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Significance

Despite 50 years of research, we still know little about how to teach reading to the smallest percentage of students who have the most severe difficulty learning to read (Gersten et. al, 2008). Students, once placed in special education settings for their literacy instruction, tend to remain there for the rest of their schooling and the achievement gap continues to widen over the years (Denton, Vaughn & Fletcher, 2003).

Our project addresses Absolute Priority 3: Improving Academic Outcomes for Students with Disabilities. Specifically the grant will support the development and initial evaluation of an instructional model based on strong theory to improve literacy outcomes for young students whose disabilities require them to receive their reading instruction in restrictive settings. The goal of these instructional strategies will be to improve student achievement to such a level that these students can be transitioned from restrictive settings for their literacy learning to the classroom. We will present strong theory and a logic model in this application to present our plan to develop an intervention that contains the intensity and instructional components needed to help disabled students close the reading gap with their peers can be developed.

Differences in achievement have been documented as early as kindergarten, and in first (Denton & West, 2002) and fourth grade (U.S. Department of Education 2001). By the time struggling readers reach middle school they have been falling behind for five or six years and they have been growing more and more discouraged. As a result, these young students who fail early in school are more likely to be retained, and more likely to drop out of school later on, (Jimerson, Anderson, & Whipple, 2002) even after differences in background, school attendance and post-grade retention achievement have

been taken into account (Roderick, 1994). In fact, a student's school performance in first grade is a better predictor of whether a student will later drop out of school, than performance in sixth grade (Garnier, Stein & Jacobs, 1997).

The negative impact of early school failure goes well beyond increasing a child's likelihood of dropping out of school but are also associated with later emotional problems in adolescence, a lack of motivation and eventually dropping out of school (Garnier, Stein & Jacobs, 1997).

The cost of literacy failure extends beyond the individual to society. Fuchs and Fuchs (2006) estimate that it costs two to three times more to teach children with disabilities, and in New York City for example, that cost translates into 22 cents for every dollar spent on education, being spent on special education (Fuchs & Fuchs, 2006).

The need to know more about effective instruction becomes obvious when one considers the findings from the What Works Clearinghouse (WWC). Thirteen interventions target the same population as we do in this proposal, beginning readers from grades 1-3 who are labeled as learning disabled, and of those 13 interventions, just 3 have studies that meet the WWC standards with or without reservations; and of those three interventions, two were found to have no discernible effects on any reading domain. According to its criteria, a 0.25 effect size or greater is considered to be "substantively important" (WWC, 2007).

Only one intervention, Peer Assisted Learning Strategies (PALS) was found to have any positive effects on reading, but even then the extent of evidence is small (3 studies in all) and the impact on student outcomes narrow; PALS had positive effects but on two domains only, comprehension and fluency.

Many of the interventions for learning disabled students have produced null effects or very small effects, except for the PALS program; it produced effects from 0.36 and 0.75 on fluency and comprehension respectively (See Table 1).

Table 1. What Works Clearinghouse: Interventions for Children with Disabilities with a Reading Focus, Grades 1-3

Intervention	Eligible Studies *	Student Outcome	Improvement Index	Effect Size**	Extent of Evidence
PALS	3	Comprehension	26	.75	Small
		Fluency	14	.36	Small
Project Read	2	Reading Achievement	5	.10	Small
Reading	1	Alphabetics	2	0	Small
Mastery		Comprehension	-1	0	Small

*Total number of studies that met standards with/without reservations
** According to its criteria, a 0.25 effect size or greater is considered to be "substantively important" (WWC, 2007).

The fact that so few studies met the WWC review standard was not due to a lack of available research; in fact 349 studies connected to 13 interventions were submitted to the WWC for review. The problem, and one that this project intends to address, is that little is still yet known about the intensity and content of instruction that will support reading disabled students in making sufficient progress to catch up to their peers (Speece and Walker, 2007).

We intend to develop and test an intervention that will be substantially more effective than current practices which have been characterized by Vaughn et. al (2002) as low quality instruction. Our project will test the ingredients necessary in an intervention, in terms of dosage, quality of the dosage and the best combination of ingredients that special education teachers can use to better support students. Our approach is a novel one aimed at a common, seemingly intractable problem.

We will address Absolute Priority 3: Improving Academic Outcomes for Students with Disabilities. Our key project objectives are to: (1) develop an instructional format based on strong literacy theory for children with disabilities who are placed in restrictive environments for their beginning reading instruction; (2) provide training in the lesson format to experienced literacy coaches who will in turn provide training to special education teachers; (3) conduct an internal, natural variation study to identify which features work best in concert to improve student's achievement levels; (4) prepare 136 Special Education teachers to deliver the intervention and (5) conduct a rigorous outside project evaluation including both experimental and qualitative methodologies.

