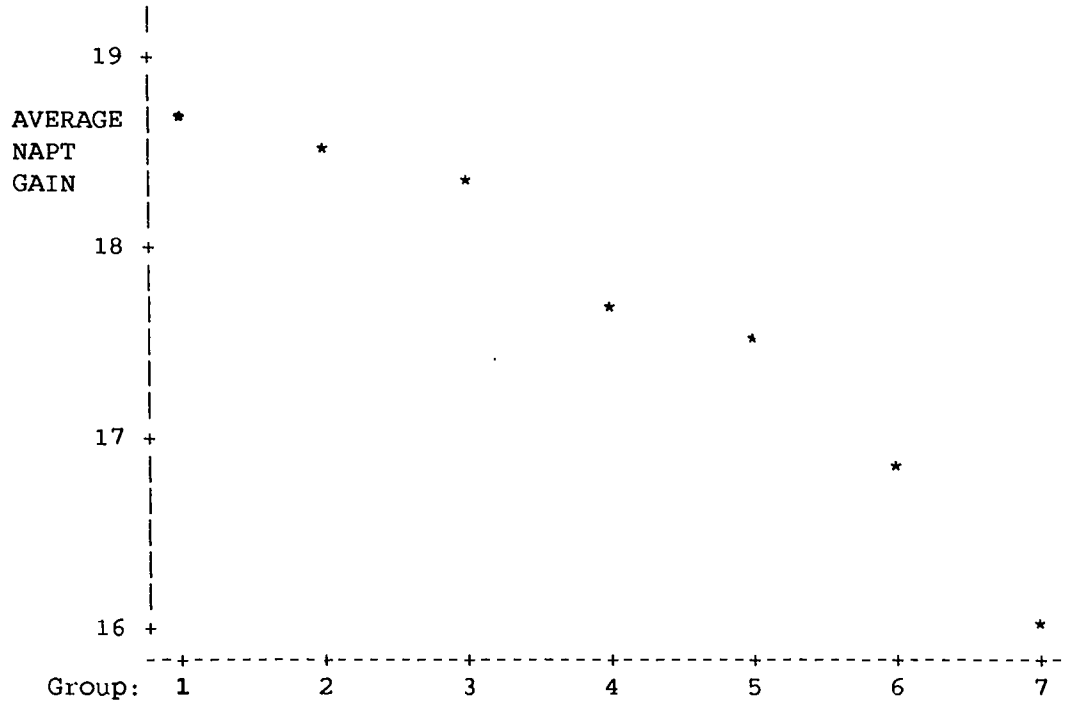
Training should be provided to increase a teacher's capacity: (a) to create a more effective, nurturing learning environment, regardless of their gender, and (b) to address the learning needs of minority children.[4]

[4] Such programs would include multi-cultural education.

Educational Costs and Expenditure

The data on educational costs demonstrated a distinct linear and *negative* relationship between average gains in NAPT student performance and District Maintenance and Operational (M&O) Per Pupil Costs; the *optimal* per pupil costs level was between $93 and $2075 (see Graph 2 below).[5]

Graph 2. Average NAPT Gain
by District Maintenance & Operational (M&O)
Per Pupil Costs Group

