ABSTRACT

Title of Thesis: AN INVESTIGATION OF THE EFFECT OF INSTRUCTIONAL CONSULTATION TEAMS ON SPECIAL EDUCATION PLACEMENT RATE

Daniel Seth Newman, Master of Arts, 2007

Thesis directed by: Professor Sylvia Rosenfield, School Psychology Program

The main goal of Instructional Consultation Teams (IC Teams) is to promote and sustain student academic success within a general education environment. Research suggests that the implementation of IC Teams is followed by decreased referrals for special education and decreased overrepresentation of minority students in special education. Yet only a limited research supports these suggestions. In the current study, special education placement rates for 46 treatment schools and 46 matched comparison schools are analyzed in a multiply replicated interrupted time series design. This provides a powerful basis for examining the effect of IC Teams by limiting threats to internal validity, thereby increasing certainty about causality. A HLM statistical analysis of the data suggests that the implementation of IC Teams is not significantly effective in reducing special education placement rates. Statistical and visual analyses suggest that IC Teams may have a differential effect with schools with different socioeconomic standings.

AN INVESTIGATION OF THE EFFECT OF INSTRUCTIONAL CONSULTATION TEAMS ON SPECIAL EDUCATION PLACEMENT RATE

by

Daniel Seth Newman

Thesis submitted to the Faculty of the Graduate School of the

University of Maryland, College Park in partial fulfillment

of the requirements for the degree of

Master of Arts

2007

Advisory Committee:

Professor Sylvia Rosenfield, Chair
Professor Gary Gottfredson
Dr. Todd Gravois, Research Associate

Acknowledgments

I would like to thank the members of my advisory committee, Sylvia Rosenfield, Gary Gottfredson, and Todd Gravois. Without their continuous wisdom and guidance, this project could not have been completed. I would also like to thank Jared Kotler, Allison Nebbergall, Joseph Nese, and my cousin, Gregory Goldsmith, all of whom provided me with critical assistance on my research design and methods. Lastly, I want to recognize my fiancée, Yael Kolett, who provided the support and emotional light to help me reach the finish line.

Correspondence concerning this manuscript may be addressed to Daniel Seth Newman, 3214 Benjamin Building, University of Maryland- College Park, College Park, MD 20742. Email: dsnewman@umd.edu.

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Chapter 1: Introduction

Consultation is generally recognized as an important element in the repertoire of a school psychologist (Ysseldyke et al., 2006). School consultation is defined by Zins and Erchul (2002) as:

> a method of providing preventively oriented psychological and educational services in which consultants and consultees form cooperative partnerships and engage in a reciprocal, systematic problem-solving process guided by ecobehavioral principles. The goal is to enhance and empower consultee systems, thereby promoting students' well-being and performances. (p. 626).

Nearly three fourths of consultation research studies from 1985 to 1995 showed some positive outcomes (Sheridan, Welch, & Orme, 1996). Although there are a variety of different consultation models, Rosenfield (1987) developed a model of instructional consultation (IC) which bridges collaborative and behavioral consultation with instructional psychology.

The Instructional Consultation Teams (IC Teams) model is a service delivery system based on the tenets of instructional consultation (Rosenfield & Gravois, 1996). As is true with other prereferral intervention teams, the specific research base in support of IC Teams is sparse and has methodological limitations. In short, the purpose of the current study is to investigate the effect of the implementation of IC Teams on the rate of student placement in special education.

IC Teams and Special Education Referrals

Although special education has no doubt resulted in educational benefits for many children over time, the special education system is not immune to criticism. Kavale and

Forness (1999) reported that since the establishment of Public Law 94-142 in 1975 (IDEA), special education has been disparaged due to its skyrocketing costs and ineffectiveness, and it has sometimes even been called immoral. Kavale and Forness (1999) call into question the effectiveness of practices that are most common in special education such as perceptual-motor training, modality instruction, and social skills training due to low to modest effect sizes found in meta-analyses of research on these interventions (.08, .14, and .20, respectively). Further, it seems that these practices have great variability in their effects (Kavale & Forness, 1999).

Kalyanpur and Harry (1999) discussed the original establishment of the special education system amidst the conflicting goals of increased diversity in schools and a growing drive for technical homogenization of students. They stated that there is a lack of attention to context, and too much subjective judgment is used in special education placement. Special education placement can also often be stigmatizing for the student, and result in long term (sometimes lifetime) labeling (Kalyanpur & Harry, 1999). Limiting the number of inappropriate referrals to special education has been one of the primary objectives of IC Teams (Gravois & Rosenfield, 2002).

Another concern within the special education system has been the historic disproportionally large number of minority student referrals to special education. Data show that "students from culturally and linguistically diverse backgrounds and of low-income status tend to end up in special education [in high incidence categories] more than any other group of students" (Kalyanpur & Harry, 1999, p. 57). The effects of labeling, segregation resulting from placement, and the potential ineffectiveness of special

education are potential reasons why disproportionate representation is so widely criticized (Hosp & Reschly, 2003).

Several reasons have been suggested for disproportionate placement of minority children in special education including cultural variables, bias in assessments, overrepresentation of African American students in categories such as mentally retarded and emotionally disturbed, and co-occurrence with poverty (Hosp & Reschly, 2003). Gravois and Rosenfield (2006) argued that ineffective pre-referral instruction and intervention practices may also result in the overrepresentation of minorities to special education.

Research critical of special education began to appear as early as the late 1970s. Soon after the passage of the landmark special education law 94-142 (the Education for All Handicapped Children Act of 1975), researchers found high numbers of students referred to special education, services not being implemented in a timely manner, and general educators' frustrations with not having appropriate training or support (Safran & Safran, 1996).

The rationale for early criticisms of the implementation of the special education law contrasted with the intentions of PL 94-142, which specified the provision of a free and appropriate education for all students within the least restrictive environment (LRE), to the maximum extent possible. As a result, there was a movement which advocated for students to be taught in general rather than special education classrooms. Accordingly, several preferral intervention team (PIT) models were developed during the 1980's (Burns & Symington, 2002; Sindelar, Griffin, Smith, and Watanabe, 1992). Some of the PIT models that were introduced included Mainstream Assistance Teams (Fuchs, Fuchs,

& Bahr, 1990), Prereferral Intervention Teams (Graden, Casey, & Bonstrom, 1985), and Instructional Support Teams (Kovaleski, Tucker, & Duffy, 1995), as well as IC Teams (Rosenfield & Gravois, 1996), all with the goal of reducing inappropriate special education referrals.

Safran and Safran (1996) distinguished between the historical bases of Teacher Assistance Teams, which stress "collaborative problem solving, general education teacher ownership and immediate classroom assistance" (p. 363), versus prereferral intervention programs (such as those mentioned above) that use a more formal, data-based process to establish prereferral as a distinct step in the special education process. Teacher Assistance Teams and consultative versions of prereferral intervention teams share the common goals of assisting teachers in developing effective interventions in working with students who are having difficulty, and preventing inappropriate referrals of students to special education (Sindelar et al., 1992).

