

Forming Catholic School Teacher Leaders: An Impact Evaluation of the ACE Ascent Program

Pre-Analysis Plan

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I. Introduction

The Alliance for Catholic Education (ACE) is implementing the ACE Ascent Program, a new program which will provide math teachers in Catholic schools with training and professional development with the goal of improving students' academic achievement. LEO is working with ACE to help them randomly select schools who will participate in the program. LEO will support ACE by randomly selecting teachers for the program and, in the future, assisting ACE with data analysis to determine if their program had an impact on the academic performance of students, particularly in the subject of math.

II. Overview of the Study

In recent decades, both Catholic school enrollment and the number of operating Catholic schools have fallen. As of 2022, there were 5,938 Catholic schools open in the US, compared with more than 11,000 in 1970.¹ Much of this decline has taken place in cities, where Catholic schools were particularly beneficial for largely minority students.^{1,2} Catholic schools, like public and other private schools, have also struggled with recruiting and retaining qualified teachers.³

This is a problem—a year in class with an ineffective teacher can leave students lagging behind the academic achievement of their peers. In the wake of the Covid-19 pandemic and the resulting decline in American students' reading and mathematics scores, students need access to high quality teaching more than ever.^{4,5} Catholic schools in particular face the additional challenge of finding teachers who will effectively promote their Catholic values and identity along with academic knowledge.

To address these interconnected challenges faced by Catholic schools and promote its mission of expanding opportunities for quality Catholic education, The Alliance for Catholic Education (ACE) has implemented the Ascent program. The Ascent program is a two-year program that focuses on forming teachers into master teachers and leaders in their school in mathematics curriculum and instruction. K-8 school superintendents, principals, teachers, and staff in two California dioceses will be brought together to complete coursework and attend workshops under a collective leadership model.

¹ Associated Press. (2022) Enrollment in US Catholic Schools Rebounds After Sharp Drop. *US News*. <https://www.usnews.com/news/us/articles/2022-02-14/enrollment-in-us-catholic-schools-rebounds-after-sharp-drop#:~:text=Catholic%20schools%20had%20a%20decline%since%20it%20has%20collected%20data>

² Dills, A. K. & Hernandez-Julian, R. (2010). Negative publicity and Catholic schools. *Economic Inquiry*, 50(1). <https://doi.org/10.1111/j.1465-7295.2010.00342.x>

³ Jakuback, K. G. (2017). *Catholic school identity: Perceptions that influence teacher retention* (Publication No. 10277902). [Doctoral dissertation, Seton Hall University]. Seton Hall University ProQuest Dissertations Publishing.

⁴ Sanders, W. L., & Rivers, J. C. (1996). Cumulative and residual effects of teachers on future student academic achievement. Knoxville, TN: University of Tennessee.

⁵ Reading and mathematics scores decline during COVID-19 pandemic. (2022). *The Nation's Report Card*. <https://www.nationsreportcard.gov/highlights/ltt/2022/>

Professional development programs for teachers, in the forms of workshops or year-long courses, are shown to have statistically significant positive impacts on students' academic achievement, especially in science and mathematics.⁶ When these programs enable teachers to actively collaborate, explore, and develop their practices with a focus on student learning, as is the case in professional learning communities, they can positively impact school culture and improve student outcomes, as measured by test scores.⁷ However, previous research on professional development interventions has focused on programs that provide development only for teachers.

This study is a randomized controlled trial designed to measure the impact of the Ascent program on student achievement. The Ascent program is distinct in that it is designed to engage superintendents and principals along with teachers, offering leadership programs for school leaders across target dioceses. Additionally, Ascent's specific focus on Catholic spirituality will provide a new lens to mathematics teacher formation research. There has yet to be a study that focuses on the impact of faith-oriented mathematics education and leadership programs in K-8 schools. An experimental study on the Ascent program will generate new evidence on the impact of this unique type of program. In addition to the randomized control trial, the Ascent study will use social network analysis to examine collaboration within and across schools as well as mixed methods to explore additional dimensions of student learning and teacher efficacy.

III. Evaluation Design

Research Question

Academics

1. Does forming math teacher leaders in service to a collaborative leadership model in Catholic schools improve student achievement in math?
 - a. Is there any difference in sub-groups? (i.e. race, low SES?)
2. How does the time/nature of mathematics teacher leader interaction with teachers and/or principals influence mathematics student achievement?

Community and Collaboration

3. How does employing a collaborative leadership model influence the nature and quantity of collaboration within and across school faculty and staff? Across the dioceses?

Vocation/Faith and Reason

4. In what ways does the dialogue between faith and reason manifest in the mathematics classroom over time?
5. How does a mathematics teacher leader's identity as a mathematics teacher intersect or overlap with their identity as a person of faith?
6. Does program participation influence the experience of joy as a virtue and/or psychological construct?
7. How do participants experience the spiritual formation aspects of the program and in what ways do they perceive these to influence their vocational commitment and experience as a Catholic school mathematics teacher/leader?
8. In what ways do participants' identities as purveyors of faith change over the course of their time in the program?