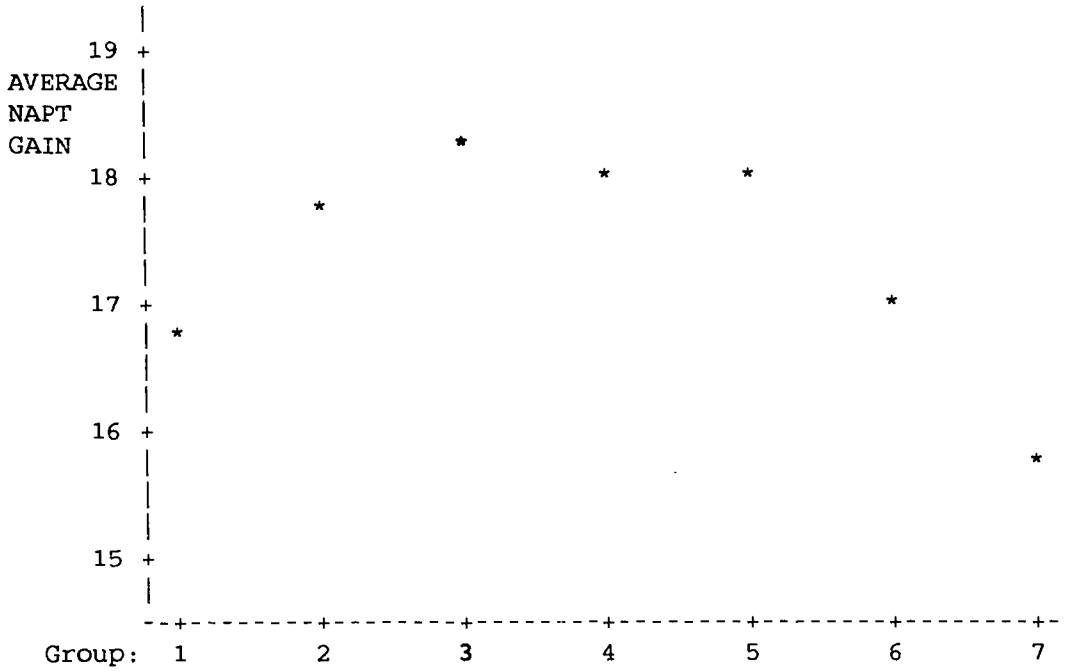


DISTRICT M&O PER PUPIL COSTS GROUP	RANGE	N	MEAN	(SD)	AVERAGE NAPT GAIN
1	**$93 - $2075**	757	$1769	($304)	**18.63**
2	$2076 - $2325	794	$2209	($73)	18.52
3	$2326 - $2575	1036	$2456	($72)	18.27
4	$2576 - $2825	1130	$2701	($73)	17.68
5	$2826 - $3075	927	$2944	($70)	17.49
6	$3076 - $3325	587	$3188	($69)	16.88
7	$3326 - $9298	766	$3823	($706)	16.08

[5] District M&O Per Pupil Costs are equal to District Total Per Pupil Expenditure (excludes long-term debt service) minus the Classroom Per Pupil Expenditure (teacher's total salary divided by class size).

In comparison, the data on Classroom Per Pupil Expenditure (PPE) shows a *nonlinear* relationship between classroom-level expenditure and gains in NAPT student performance; the *optimal* per pupil expenditure level was between $1376 and $1625 per pupil (see Graph 3 below).[6]

Graph 3. Average NAPT Gain
by Classroom Per Pupil Expenditure (PPE) Group



CLASSROOM PPE GROUP

CLASSROOM PPE GROUP	RANGE	N	MEAN	(SD)	AVERAGE NAPT GAIN
1	$286 - $1125	818	$1023	($83)	16.83
2	$1126 - $1375	1814	$1252	($71)	17.79
3	**$1376 - $1625**	1593	$1492	($72)	**18.14**
4	$1626 - $1875	1004	$1738	($70)	17.92
5	$1876 - $2125	41[illegible]	$1980	($72)	17.93
6	$2126 - $2375	178	$2225	($68)	16.88
7	$2376 - $4750	172	$2752	($404)	15.83

[6] Classroom PPE is the teacher's total salary divided by class size.

Policy Recommendations

The teacher salary system should be redesigned with a stronger emphasis on pay based more on strategic areas of the classroom learning enterprise, like class size and type of students (e.g., gifted, bilingual). For example, Table 1 below illustrates a range of teacher salary steps based on class size and classroom per pupil expenditure.

Part of the teacher's pay could be tied to *absolute* gains in student performance for *each* student – the primary area of accountability among the teacher, the parent, and the student. Provisions would need to be built into such a system, however, for student/parent factors outside the control of the teacher, e.g., teenage pregnancy, student mobility, family economic status. *Standards of achievement would be used only to determine remedial strategies for each individual student, as well as for future assignments to teachers.*

Campus school administrators should use the findings on Classroom Per Pupil Expenditure (PPE) as guidelines for *regulating* elementary classroom student assignments: i.e., *by increasing or decreasing class size relative to the teacher's total salary until the suggested optimal Classroom PPE range is reached.*

Districts should strive to *reduce* maintenance and operational per pupil costs, e.g., *by centralizing non-classroom related district functions at the regional Educational Service Centers (ESC).*

Table 1. Teacher Salary Step Scheme
Based on Class Size and Classroom Per Pupil Expenditure (PPE)