Research on IC Teams

Gravois and Rosenfield (2002, 2006) have reported reductions in both the special education referral rate in schools as well as in minority overrepresentation in special education in schools that implement IC Teams. Nevertheless, the research that is currently available in support of instructional consultation and IC Teams is limited in quantity and has methodological flaws. These limitations are not unique. There is little research on most prereferral intervention teams, and the research that does exist is often conflicting in its findings (Burns & Symington, 2002; Sindelar et al., 1992). Given the large number of schools, teachers, and students that are influenced by the implementation

of IC Teams, it is useful to look closely and critically at the data that are currently available.

Gravois and Rosenfield (2002) presented a framework for evaluating IC Teams and offered three separate studies in which decreased referral rates for special education and decreased disproportion in minority student referrals were reported as a result of the implementation of IC Teams. The authors based these studies on the conceptual model of consistency, one of Reynolds' (1998) six criteria for understanding and verifying causality in studies about program effects, according to his argument for confirmatory program evaluation (CPE).

In concordance with CPE, Gravois and Rosenfield (2002) suggested that the consistent results of their studies (the reduction of special education evaluations and placements), which utilize a variety of methodologies conducted in different schools and populations, with different implementations, supports a causal inference of the effect of IC Teams. However, the studies by Gravois and Rosenfield (2002) also share consistent methodololigical flaws (outlined below) which make drawing conclusive inferences problematic. The sum of several studies with the same methodolical limitations does not result in conclusive inferences about causality.

In the first study, 14 schools that volunteered to implement IC Teams are considered in a pre-post design, and decreases in placement in special education were reported. One data point was used as a pre-measure (i.e. the percentage of students placed in special education during one school year) and one point as a post-measure (i.e. the percentage of students placed in special education during the following year).

Because the research did not establish a stable baseline of multiple points prior to treatment, and because only one point following treatment was considered, threats to internal validity can make drawing conclusions from this study problematic. For example, it is possible that with the implementation of IC Teams, there is an immediate decrease in referral rate which may actually reflect a delay of referral to (and eventual placement in) special education. Perhaps a student who is referred to IC Teams will still end up referred to special education in the second year of implementation. Additionally, from a larger system perspective, although the number of referrals for testing might decrease one year after implementation, a change in the attitudes or culture of the school and its personnel is not necessarily reflected. Without more than one year of post implementation data available, these possibilities cannot be convincingly refuted.

Internal validity threats that are prevalent in longitudinal designs such as history, maturation, and regression are flaws in the first study reported by Gravois and Rosenfield (2002). Selection is also a potential threat to validity because certain schools voluntarily requested treatment; the differences between such schools and those not in the sample may play a part in the resulting findings. When a consistent baseline is not established prior to the intervention, any change that results after the intervention can be called into question because of these threats. Furthermore, the data in this study are taken as an aggregate in which all of the schools referrals are added up for the 1993-1994 year (pre-intervention), and then for the 1994-1995 year (post-intervention). This does not allow for the distinction of treatment effects between schools. For example, despite the overall pre-post difference that was reported, it is not clear if one school had a tremendous effect from the treatment, and the other nine schools were unaffected. With a small number of

schools influencing the aggregate, it would be helpful for individual effects to be distinguished in some manner, or for appropriate statistical tests to be applied.

In the second study reported by Gravois and Rosenfield (2002), a similar design was used to examine 13 voluntary treatment schools and 20 comparison schools, and the authors again found a reduction in the special education referral rate (operationalized as "percent of student population identified as special education,") (p.22). Threats to internal validity in the second study are similar to those mentioned above, with selection as perhaps the strongest. In terms of selection, the treatment schools are again voluntary. Although it is not clear from the description of the study in Gravois and Rosenfield (2002), the selection threat might be confounded if the comparison sites had a choice of whether or not to implement instructional consultation, and decided the latter. Longitudinal based threats such as history, maturation and regression apply to this study in the same manner as in the first study.

Furthermore, the manner in which the data are graphed by Gravois and Rosenfield (2002) makes it difficult to draw clear conclusions. Data are reported by averages of treatment versus comparison schools; this makes it impossible to parse out the specific effects of treatment per school. Although it is important to consider the aggregate effect across schools, more clarification on specific school effects would be helpful considering the small number of schools. Data are also graphed on the abscissa by year although the treatment took place in different schools in different years. This makes it difficult for the reader to clearly compare the pre-intervention versus post-intervention schools, and understand the difference which may have occurred following treatment.

In the third study reported on in Gravois and Rosenfield (2002), the patterns of student referrals to special education in IC Teams versus other teams within the same school are compared over 20 different schools. This comparison showed that fewer IC Team cases than other team cases were referred to or placed in special education. Again, internal validity threats put the conclusions of this study into question. First, selection bias should be considered as a large problem. As will be discussed later in this paper in a review of the IC Teams process, teachers must take an active role in seeking out and referring a student to the team (especially if the IC Team is not the only team in the building). Therefore, those teachers who chose to refer to the IC Team may be more likely than those who referred to another team to work on successfully implementing an intervention. In the third study, Rosenfield and Gravois (2002) also concluded that significantly fewer African-American student cases were referred and placed in special education with the IC Teams model, although this inference is subject to the same internal validity threats as the other inferences reported in these three studies.

In another study by Gravois and Rosenfield (2006), the authors continued the investigation into the effect of IC Teams on the referral of minority students to special education. Thirteen IC Team schools and nine comparison schools were considered using risk indexes, odds ratios, and composition indexes over the course of one baseline year and two years of IC Teams implementation. Gravois and Rosenfield (2006) concluded that IC Teams decreased the risk and odds of placement in special education for minority students. As in the previous studies, the data in this study are less conclusive than might be the case if more pre and post intervention points were utilized. Internal validity threats of history, regression and selection are all obstacles to causal inferences

A strength of the data reported by Gravois and Rosenfield (2006) is that disproportionate placement of minorities in special education is reported in terms of risk indexes, odds ratios, and composition indexes. The authors claim that reporting the data in this way allows for a clearer picture of the impact of instructional consultation on disproportionate special education placement (Gravois & Rosenfield, 2006). It should be noted that the odds ratio is calculated in this article by dividing the risk index of one group with the risk index of another. A different, generally accepted means of calculating an odds ratio is to look at the probability of being placed in special education divided by one minus the probability of being placed in special education. This can be considered for minority and non-minority students in lieu of the comparison of proportions or percentages.