Project Design

Decades of reading disabilities research leads to the conclusion that, for many children, their impairment can be traced back to inadequate instruction rather than biological factors (Vellutino et. al, 2004). It seems reasonable to expect therefore that evidenced-based instruction, designed for children having great difficulty learning to read, and tailored to individual needs will result in accelerated growth.

In the following sections, we describe the design of our project: we identify the target population, describe the instructional setting, and provide theory to support the five components of the instructional framework. Then, we present our four-stage plan to develop a novel intervention based on this strong theoretical framework.

Lesson Framework: Five Instructional Components and Three Activities

Teachers will be trained in how to deliver the following five lesson elements: fluency instruction, word recognition, letter identification, phonemic awareness and decoding strategies. These five lesson components will be targeted in three main activity

types that will be present in each lesson: reading connecting text, writing connected text, and work in isolation, as displayed in the table that follows. We will develop the lesson activities as part of our Stage One work (See the section which follows for a description of our Four-Stage Development Plan.) Table 2 provides a general organizational plan.

Table 2. Lesson Framework: Five Instructional Components and Three Activities

Activity	Targeted Lesson Components
Reading Connected Text	
• Rereading a familiar book • Reading a new book • Rereading yesterday's new book and taking a running record.	Fluent reading of familiar text, decoding strategies words, word recognition.
Writing Connected Text	
• Writing a short story • Rereading one's story	Phonemic awareness, word recognition, fluency instruction, letter identification.
Work In Isolation	
• Sorting, naming letters with speed. • Building a core reading vocabulary • Decoding strategies • Phonemic awareness training	Word recognition, letter identification, phonemic awareness and decoding strategies

We plan to include instruction in oral reading fluency because it is an accurate predictor of later reading achievement (Baker et al., 2008). There is strong theory to support the notion that fluency is complex and multi-faceted and that comprehensive

instruction and large amounts of practice are needed (Hudson, Pullen, Lane & Torgesen, 2009, p.26) and also that students should be taught to read with automaticity and prosody on familiar texts (Kuhn, Schwanenflugel & Meisinger, 2010 , p.245).

We also plan to include word recognition instruction because studies that evaluate the relationship between word identification and written and oral language comprehension processes suggest that inadequate facility in word identification impairs reading comprehension (Vellutino, Fletcher, Snowling & Scanlon, 2004, p.6).

Letter identification and recognition will also be addressed. Letter name and letter sound knowledge of preschool and kindergarten students predict subsequent literacy skills and are thus an important learning goal for young children (Piasta & Wagner, 2010). Alphabet knowledge has a strong relationship to later decoding and spelling and a moderate relationship with reading comprehension (NELP, 2008, p.67).

Phonemic awareness instruction will also be included because it is a predictor of individual differences in reading development (Melby-Lervag, Lyster and Hulme, 2012). Strong theory suggests that phoneme awareness training, the kind that makes explicit the connections between phonemic segments and letters and closely resembles the task of reading, improves the early reading and spelling of students (Ball & Blachman, 1991)

The instructional format will also include attention to decoding strategies using both letter-sound relationships and context-based strategies; because as Vellutino & Scanlon (2002) note, an over-reliance on either one strategy will likely impede a child's acquisition of an adequate sight vocabulary and progress in reading.

All lessons will contain the five components and they will all be delivered in a one-to-one setting, but the lessons will vary according to:

1. The length of each lesson.
2. The degree of focus on each lesson component. The degree of focus means, for each component, how many instructional minutes are spent on teaching, or reviewing.
3. The frequency of the lessons.

Target Population. The target population is students between the ages of six and nine (inclusive) who are having the greatest difficulty with beginning reading. These are students who have been identified as learning disabled (according to state definitions) and have individualized education plans (IEPs) that identify progress in reading as a goal. They have already been identified as needing special education services for reading and are working with an alternative reading program from the one used in their classrooms; they are at least one grade level behind their age peers in reading achievement and all are working at a beginning reading stage.

We exclude younger students who are in kindergarten because we are working from a perspective that students should first have access to classroom instruction as their initial tier of instruction, before being referred for testing and having an IEP for reading instruction (Fuchs & Fuchs, 2002). We acknowledge that there are students who are older than 9 who also have IEPs for reading who meet these criteria but we must exclude them because the theoretical base from which we draw is related to younger students who are encountering severe difficulty with beginning reading and writing. While we know that older children are just as in need, it is important that development work be targeted and focused. Our findings may inform work with older students.

Instructional Setting. The lessons will be delivered one-to-one and not in small groups. One reason is that we are targeting children who are having the greatest difficulty learning to read so we therefore assume that the most intensive instructional setting will be needed (Fuchs and Fuchs, 2006). In addition, all available evidence consistently demonstrates larger effect sizes for individualized instruction over small group for beginning readers having the greatest difficulty learning to read (See D'Agostino and Murphy, 2004; Brown, Morris & Fields, 2005, Schwartz, 2005). The special education directors with our district partners have already indicated that providing one-to-one instruction will not be an issue for this development project; the schools teams have already identified students who need this instructional format because they have not responded to whole or small group instruction.