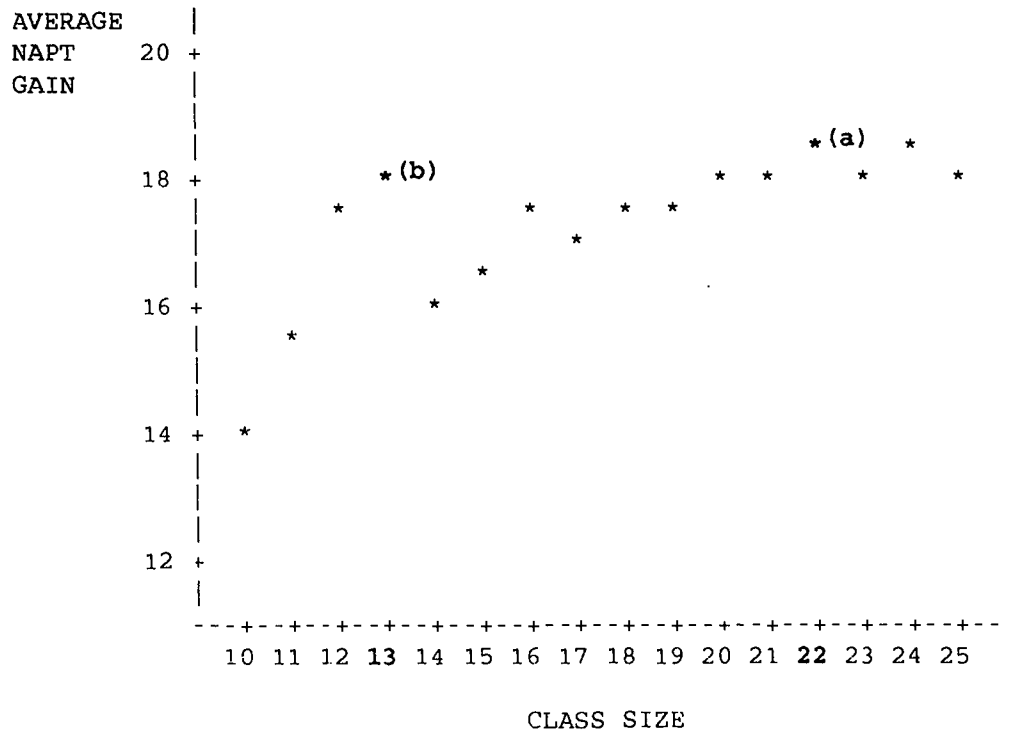
CLASS SIZE	CLASSROOM PPE[a] LOW	CLASSROOM PPE[a] HIGH	TEACHER SALARY STEPS[b] LOW	TEACHER SALARY STEPS[b] HIGH
13	$1,376	$1,400	$17,888	$18,200
14	$1,401	$1,425	$19,614	$19,950
15	$1,426	$1,450	$21,390	$21,750
16	$1,451	$1,475	$23,216	$23,600
17	$1,476	$1,500	$25,092	$25,500
18	$1,501	$1,525	$27,018	$27,450
19	$1,526	$1,550	$28,994	$29,450
20	$1,551	$1,575	$31,020	$31,500
21	$1,576	$1,600	$33,096	$33,600
22	$1,601	$1,625	$35,222	$35,750

[a]Classroom PPE is the optimal range identified ($1,376 - $1,625) divided into $25 increments.
[b]Defined as Class Size times Classroom PPE (low and high, respectively).

Class Size

The data on class size provided two major findings, as illustrated below in Graph 4. If the goal is to expand the use of a teacher's capacity (e.g., skills, knowledge) without negative effects to student performance, then the current Texas class size policy of *22-to-1* is supported by the study (point a). In comparison, other statistical analysis showed that, if the singular, primary goal is to *maximize* gains in student performance, then the optimal class size is *13 students per classroom* (point b).

Graph 4. Average NAPT Gain by Class Size



Policy Recommendations

These findings strongly suggest that for elementary grade-levels (kindergarten - sixth grade), *class size should be limited to 13 students*; only if the teacher has six or more years of experience should class size be increased to *22 students*.[7]

The school's site-based decision making team should have the authority to implement and monitor the 13/22-to-1 policy on a classroom-by-classroom basis.[8]

[7] Graphical analysis suggested that teachers do not fully develop their capacity to teach until after six to seven years of classroom teaching experience; therefore, larger class sizes should be reserved for teachers with more experience.

[8] Only if the school's site-based decision making team is to be held accountable for class size management would they have such authority.