⁶ Blank, R. K. & de las Alas, N. (2009). The effects of teacher professional development on gains in student achievement: How meta analysis provides scientific evidence useful to education leaders. Council of Chief State School Officers.

<https://eric.ed.gov/?id=ED544700>

⁷ Vescio, V., Ross, D., & Adams, A. (2008). A review of research on the impact of professional learning communities on teaching practice and student learning. *Teaching and Teacher Education*, 24(1). <https://doi.org/10.1016/j.tate.2007.01.004>

Eligibility

ACE has identified 46 schools across two California dioceses that will participate in the impact evaluation. Over the course of the five years of the study, the Ascent program will expand to all of these schools.

Randomization

ACE is rolling out the Ascent program to participating schools in Diocese 1 (N=9) and Diocese 2 (N=35) over five academic years beginning in the 2023–24 academic year. Schools were randomly selected to receive the program in one of the five study years. During the summer before the selected school year, a teacher from the participating school will begin the Ascent program. Students attending schools in years where there was an Ascent-trained teacher will be considered part of the treatment group. Students attending schools in years where there was not yet an Ascent-trained teacher will be considered part of the control group. Thus, the study will compare student outcomes between schools selected earlier and later in the study to receive an Ascent teacher, which was randomly determined.

Random assignment for the program has already taken place. LEO took the list of schools who would be participating in the study and randomly assigned each school to the year in which it would receive the program. The following protocol was used to determine the rollout for each of the two dioceses:

Diocese 1 (N=9)

The nine schools were determined to be served across the first 4 years of the research study. In the diocese, there were two schools not included in the study that were to be included in the first cohort (i.e. 11 total Diocese 1 schools trained). This means that in each of the first four years, three Diocese 1 schools were to be served, except one year where only two would be served.

1. Randomly select which year would only serve two Diocese 1 schools.
2. Assign each school within the diocese a random number between 0 and 1.
3. In each treatment year, pick the schools with the smallest random number that had not yet been assigned to a treatment year up to the number of schools to be served that year.
 - a. One school was not eligible to be picked in year 1. If it had been assigned a low random number, it would not have been selected in that year.

Diocese 2 (N=35)

In Diocese 2, six schools were to be selected in each of the first 4 years of the study, with the fifth year having nine Diocese 2 schools in the program. In Diocese 2, 24 of the 35 schools were not eligible to be selected for the program.

1. Assign each school with the diocese a random number between 0 and 1.
2. In each of the first four treatment years, select the 6 schools with the smallest random number that had not yet been selected for treatment.
 - a. If a school is not eligible to be selected in year 1, do not assign them treatment in year 1.
3. In the final year of the study, assign treatment to the remaining 9 schools not yet assigned a treatment year.

In order to accurately assess the impact of the program, it is critical that schools scheduled to receive Ascent in later years do not seek out similar programs in the years that they will serve as a control group. ACE has emphasized the importance of this process to the participating dioceses and is confident that they will follow

the set randomization protocol. The research team has also discussed strategies to maintain this commitment over the length of the study, such as through interim results sharing as a way of maintaining excitement for the evaluation.

Intervention

Schools selected to participate in ACE's Ascent program will nominate a teacher who will engage in coursework, for a total of 18 graduate credits, to support them in becoming "teacher leaders" in their own schools. Coursework includes four leadership courses and four mathematics courses. Topics attended to in the program include, but are not limited to, ambitious lesson planning, classroom observations, coaching cycles, disciplinary knowledge and pedagogy in the areas of number and operations, ratio and proportion, geometry and measurement, and algebra and functions. Throughout their two years in the program, teachers will come to Notre Dame's campus twice, and the majority of programming will take place in their schools or be virtual. Teachers will participate in Ascent programming outside of class time, and students will not be directly affected by the implementation of the program and the project. Participants will also engage in four faith-forward retreat experiences over the course of the two years and all coursework is integrated with a spiritual dimension.

Power Calculations

Power calculations for this study were conducted using test score data from 2018–2022 provided by the two dioceses on the schools participating in the study. Using the randomization protocol implemented in the study, the researchers generated 10,000 iterations of the treatment assignment over the schools in the study. For each iteration, the researchers estimated a two-way fixed effects model with school and year fixed effects and an indicator for whether the students in that school-cohort were treated. Effects were estimated separately for 3rd, 4th, and 5th grade standardized math test scores. These calculations yielded a projected MDE of 0.163 to 0.187 standard deviations in test scores.