Statement of the Problem

Given the internal validity threats to the research suggesting effects of IC Teams on special education referrals, the current study will consider the effect of IC Teams on special education rate using archived data and a replicated interrupted time-series design with nonequivalent comparison schools. Shadish, Cook and Campbell (2002) indicate that interrupted time-series design is "one of the most effective and powerful of all quasi-experimental designs" when enhanced with certain features (p. 171). Such features are currently not present in the pre-post research conducted by Gravois and Rosenfield (2002, 2006).

One design feature that will enhance the current study is the addition of matched comparison schools to the design. This helps cope with the threats of history and selection bias. A second feature that improves a quasi-experimental time series design is

an increased number of pre and post treatment data points. Pre-intervention points allow for the clarification of any trends that are present prior to the intervention implementation and help further examine the threats of history and maturation. Post-intervention points help account for threats from regression. Moreover, they allow for one to see the changes that take place over time. This is especially relevant for the IC Teams process which is believed to be influenced by the change in school culture over a multiple year timeframe (Rosenfield & Gravois, 1996).

The data in the current study will be graphed in a way in which the effects of treatment are more evident. To do this, the data can be graphed by number of years prior to intervention and number of years post intervention, as opposed to by calendar year. Although an aggregate effect will be graphed, the number of schools influencing the effect at a given point in time will be clarified for the reader.

Research Questions

1) Does the implementation of IC Teams result in a decreased placement rate in special education?
2) If IC Teams' implementation does have effects, is there a time lag through which it operates?

Chapter 2: Method

The present study focuses on evaluating the effectiveness of IC Teams, a prereferral intervention process which was developed based on the underlying principles of IC. IC is a stage-based problem-solving process in which a consultant works with a teacher to intervene on academic or behavioral problems within a classroom. During this process, the student, particularly focusing on his or her prior knowledge base, is viewed as part of a larger instructional system that also includes a given task that is presented to the child, and a particular treatment (instructional strategies employed by the teacher) (Rosenfield, 1987). By considering these three aspects of the instructional system, assumptions about a learning deficit as being located within the student are replaced with a goal of facilitating an instructional match between the student's prior knowledge, the classroom task, and the instruction. The consultant works with the classroom teacher to address these three parts of the so called instructional triangle in order to provide an effective intervention (Gravois & Rosenfield, 2002).

The instructional consultation process is distinguished by three components: stress on utilizing effective communication skills to establish the relationship, engagement in effective problem solving, and instructional assessment and intervention (Rosenfield, 2002). The problem solving stages of instructional consultation include entry and contracting, problem identification and analysis, intervention planning, intervention implementation, and termination (Rosenfield, 1987; Rosenfield, 2002). Rosenfield (1987, 2002) provides a comprehensive description of each stage.

Over the past two decades, IC Teams have been implemented in more than 150 schools, more than 40 districts and 7 states. The core characteristics include a school

based multidisciplinary team, an instructional consultation based problem-solving process, and a process evaluation to promote treatment integrity and examine outcomes (Gravois & Rosenfield, 2002). An IC Team facilitator is trained in the instructional consultation process and prepares to lead a team of several school personnel, which may include administrators, general and special educators, the school psychologist, guidance counselor, nurse, pupil personnel worker, and others.

The process of implementing IC teams in the schools is thought to result in a change to the school culture, and takes some time, from three to five years, to reach full implementation (Rosenfield & Gravois, 1996). Once the model is implemented, the team meets regularly, assesses team needs and addresses them, and responds to requests for assistance from teachers. Teachers are assigned a team member, termed a case manager, who utilizes instructional consultation to engage in collaborative work. The team supports the case manager and teacher by monitoring progress and offering assistance as needed. The team documents progress through the stages and outcomes of the cases, as well as the overall functioning and effectiveness of the team (Rosenfield & Gravois, 1996).

In the current study, school-level data archived on the Maryland State Department of Education's website (2006) are used to compare schools which implemented IC Teams to non-IC schools over a period of time. Data are available from 1992 to 2006, and the years used for each school differ according to the year that implementation took place. The data to be considered include special education placement rates (with consideration given to each school's total population), the percentage of students who access Free and

Reduced Meals (FARMS), and the percentage of students with Limited English Proficiency (LEP).

The total sample includes 92 schools from Maryland, 46 schools that implemented IC Teams and 46 comparison schools. The comparison schools were selected from a list of elementary schools within 11 counties in which the 46 treatment schools are present. This study does not include all Maryland schools that have implemented IC Teams, but all those are based on the following inclusion criteria: at least two years of implementation, at least two years of pre-treatment data available (data are only available from 1992 and later, therefore implementation must have occurred 1994 or later) and at least two years of post data available (implementation must have occurred 2004 or earlier).

Comparison schools were matched with IC Teams schools based on county, similarity of slope of special education placement rate over time (i.e. direction and value), and the mean special education placement rate (i.e. value). In the calculation of both slope and mean, all years of available data were used for comparison schools, while all data available prior to IC Teams implementation (i.e. before year 0) were used for IC Teams schools. Odds of placement in special education is reported as the ratio of the number of students with a special education disability and IEP to the total population minus the total number of students with a disability and IEP.

Hierarchical linear modeling (HLM) was used in the calculation all analyses in a manner analogous to a repeated measures analysis of variance (ANOVA). In this study, the special education placements of individual schools (both treatment and comparison) were measured at different points in time (pre and post intervention).

Since special education placements represent count data, a Poisson sampling model was incorporated within the generalized HLM. Y_{ti} = the number of placements occurring during year *t* in school *i* having an enrollment of m_{ti} students. The enrollment size, m_{ti}, is the school's exposure variable because numbers of special education placements must depend on the number of available students. Then under a Poisson sampling model with event rate λ,

$$Y_{ti} \mid \lambda_{ti} \sim P(m_{ti}, \lambda_{ti}). \quad (1)$$

To implement this level one sampling model, the log of the event rate is treated as the dependent variable, that is

$$\eta_{ti} = log\ (\lambda_{ti}). \quad (2)$$

The level one model for the log of the event rate is

$$\eta_{ti} = \pi_{0i} + \pi_{1i}\alpha_{1ti} + \pi_{2i}\alpha_{2ti}. \quad (3)$$

for $i = 1, \ldots, n$ schools, and where a_{1ti} = year before or after the introduction of IC Teams at time *t* for school *i*, and π_{1i} is the linear growth trajectory parameter. Each school is then observed on T_i occasions, which may vary across schools. The level one model contains a time-varying predictor reflecting whether or not IC Teams had been put in place (α_{2ti} = 0 if no IC Teams, 1 if IC Teams).