Recommendations for Education Practice

This study examined the effect of the relationship between various sources of classroom student diversity and teacher capacity on student performance to determine what classroom student diversity/teacher capacity (ethnicity, gender) combinations could be suggested to maximize overall classroom student performance.[9] As such, these combinations represent *classroom diversification strategies* for kindergarten through the sixth grade.[10]

The organization of this section is as follows. For each area of analysis, the conclusions of the findings are summarized, followed by two types of recommendations for educational practice.

- From the perspective of the classroom's student diversity: Given a classroom's student diversity, what type of teacher capacity (ethnicity, gender) can be assigned to the classroom *to maximize student performance?*
- From the perspective of teacher capacity utilization: What classroom student diversity provides an opportunity to best use a teacher's capacity (ethnicity, gender), as defined by *the greatest gains in NAPT student performance?*

[9] Classroom student diversity refers to the ways students differ in their *attributes, unique educational requirements,* and *modes of knowledge and skill acquisition.* A teacher's capacity refers to the *skills, abilities,* and *knowledge* derived from his or her training and experiences relevant to the classroom learning enterprise.

[10] Although the study focused on fourth grade classrooms, the strategies can be extended to teacher/student assignments in kindergarten through the sixth grade – as supported by the similarity of the sample data to the Texas teacher and student population.

Student Ethnicity/Teacher Ethnicity

The data demonstrated clear and distinct differences in student performance by teacher and student ethnicity. For example, Hispanic and African American teachers were able to maximize gains in NAPT student performance for classrooms where the teacher's *ethnicity* was dominant among the classroom student population. Significant findings were also found for dominant White classrooms and multi-ethnic classes.

Practice Recommendations

In elementary classrooms whose dominant student ethnicity is Hispanic (≥ 51%), *the assignment of a Hispanic teacher would be advisable.*

Likewise, in elementary classrooms whose dominant student ethnicity is African American (≥ 51%), *the assignment of an African American teacher would be most prudent* with regards to maximizing gains in student achievement.

For elementary classrooms whose dominant student ethnicity is White (≥ 51%), assigning either a Hispanic or White teacher will maximize gains in student performance.

In comparison, *if* the elementary classroom student population is multi-ethnic (each dominant student ethnic group is represented but ≤ 50%), a teacher from any of the major ethnic groups could be assigned; i.e., all provide similar gains in student performance.

For all three teacher ethnic groups, teachers derive the best use of their capacity in elementary classrooms where the dominant student ethnic group is White (≥ 51%).

Student Gender/Teacher Gender

After controlling for classroom student diversity and teacher experience, the research revealed that:

- Female teachers were able to produce higher gains in NAPT student performance than male teachers.
- For female teachers, *no differences in student performance* were noted among classrooms that had either more girls or more boys or a balanced number from both genders.
- Male teachers did best in classrooms that had either a dominance of girls or a dominance of boys than in classrooms that had a balanced number from both genders.

Practice Recommendations

Although male teachers achieve similar levels of gains in student performance as female teachers, *male teachers would be most effective in elementary classrooms where one or the other student gender groups is dominant* (≥ 55%).

Student Ability/Teacher Capacity

Analysis on student ability and teacher capacity revealed the following:

- Heterogeneous ability-grouped classrooms produced a significantly *higher* level of gains in NAPT student performance than dominant Chapter 1 classrooms or dominant regular classrooms, but a *lower* level than dominant gifted classrooms.
- In classrooms that had a significant number of Chapter 1 students, teachers certified in *secondary reading* produced a higher level of gains in NAPT student performance than teachers not certified in this area. In comparison, such certification did not make any difference in classrooms that exhibited heterogeneous ability grouping.
- Moreover, there were no differences in affecting student performance between teachers certified and not certified in gifted education for classrooms with this student population.

Practice Recommendations

If the elementary classroom student population is dominant Chapter 1 ($\geq 51\%$), *assigning a teacher with a secondary reading certificate is a viable strategy for maximizing gains in student performance.* On the other hand, such teacher capacity provides no advantage in classrooms where student ability is heterogeneous.

In gifted elementary classrooms a teacher's gifted endorsement should not be a factor regarding teacher/student assignments: *such certification provides no indication of teacher capacity (quality) in these classrooms.*

Teachers derive the best use of their capacity in elementary classrooms where the student population is gifted.