IV. Key Data Sources

The following section summarizes the planned primary data sources for this project. Notably, securing access to these data sources is partially complete. Given this, any outcomes for which we do not already have data secured may ultimately be excluded if there are barriers to gathering the needed information.

Quantitative Data Sources:

Standardized Test Scores

Administrative records of student outcomes come from the dioceses. The dioceses will provide data on students' academic outcomes to be used for the evaluation of the program's impact. LEO and ACE have established data sharing agreements with both dioceses, outlining the plan for the study and establishing procedures for sharing student outcomes data. The data will be recorded by the investigator in such a manner that subjects cannot be identified. The researchers will access baseline data on student characteristics and performance retrospectively. The data sharing agreements between Notre Dame and the participating dioceses outline that the dioceses will share data with Notre Dame on students' historical measures of items including test scores, absences, and extracurriculars. The researchers will use this data to control for students' historical academic performance when evaluating the impact of the program.

Specifically, the ACE and LEO team will receive STAR testing data from both dioceses to determine student achievement. STAR tests are adaptive standardized tests administered (Fall, Winter, and Spring) during the

school year to 3rd - 11th grade students. Students complete separate Math and English Language Arts STAR tests. The dioceses will share both sets of scores with the ACE and LEO team. These tests measure student achievement in the specified subject by providing adaptive questions to better capture student understanding. The standardized test scores will address Research Questions 1 and 2.

<i>Data Source Title</i>	STAR test scores in Math and English
<i>What is being measured?</i>	Student level math and english mastery of grade level concepts
<i>How is it being measured?</i>	STAR tests administered by teacher, scores shared with researchers from Diocese
<i>When will it be collected?</i>	Fall, Winter, Spring annually

Activity Tracking

Teacher-leaders report how they spent their work time on a Qualtrics survey. They will report on and log the amount of time spent on various teaching activities. Teacher Leaders will complete this survey twice weekly (Tuesday and Thursday) beginning the last week of September through the first week of November and again beginning the last week of January through the first week of March. Teacher Leaders will complete the activity log during their two-year enrollment in the program as well as the first year after completion, for a total of three years. The Activity Tracking survey addresses Research Question 2.

<i>Data Source Title</i>	Activity Tracking
<i>What is being measured?</i>	Teacher-leaders report how they spent their work time. Amount of time spent on various teaching activities
<i>How is it being measured?</i>	Teachers report using an app built for the study
<i>When will it be collected?</i>	Tuesdays/Thursdays last week of Sept. to first week of Nov. (also in the Spring last week of Jan through first week of March)

Social Network Analysis Survey

The Social Network Analysis (SNA) survey is aimed at understanding teacher collaboration within and across schools. The SNA survey asks faculty members to identify who they speak with for advice and counseling about their teaching as well as the nature of these conversations. The Ascent research team will manually match names given by respondents to teachers in study schools, where possible. Survey respondents may include up to ten people with whom they collaborate about their teaching practice as well as complete a trust scale aimed at understanding how well faculty members trust colleagues and feel about school culture.

To obtain baseline data, every teacher and principal in all 46 schools completed the SNA survey in the Fall of 2023. Once schools enter the treatment group, all teachers and principals will complete the SNA survey during November and April of each school year, as well as during the April preceding enrollment. The SNA survey aims to answer Research Questions 3 and 4.

<i>Data Source Title</i>	Social Network Survey
<i>What is being measured?</i>	Who have you talked with or gotten advice/counseling for teaching? Put up to 10 people, how often do you talk to these people, what was this convo about Trust questions - can you trust colleagues, how do you feel in your school culture, makes a trust scale
<i>How is it being measured?</i>	Teachers and principals will take online survey
<i>When will it be collected?</i>	April/November: all teachers/principals for schools currently in Ascent or about to begin

Teacher-Leader Surveys

Teacher Leaders complete surveys (citations below) aimed at understanding their Math identity, Spiritual well-being, dispositional joy, and intersection of math and spiritual lives. In these surveys, participants are asked to fill in a likert scale in response to a series of statements within each domain. Teacher leaders take these surveys at the start of their first year in the program (July), at the one-year check-in (July), and again at the end of the program (May). These surveys address Research Questions 6 and 7.

<i>Data Source Title</i>	Teacher Leader Survey
<i>What is being measured?</i>	Math identity, spiritual well-being, dispositional joy, intersection of math/spiritual
<i>How is it being measured?</i>	Teacher Leaders will take surveys
<i>When will it be collected?</i>	Start of school Year 1, between school Years 1 and 2 and end of Year 2

Paloutzian, Raymond F., and Craig W. Ellison. "Spiritual well-being scale." A spiritual strategy for counseling and psychotherapy. (1982).

Watkins, P.C., Emmons, R.A., Greaves, M.R., and Bell, J. (2018). Joy is a distinct positive emotion: Assessment of joy and relationship to gratitude and well-being. *The Journal of Positive Psychology*, 13(5), 522-539.