Equation 3 represents a linear model. A quadratic term (the square of year before or after the introduction of IC Teams), $\pi_{3i}\alpha_{1ti}^2$ can be added in the consideration of non-linear data trends.

$$\eta_{ti} = \pi_{0i} + \pi_{1i}\alpha_{1ti} + \pi_{2i}\alpha_{2ti} + \pi_{3i}\alpha_{1ti}^2 \quad (4)$$

Within the level one model of equation 3 or equation 4, an interaction term for the interaction of IC Team implementation and time, $\pi_{4i}(\alpha_{1ti}\alpha_{3ti})$, can be added.

$$\eta_{ti} = \pi_{0i} + \pi_{1i}\alpha_{1ti} + \pi_{2i}\alpha_{2ti} + \pi_{3i}\alpha_{1ti}^2 + \pi_{4i}(\alpha_{1ti}\alpha_{2ti}) \quad (5)$$

The level two models allow growth parameters to vary across schools and allow an examination of whether various school characteristics predict parameters at level one. Two school-level characteristics will be examined: The percentage of students receiving Free and Reduced Meals (FARMS) and the percentage of students with Limited English Proficiency (LEP). FARMS percentage can be considered a proxy for school population socioeconomic status (SES). The level two models have the following form:

$$\pi_{0i} = \beta_{00} + \beta_{01}X_{1i} + \beta_{02}X_{2i} + r_{0i} \quad (6)$$

$$\pi_{1i} = \beta_{10} + \beta_{11}X_{1i} + \beta_{12}X_{2i} + r_{1i} \quad (7)$$

$$\pi_{2i} = \beta_{20} + \beta_{21}X_{1i} + \beta_{22}X_{2i} + r_{2i} \quad (8)$$

$$\pi_{3i} = \beta_{30} + \beta_{31}X_{1i} + \beta_{32}X_{2i} + r_{3i} \quad (9)$$

where X_{1i} is FARM percent and X_{2i} is LEP percent.

β_{20} represents IC Teams' effect on special education placement rate, and the interaction effect of IC Teams with any school characteristics is represented by β_{21} (FARMS interaction) and β_{22} (LEP interaction).

Shadish, Cook, and Campbell (2002) stress the importance of using helpful graphics in presenting the data to supplement statistical analyses. This is accomplished here by distributing the abscissa evenly by number of years pre and post intervention, and clarifying the number of schools that are aggregated at each point in time.

Coping with Threats to Validity

The biggest limitations to quasi-experimental time-series designs involve threats to internal validity. The most notable threats in the current study are history and selection. The methodology in the current study – a repeated short time series design with

comparison group – reduces the history threat in two ways: by using multiple pre and post data points, and by looking at many treatment and comparison schools simultaneously. For example, if all of the treatment schools show a drop in placement rate in special education after treatment, and comparison schools do not show the same trend, one can conclude that the change occurred due to treatment, not history. Moreover, because different schools implemented the same treatment at different points in time, a specific historical event can be ruled out as responsible for trends.

Using another example to demonstrate the strength of the current design, the idea that a decrease in placement rate only represents a delay before eventual placement is ruled out because the analysis considers an aggregate trend for a long period of time following intervention (up to 12 years). Selection continues to remain a threat to this study, but it is ameliorated by the use of covariates (percent FARMS and LEP). Selection is considered further in the limitations section.

An important issue in the current study is designating the point in time that the intervention took place. The implementation of IC Teams is likely diffuse or gradual rather than abrupt. It is also not clear at what point in time treatment terminated in individual schools because data about treatment were not available for all schools. It will be important to analyze data visually, but to not create false effects due to the assumption that treatment took place abruptly at a specific point in time (Shadish et al., 2002). To cope with this issue, interpretations of visual results will be made cautiously.

Similarly, it is important to explore the lag that takes place from treatment initiation to effect. Shadish et al. (2002) suggest that without knowing the exact rate and form of diffusion, one is best off looking for delayed effects after treatment

implementation (p. 197). The application of statistical analyses in conjunction with graphic presentations will aim to clarify any delayed effects (which seem likely due to the changes in school culture that result from the implementation of instructional consultation). As Rosenfield and Gravois (1996) stated, change due to program treatment "is a process not an event" (p. 62). If there is an effect that is found for IC Teams, it will likely take place over time.

By using a time-series design with several pre and post intervention data points and several treatment and comparison schools, defensible inferences about changes in special education placement can be made. The time it takes IC Teams to absorb into school culture can also be explored based on the delay from intervention implementation to post intervention data points. This analysis can shed light on the desirability of the implementation of IC Teams in schools and provide future directions for research (such as the use of more pre-intervention and post-intervention data in drawing conclusions about IC Teams).

Chapter 3: Results

Using HLM, 46 IC Teams schools were compared with 46 comparison schools on slope of special education placement over time. Three different models were run, and years for schools in all analyses ranged from as many as 12 years pre-implementation (i.e. schools that implemented IC Teams in 2004 and had data available from 1992) to as many as 12 years post implementation (i.e. schools that implemented in 1994 and had data available to 2006).

Of the three models run, two were general models, and the last was a model testing for the interaction of IC Teams and time. For the first general model (the main analysis) and the third model (an interaction model), Poisson regression was used with school size treated as an exposure variable; special education placement count was the outcome variable. For the second model (a sensitivity analysis), the log of the special education placement rate was used as the outcome variable. This is an alternative method of analyzing the data, and was used to learn if the pattern of results was robust across different analytical methods. Theoretically, these two methods of analysis approximate one another and should not differ greatly in their results.

Initially, a statistical analysis was conducted to test the three models for linear trends (equation 3). The slope of the linear trend for IC Teams and comparison schools differed significantly (IC Teams schools showed a lower slope than comparison schools after implementation), and the interaction of IC Teams was also significant with time. Upon graphing the data (see Figure 1), however, it became apparent that a non-linear trend should be accounted for and that a linear model was potentially misleading. A