Student Mobility (Migrant)/Teacher Capacity

The data showed that non-migrant classrooms had *lower* gains in NAPT student performance than migrant classrooms. Post-analysis of the data suggests that migrant students are being assigned to smaller classes than non-migrant students. Since higher gains in student achievement are associated with smaller classes, higher gains in NAPT student performance should be expected for migrant classrooms. *On the other hand, a teacher's level of classroom experience can also make a significant difference with regards to student achievement.*

Practice Recommendations

The data demonstrated that teachers with *16 to 30 years of classroom teaching experience* were more effective in serving migrant students: gains in NAPT student performance were maximized by these teachers.[11] Therefore, the assignment of migrant students to teachers with *less than fifteen years of classroom experience* should be avoided.

Given the smaller class size, teachers derive the best use of their capacity in migrant classrooms rather than in non-migrant classrooms.

[11] The 16 to 30 years of classroom teaching experience corresponds to the Maturity Stage (16-22 years) and the Decline Stage (23-30 years) of teacher experience (see Graph 1).

Student Social Economic Status (SES)/Teacher Capacity

The data clearly indicated that low SES classrooms had significantly *lower* gains in NAPT student performance than non-low SES classrooms. Essentially, a student's *social economic status* continues to be a major determinant of student achievement; however, a teacher's level of classroom experience can make a significant difference with regards to student achievement.

Practice Recommendations

Teachers with 8 *to 30 years of classroom teaching experience* provide the most significant gains in student performance.[12] Therefore, the assignment of low SES students to teachers with *less than seven years of classroom experience* should be avoided.

Maximum gains in student performance are achieved in *classrooms of 13 students*. Consequently, *class size* should also be considered when assigning low SES students to teachers for elementary grade-levels (kindergarten - sixth grade).

Teachers derive the best use of their capacity in classrooms that have few low SES students.

[12] The 8 to 30 years of classroom experience corresponds to the Refinement Stage (8-15 years), Maturity Stage (16-22 years), and the Decline Stage (23-30 years) of teacher experience (see Graph 1).

Student Language Proficiency/Teacher Capacity

No differences in student performance were noted among Limited English Proficiency (LEP) classrooms, English as a Secondary Language (ESL) classrooms, and non-LEP/ESL classrooms. Moreover, within their associated classroom contexts, *no differences in NAPT student performance were found between teachers certified or not certified in bilingual (LEP) and/or ESL education.* On the other hand, the data clearly demonstrated that *Hispanic teachers* were able to achieve *higher gains in NAPT student performance* than either White or African American teachers in *dominant Hispanic classrooms*.

Practice Recommendations

A teacher's *ethnicity,* in combination with *language skill capability,* should be considered as more viable factors when assigning LEP students to classrooms – *rather than teacher certification.*

Teachers derive the best use of their capacity as effectively in non-LEP/ESL classrooms as in LEP or ESL classrooms.

Special Education Inclusion/Teacher Capacity

No differences in student performance were noted among non-inclusion classrooms and special education inclusion classrooms. Moreover, within inclusion classrooms, *no differences in NAPT student performance were found between teachers certified or not certified in special education.*

Practice Recommendations

Educators and parents should be less anxious about the inclusion of special education students in regular classrooms; *however*, this does not imply that current support structures for special education should be reduced or eliminated.

Moreover, less concern should be placed on teacher certification and more on *the teacher's years of experience, the make-up of the students in the class, as well as class size.* These factors and their interaction play a more significant role in effecting gains in student performance and should be considered in teacher/student assignments.

Teachers derive the best use of their capacity as effectively in non-inclusion classrooms as in inclusion classrooms.

Final Insight

In light of this study, the following insight is advanced. When educational professionals assign a student to a particular classroom, they are making a strategic decision whose consequences may alter the fundamental nature of the learning environment, and may involve a substantial redeployment of resources and a redirection of human energy. In this regard, the summation of these strategic decisions can be defined as a classroom diversification strategy; however, *classroom diversification is neither a goal nor a plan.* Ideally, each student assignment decision should take into consideration such issues as:

- Class size.
- The teacher's training, experience, and background.
- The student's attributes, unique educational requirements, and modes of knowledge and skill acquisition.
- The diversity of the student population within that classroom.

Consequently, while there is no single strategy of classroom diversification, the study clearly demonstrates that some strategies work more effectively than others in effecting student achievement.

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