Willis, R., Lynch, D., Peddell, L. et al. Development of a teacher of mathematics identity (ToMI) scale. *Math Ed Res J* 35 (Suppl 1), 107–132 (2023). <https://doi.org/10.1007/s13394-021-00391-w>

Qualitative Data Sources:

Program Coursework

Vocation and Faith Life Graph

Vocation and Faith Life Graph

At the start of their first year in the program and again at the end of the program, teacher leaders write a Math Autobiography about their experience and journey as both a learner and teacher of mathematics. Within

these autobiographies, teacher leaders also reflect on the role that faith and spirituality has played in their lives. After completing the autobiography, teacher leaders create two lifegraphs - one focusing on their journey as a math educator and the second focuses on their spiritual life over the same time period. Participants then submitted recordings of their explanations of each lifograph as well as the connections and differences between each lifograph. The lifegraphs will address Research Questions 6 and 8.

Vocation and Faith Interviews

Teacher leaders will participate in interviews with the Ascent team at the start (September) and end (May) of their 2-year enrollment in the program. These interviews are aimed at understanding teacher leader views about their own identity as mathematics teachers, and people of faith as well as the connection between those identities. These interviews will address Research Questions 8 and 9.

V. Subgroup Analysis

The research team is interested in determining whether the intervention is more effective at increasing math test scores for certain populations relative to others. The following are areas of interest for exploratory analysis of subgroups:

- A. Low-SES*
 - 1. Eligible for free-reduced price lunch
- B. Pre-study test scores*
 - 1. Above/below median pre-study math test scores for national STAR
- C. Gender*
 - 1. Female = Self-identified as female; Male = Self-identified as male
- D. Grade-level*
 - 1. Grades 3-5
- E. Race/Ethnicity*
 - 1. Hispanic = Self-identified as Hispanic or Latino; Other = everyone else
 - 2. Non-white = Not white, non-hispanic
 - 3. White, non-Hispanic = Self-identified as White and Non-Hispanic or Non-Latino; Other = everyone else

VI. Data Analysis

The Ascent study will leverage random assignment to estimate the causal impact of the program on Math achievement. To supplement this analysis, the research team will also explore how outcomes only observed in schools currently participating in Ascent changed before and after the rollout of Ascent, as well as using qualitative analysis to better understand mechanisms behind program impact.

RCT Program Impacts

We will estimate intent-to-treat (ITT) treatment effects by OLS using the following regression:

$$Y_{ist} = T_{st}\beta + \alpha_s + \tau_t + \Gamma X_{i0} + \epsilon_i$$

Y_{ist} is an outcome for student i at school s observed in year t . T_{st} is an indicator from random assignment that equals 1 if school s has a teacher that has started the Ascent program by year t . α_s and τ_t are school and year fixed effects. The vector X_{i0} includes a set of person-level characteristics measured prior to the start of the

research study (e.g., pre-rollout math scores), and ϵ_i is an error term. The coefficient on the treatment dummy β will give us the difference in means between students at treated schools compared to not-yet treated schools, the estimated impact of the program.

A. Covariates

We plan to include the following covariates in our regressions:

1. Value of dependent variable at baseline, if applicable
2. Gender (1 = female, 0 otherwise)
3. Indicator for free/reduced-price lunch (if available)
4. Set of mutually exclusive variables for race/ethnicity

B. Standard Errors

We will cluster standard errors at the level of random assignment (school-year level).

Pre/Post Analysis

There are a number of outcomes that will only be measured in schools where the program has begun and will not be measured at control schools. These outcomes will be measured as teachers start the program and post-program and differences will be compared to assess for change in the treatment schools. These outcomes include teacher self-report of math identity, dispositional joy, state of spirituality as well as number of social connections within and during the program.

Qualitative Analysis

Our qualitative data is being used to answer the five research questions that center on vocation and the integration of faith and reason. While there are existent studies in the field of sociology, psychology, theology and possibly others, that attend to dimensions of vocation and faith, we do not believe there is an existing body of literature around the lines of inquiry that we are exploring, specifically as they relate to the faith formation of teachers in Catholic schools. Hence, we will take a Grounded Theory approach using Strauss and Corbin's (1998) design.

The purpose of Grounded Theory is to develop a theory about a certain process or phenomenon. In this study, we are interested in determining how participants' experiences with the spiritual formation components of our program influence their identity development as Catholic school mathematics teachers, as purveyors of faith, and as experiencing joy as a psychological construct or virtue and how this influences their vocational commitment.

Qualitative data collection will primarily focus on interviews and we will use open, axial, and selective coding while continuously comparing our data against the emerging theory. Researchers will maintain consistent memos throughout the life of the study and use these in the constant comparison process.