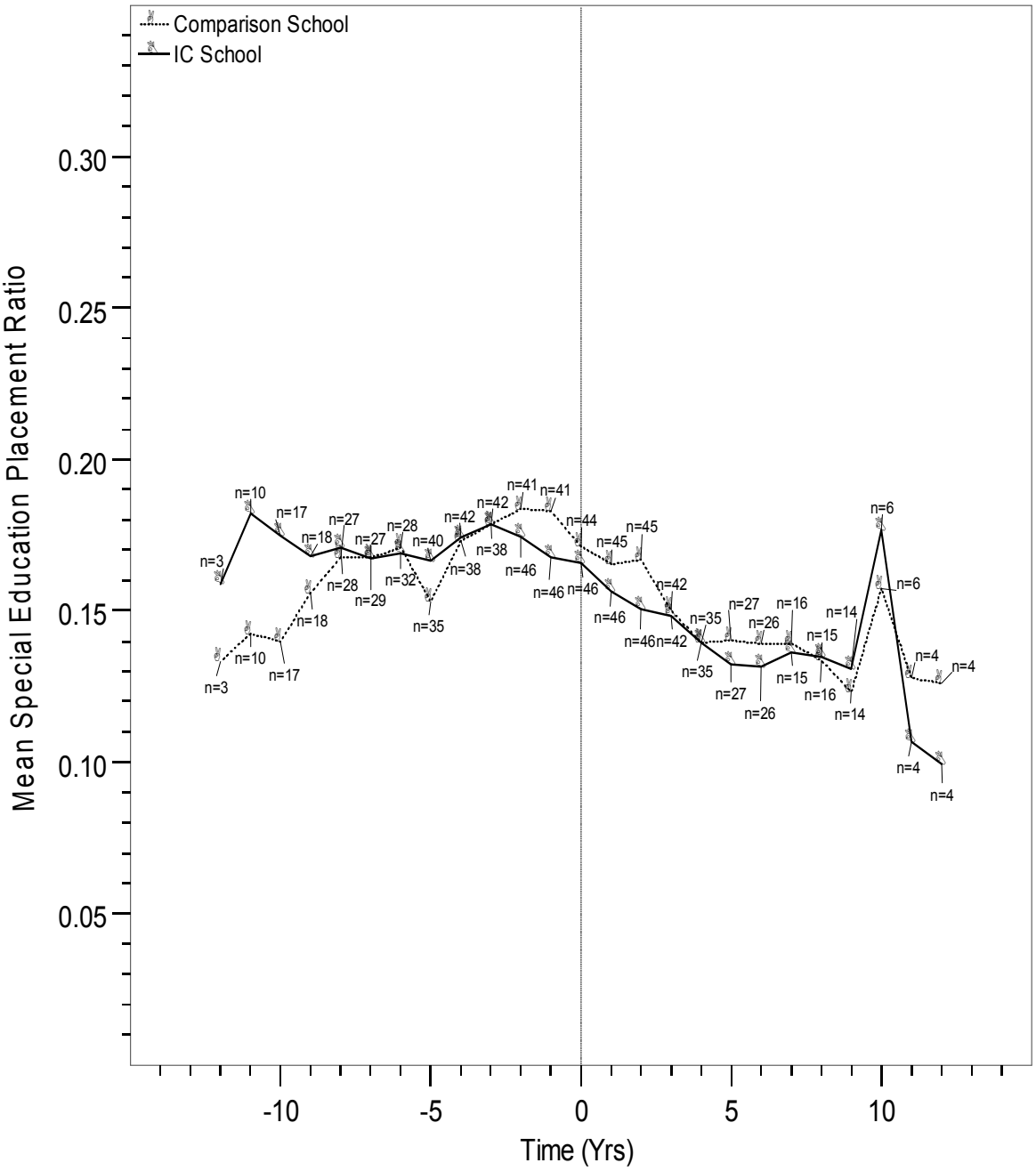

Figure 1. Mean special education placement ratio for IC-Teams schools versus comparison schools over time. Time = 0 is the year of implementation of IC Teams. Special education placement ratio = [placement count / (enrollment count - placement count)]. *n* = the number of schools aggregated to calculate the mean special education placement ratio of IC Teams of comparison schools at a given point in time.

quadratic term was added to the level one model (equation 4), and all statistical analyses were rerun.

Main Analysis

Table 1 shows the results of the main analysis. Time (β_{10}) has a significant effect on placement rate at the .001 level. Schools that utilize IC Teams do not differ significantly from comparison schools in placement ratio (for β_{20}, p = .229). That is, schools that implement IC Teams do not show fewer special education placements. The data show a significant non-linear trend (for β_{30}, p = .001). Taken in conjunction with Figure 1, the trend in special education placements appears to have a parabolic shape with time.

The interactions of IC Teams with FARMS percentage and LEP percentage, two school level characteristics, are also shown in Table 1. FARMS percentage significantly interacted with IC Teams implementation, suggesting that IC Teams may have a differential effect with schools with dissimilar FARMS populations. The coefficient of .04 means that as FARMS percentage increases, there is an increase in special education placements in IC Teams schools relative to non IC Teams schools. LEP percentage (p = .294) does not show significant interaction effects with IC Teams. The effect of IC Teams does not appear to be different in its effect with schools with dissimilar LEP populations.

Table 1 also shows the event rate ratio and confidence interval for each effect. The Event Rate Ratio can be thought of as the percentage change in the outcome variable (special education count) that is related to a one unit increase in the independent variable (implementation of IC Teams), holding other factors (school size, poverty, and language

Table 1

Model 1: Model Parameter Estimates with Enrollment Count as Exposure Variable and Special Education Placement Count as Outcome Variable

Fixed Effect	**Coefficient**	**Std. Error**	***t*-Ratio**	**Approx. *df***	***p***	**ER Ratio**	**Confidence Interval**
Time, β_{10}	-.012	.004	-3.429	91	.001	.988	.981-.995
IC in Place, β_{20}	-.036	.030	-1.213	89	.229	.964	.908-1.023
FARMS %, β_{21}	.004	.001	4.020	89	.000	1.004	1.002-1.006
LEP %, β_{22}	-.012	.011	-1.056	89	.294	.988	.966-1.010
Non-Linearity, β_{30}	-.002	.000	-3.605	91	.001	.998	.997-.999

Note. Effects are calculated using a unit-specific model with robust standard errors. β_{10} = effect of time on intercept level; β_{20} = effect of IC Teams on intercept level; β_{21} = interaction effect of IC Teams with FARMS Percentage; β_{22} = interaction effect of IC Teams with LEP Percentage; β_{30} = non-linear slope.

proficiency) constant. The confidence interval is the band within which that Event Rate Ratio may fall. The Event Rate Ratio of .964 for β_{20} means that the likelihood of placement in special education is approximately 96 percent of what it would be without implementation of IC Teams. Stated another way, the implementation of IC Teams decreases the likelihood of special education placement by approximately four percent.

The Event Rate Ratio for FARMS percentage is 1.004 and for LEP percentage is .998, implying that these school characteristics have little influences in placement ratio.

Sensitivity Analyses

Table 2 shows the results of the second general model, which uses the log of the special education ratio as the outcome variable as opposed to the special education placement count used in model 1. The results in this model confirm the results found in model 1. First, the slope of time $p = .006$) remains significant. Second, the effect of IC Teams (β_{20}), is not significant ($p = .133$). Third, the school level characteristic of FARMS percentage significantly interacts with IC Teams implementation. Lastly, the non-linear trend is still significant ($p = .001$).

In the third model, the data are analyzed in the consideration of the interaction between IC Teams implementation and time. This is calculated in the same manner as model 1 (i.e., with the use of a Poisson regression), however with the addition of an interaction term which considers that interaction of IC Teams implementation and time (equation 5). Table 3 shows the results of this interaction model (β_{30} in this model) which does not show significance ($p = .791$). Non-linearity ($p = .013$) and FARMS percentage ($p = .001$) retain their significance in the interaction model, while time ($p = .134$) is no longer significant.

Visual Analyses

In order to consider the exploratory research question of the lag through which the implementation effect may operate, the data are graphed in Figure 1. Because there are a different number of schools that influence the aggregated mean at different points in time (e.g., there are only three IC Teams schools and three comparison schools in year -12),

Table 2

Model 2: Model Parameter Estimates with Log Special Education Placement Ratio as Outcome Variable

Fixed Effect	**Coefficient**	**Std. Error**	***t*- ratio**	**Approx. *df***	***p***
Time, β_{10}	-.012	.004	-2.819	91	.006
IC in Place, β_{20}	-.055	.036	-1.514	89	.133
FARMS %, β_{21}	.004	.001	4.137	89	.000
LEP %, β_{22}	-.013	.013	-.975	89	.333
Non-Linearity, β_{30}	-.002	.001	-3.439	91	.001

Note. Effects are calculated using a unit-specific model with robust standard errors. β_{10} = effect of time on intercept level; β_{20} = effect of IC Teams on intercept level; β_{21} = interaction effect of IC Teams with FARMS Percentage; β_{22} = interaction effect of IC Teams with LEP Percentage; β_{30} = non-linear slope.

the number of IC Teams schools and comparison schools are listed next to their given point in time. Year 0 is the year of implementation. All figures utilize the mean special education placement ratio (calculated as special education placement ratio = [placement count/ (enrollment count – placement count)]) on the ordinate and year of implementation on the abscissa.

Table 3

Model 3: Interaction between IC Teams and Time

Fixed Effect	**Coefficient**	**Std. Error**	***t*-Ratio**	**Approx. *df***	***p***	**Event Rate Ratio**	**Confidence Interval**
Time, β_{10}	-.008	.006	-1.513	91	.134	.991	.981-1.003
IC in Place, β_{20}	-.050	.031	-1.634	89	.105	.950	.894-1.011
FARMS %, β_{21}	.003	.001	3.557	89	.001	1.003	1.002-1.005
LEP %, β_{22}	-.011	.011	-.951	89	.345	.989	.968-1.012
Non-Linearity, β_{30}	-.001	.001	-2.547	91	.013	.999	.997-1.000
Interaction, β_{40}	-.003	.011	-.266	91	.791	.997	.975-1.019

Note. Effects are calculated using a unit-specific model with robust standard errors. β_{10} = effect of time on intercept level; β_{20} = effect of IC Teams on intercept level; β_{21} = interaction effect of IC Teams with FARMS Percentage; β_{22} = interaction effect of IC Teams with LEP Percentage; β_{30} = non-linear slope β_{40} = interaction of IC Teams and time.

It appears that IC Teams begin with special education placement rates that are lower than comparison schools as many as two years prior to implementation. Both treatment and comparison schools show trends of placement rates decreasing over time.

These trends appear to be non-linear (which is confirmed by the significance of non-linearity in the statistical results). In year 2, comparison schools trend upward in their placement while IC Teams schools continue to decrease. However, at year 3, the placement rate of IC Teams schools and comparison schools become similar and stay that way over the course of time. Although at years 5 and 6, IC Teams schools are below comparison schools, their rates are extremely similar. If the visual analyses suggest an effect of IC Teams, it would be through year 2, but not beyond. The results of this graph should be taken in consideration with the statistical analyses which show no significant effect.

Data are analyzed in the statistical models as late as year 12 to establish trends and explore potential delayed effects of the intervention, and are therefore graphed. However, due to the small number of schools aggregated at points in the extremities, and not knowing the year when schools ended their implementation of IC Teams, trends before year -5 and after year 5 should be deemphasized by the reader.

High and Low FARMS

The results of the statistical analyses in the main analysis and both sensitivity analyses showed that the interaction of IC Teams and FARMS percentage is significant – special education placement ratios are higher in IC schools with high FARMS percentages. This interaction calls for additional exploration. The distribution of FARMS percentages of for the 46 IC Teams schools in the study is shown in Figure 2. Comparison schools were not included in this part of the investigation because redistributing the schools according to FARMS percentage would remove the matching criteria which had previously been put in place. To facilitate further analysis, FARMS

percentage was divided at the 40 percent marker, creating two groups. Schools with a mean above 40 percent FARMS are considered to have a high rate of FARMS (n = 23) and schools with a mean below 40 percent are considered to have a low rate of FARMS (n = 23). FARMS percentage is a proxy for SES, with high FARMS percentage suggestive of lower SES and low FARMS percentage suggestive of higher SES.

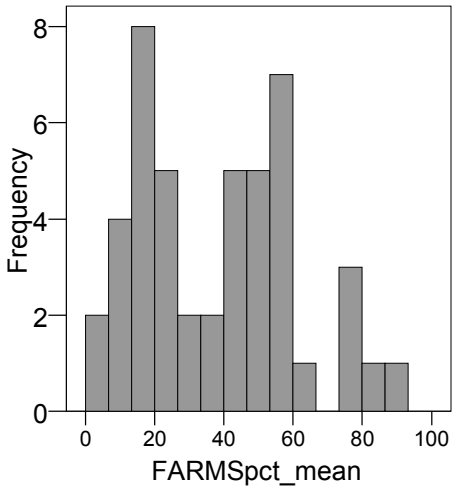

Figure 2. Distribution (split at 40%) of mean FARMS percentage for IC Teams schools (n = 46).

Figure 3 shows the mean special education placement rate for lower and higher SES schools that implemented IC Teams. This Figure demonstrates that lower SES schools begin with higher placement rates than higher SES schools and appear to stay that way over time, regardless of the implementation of IC Teams. It appears that following the implementation of IC Teams, lower SES schools have a decreased rate for approximately four years, and then go back to higher rates than they initially started with (although the number of schools at this point becomes quite small). On the other hand,

higher SES schools tend to decrease gradually from the year of implementation, and stay lower over the course of time.

These graphic data should be taken in conjunction with the statistical data. IC Teams did not show a significant effect in the reduction of special education placement rate in a non-linear model in the main analysis, and both sensitivity analyses. The effect of IC Teams did show a significant interaction with the school characteristic of FARMS percentage in all three analyses. This difference in effect is what is illustrated by Figure 3. IC Teams do not appear to lower placement rates in low SES schools, although IC does lower placement in high SES schools. Again, as with Figure 1, data graphed at the extremes should be deemphasized by the reader due to a small numbers of schools, and lack of knowledge about implementation at those points in time.

Figure 4 presents a box plot with whiskers to demonstrate the variance in placement rates of all schools that implemented IC Teams. This figure can be used to compare high SES and low SES IC Teams schools. It appears that IC Teams schools with higher SES have less overall variance in their year to year scores. Although there are several outlying scores on the high SES graph, there are no more than two outlying scores in a given year. Low SES schools have a larger spread contributing to their scores in a given year, but have fewer outlying scores than high SES schools.

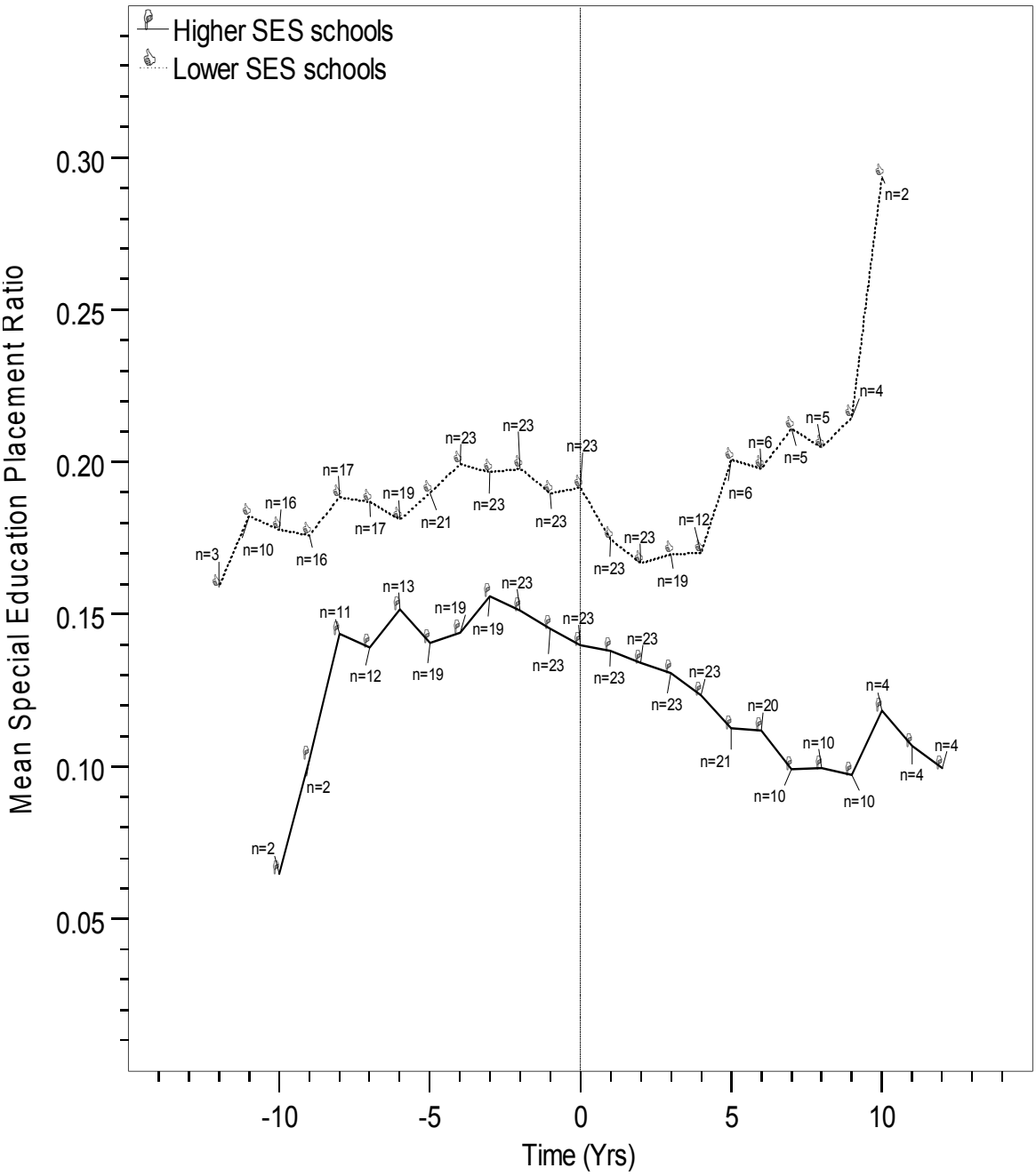

Figure 3. Mean special education placement ratio for IC Teams of lower SES (Mean FARMS percentage > 40 %) and higher SES (Mean FARMS percentage < 40%) schools. Time = 0 is the year of implementation of IC Teams. Special Education Placement Ratio = ([placement count / (enrollment count – placement count)]. *n* = the number of schools aggregated to calculate the mean special education placement ration for IC Teams schools or comparison schools at a given point in time.

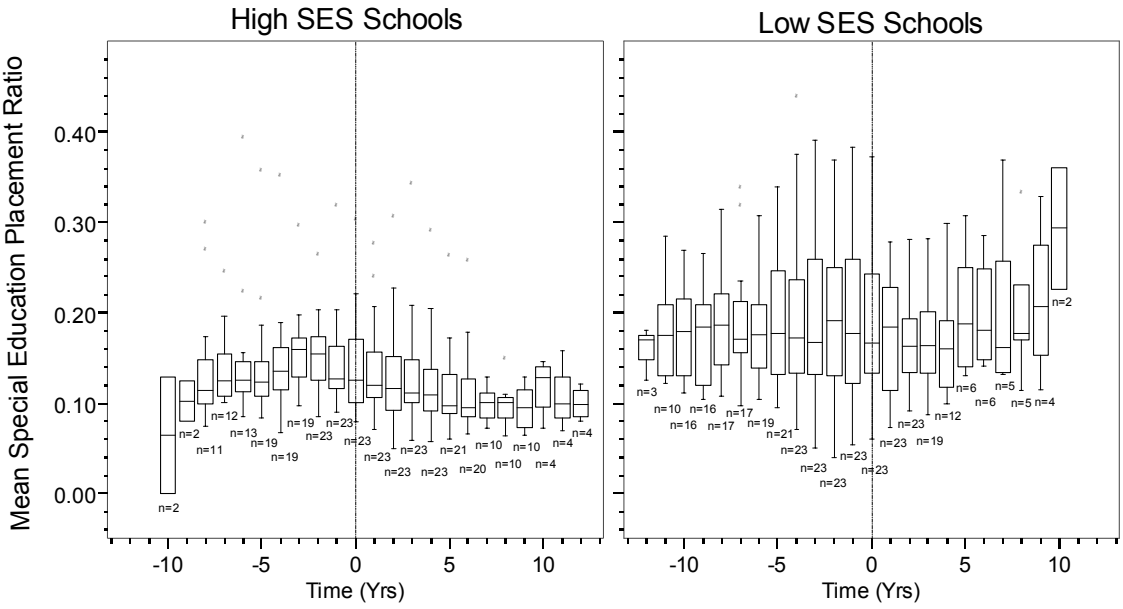

Figure 4. Variance of low SES IC Teams schools (n = 23) and high SES IC Teams schools (n = 23) at all years pre and post intervention. Outliers are represented by circles. Boxes are marked at their median.

Chapter 4: Discussion and Conclusion

Research Design

The use of a quasi-experimental short time series design with multiple pre and post treatment data points, and an equivalent number of treatment and comparison schools is a novel approach to the investigation of program effect. This method allowed for the exploration of the effect of IC Teams in a manner that accounted for threats to validity with greater strength than has been done in the past. The use of strong graphical data representation illustrated a picture of non-linear trends in special education placement for both implementation and comparison schools. This demonstrated the necessity of adding a non-linear term to the model for analysis – the original linear analysis which suggested a significant effect of IC Teams was misleading.

Effect of IC Teams over Time

According to this study, although the intervention does appear visually to have a short term effect, IC Teams do not have a statistically significant effect in reducing the placement of students in special education over time. The point estimate for the effect as measured by the Event Rate Ratio was a 4 % reduction of special education placement with the implementation of IC Teams. Figure 1 demonstrates that IC Teams begin with special education placement rates that are lower than comparison schools as many as two years prior to implementation. Therefore, even though IC Teams are lower in placement rates than comparison schools in the first few years of implementation, this may be related to their relative starting points. Following year 3, there is no longer a substantial visual difference between IC Teams schools and comparison schools.

Differential Effectiveness with Low and High SES Schools

Analyses revealed a significant interaction between IC Teams and school FARMS percentage in the main analysis, and in both sensitivity analyses. This result, taken in conjunction with Figure 3, points to an apparent difference in IC Teams' effectiveness between schools with low and high SES. Based on Figure 3, one might speculate that IC Teams' implementation may have small effects initially with lower SES schools, but then this effect fades with time. On the other hand, with higher SES schools, IC Teams appears to have an effect that grows with time. This may be related to the process of program institutionalization (see Rosenfield & Gravois, 1996, Chapter 8).

Many lower SES schools share concerns related to a general lack of resources, although lower SES schools do have access to state and federal funding (Jacob, 2007). There is often high teacher turnover and a lack of quality teachers (Elias et al., 2003; Jacob, 2007), minimal budgets, low per-student expenditure, and systemic racism (Hunter & Donahoo, 2005). These qualities may impact classroom practices and school culture, both of which relate back to over-referral of students to special education. The attributes of lower SES schools may also result in detrimental consequences for program implementation and institutionalization of an intervention such as IC Teams. Although the issue of differences in school characteristics of low and high SES schools is important to consider briefly in this discussion, to explore this topic beyond a surface level would be speculative, and beyond the scope of this paper.

The differential patterns of special education placements in different SES schools can be considered problematic for two main reasons. First, in general, Figure 3 shows that students are more likely to be placed in special education in lower SES schools

versus higher SES schools prior to intervention. This means that the goal of limiting special education placement and keeping students in general education environments is less successful with the schools that need this result the most. Second, co-occurrence of poverty and special education placement has been documented as one reason for disproportionate placement of minorities in special education (Hosp & Reschly, 2003). IC Teams' ineffectiveness in lower SES schools means a failure to combat the problem of minority overrepresentation where this problem may be most prevalent, although it does not indicate whether IC Teams is effective with minority students in higher SES schools where some of the earlier research on IC Teams was done (Gravois & Rosenfield, 2002, 2006).

Future Research

There are several directions for future research on IC Teams. The addition of various types of data would help in the analysis of the effect of IC Teams and in interpreting results. Incorporating data about treatment (e.g., integrity, length, acceptance, etc.) would aid in several areas. These data could clarify what specific resources are most needed by schools for successful intervention, and allow for a more comprehensive interpretation of various graphic data trends. Measuring school climate prior to intervention may assist in understanding differences between schools that may relate to differential effect. It would be beneficial to replicate the results of the current study using new data that are currently being developed, for example data from schools in other states and counties.

Limitations

A first limitation involves generalizability of the results. The data are

representative of only a limited geographic area (although there are several counties, all are within the state of Maryland). Further, those schools who received treatment did so voluntarily and might therefore have certain associated qualities. For example, volunteering schools might have heightened special education rates to begin with, and therefore, the additional threat of regression to the mean would be present. It is also possible that volunteer schools might have differential desire to work on their problem, and openness to input from outsiders from control schools. As a result, the present study might only generalize to schools that voluntarily implement IC Teams. At the same time, this would tend to over rather than underestimate the effects of IC Teams in a more representative sample. Generalizability of the data is also limited to schools that are similar in their demographic and regional composition to those where the data were originally recorded.

Other limitations to this study that should be noted involve the use of archived data, and are outlined by Shadish et al. (2002). Accessing data can be very challenging. The researcher must pay careful attention to the operational definitions of terms to make sure it is clear what data mean, and how they should be used. Archived data are inflexible, so it might be difficult to disaggregate in the manner desired. For example, the state did not disaggregate race, limiting the analyses that were possible.

The use of archived data can also result in a threat to construct validity (although it should be noted that construct validity is less an issue in time-series designs when archived data are used because reactivity is not as great a concern; Shadish, et al., 2002). The use of only one outcome measure (special education placement rate as archived in a Maryland state report) is problematic. For example, although special education

placement rate was used as the outcome measure in this study due to these data being available, perhaps other individual or supplemental outcome variables would be more appropriate measures of the effect of IC Teams. This could include a measure of referral rate to special education, which may be more sensitive to change over time (e.g., in accounting for issues of population mobility) than placement rate, but was not available in the archive.

A last data limitation involves treatment, which was a black box in this study; integrity ratings were not available, and it was not clear at what point in time each school ended its implementation of IC Teams. Limitations in knowledge about treatment create limitations in the breadth and depth of conclusions that can be drawn with certainty. Despite the limitations to this study, it is apparent that this research provides new evidence about the effect that Instructional Consultation Teams has in schools, and how that effect takes place over time.

Conclusion

This study used a quasi-experimental interrupted time series design and a HLM analysis with 92 schools (46 IC Teams schools and 46 matched comparison schools), and as many as 12 years pre and post intervention. These methods made possible a more comprehensive analysis of IC Teams' effect on special education rates than has been done in the past. Although there are limitations to the current study, it provides an example of an innovative methodology that can be used in future research to examine the effectiveness of IC Teams as well as other school based interventions.

The results of the analysis provide statistical and visual evidence that the intervention of IC Teams may not be effective in decreasing special education placement.

This finding is contrary to prior less rigorous research by Gravois and Rosenfield (2002, 2006). There is some visual evidence that IC Teams may be more effective with higher SES schools. This may be due to the many barriers to implementation and institutionalization that are prevalent in low SES schools.

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