We will vary the frequency of lessons. Even though there is consensus amongst many researchers that intensive instruction delivered daily is more potent than periodic lessons (Gersten et. al, 2008, Vellutino & Scanlon, 2002), we want to vary this lesson feature and test it as part of our development work. We know from our experience working with special education teachers that scheduling challenges make it very difficult for some to teach students on a daily basis. It may be however, that this development work might indicate that for this particular population of students, daily lessons are related to higher student outcomes and this would be a useful finding for educators.

Four-Stage Development Plan. The development work will proceed according to a four-stage plan to help us determine the lesson format that will best accelerate the progress of students with disabilities in restrictive settings for their beginning reading instruction.

Stage 1, Initial Lesson Development. (January – June, 2015): Our development work will take advantage of the fact that each university partner to this grant has already-trained coaches (also called teacher leaders) who are highly skilled at working with teachers to support instructional change. These coaches have already completed 21 semester hours of in-residence graduate coursework with the faculty learning how to coach teachers, provide school visits to teachers to observe teaching and provide support, collect data and submit it to a secure database for analysis. They are employed by the school districts that will partner with us on this proposal to train their teachers.

Faculty will each work with these already experienced literacy coaches at each of the four partner institutions in order to accomplish two deliverables between January and June 2015: develop a lesson format that incorporates the five lesson components and develop common syllabi for two graduate courses for the special education teachers. During this initial six-month development period in Stage1, the coaches will each work with at least one student in order to test out and develop the lesson components.

Stage 2, Natural Variation. (July 2015- June 2016) The coaches and faculty at each institution begin training 10 special education teachers (40 teachers in all) in the lesson components. The teachers begin working with 4 students each from the targeted population. The teachers will be enrolled in the first graduate class in fall semester as they learn about the lesson components and about formative assessment. No instructional time will be lost; the teachers will begin working with their four targeted students as soon as they enroll in the graduate coursework.

As the teachers begin working with students, they will continuously track their progress by administering daily running records (Clay, 2005) and weekly DIBELS word

identification fluency tests. (See Clemens et. al, 2014 for a justification for using WIF to monitor reading growth.) They will enter the data in a secure web-portal maintained by Ohio State's International Data Evaluation Center (IDEC), which create graphs for the coaches and teachers that indicate if the students are making adequate progress based on the growth required to reach our exit goals per grade. If the student is progressing at an adequate or better rate, they will continue with the instructional plan that they established for the student based on the student's pretest scores. If the student's growth is inadequate, they will, with input from their coaches, vary the student's instruction until progress monitoring indicates greater growth. Our exit goals for students are:

- Reading at a text reading level (90% accuracy or better) that is comparable to at least the lowest reading group in the peer classroom.
- Word recognition fluency task from DIBELS.

In this natural variation in Stage 2 of our development work, the teachers will begin by graphing for each student, a target reading level and a target word recognition fluency rate to be achieved by the students at the end of the school year. Each week, teacher and coaches will check the student progress against the exit goal and, depending on the students' progress, make decisions to vary at least one of three features of the lessons: (1). Degree of focus on each lesson component. The degree of focus means how many instructional minutes are spent on each component. (2). Length of the lesson. (3). Frequency of the lessons.

The teachers will keep detailed lesson records of their instructional changes which we will analyze using qualitative methods to better understand variation in teacher decision-making and the relationship with student outcomes. They will also enter data

about the three features into a secure, already-established web portal, along with the student monitoring scores. As a sufficient amount of data are amassed during Stage 2, we will use hierarchical linear modeling (HLM) to statistically model student growth on running records and word identification, and predict growth with instructional variables (component emphasis, lesson length, and lesson frequency) that will be gleaned from the on-line instructional logs.

We will pay particular attention to periods of growth acceleration, or those periods when student learning increases more rapidly. It will be possible to develop rather detailed growth models given the numbers of testing points available per student (daily and weekly). The growth model at the student level will be:

$$Y_{ti} = \pi_{0i} + \pi_{1i}a_{ti} + \pi_{2i}a^2_{ti} = e_{ti},$$

where Y_{ti} indicates the test score for the "ith" student at the "t" time point, that is predicted with the estimated score at baseline (coded 0), π_{0i}, a linear growth rate, π_{1i}, a quadratic growth rate, π_{2i}, reflecting acceleration, and a residual term per student, e_{ti}. The baseline, linear, and acceleration values are expected to vary across students, and will be predicted with instructional variables at Level Two (see Raudenbush & Bryk, 2002). We will include the instructional variables coded at given time points to ascertain which instructional approach is best associated with student growth. That is, we will predict the variation in π_{1i}, and π_{2i} with the instructional configurations at each given time period to elucidate the instructional features that best coincide with general linear growth and acceleration These analyses will inform us as to which instructional models should be trialed in Year 2 in terms of the instructional activities, the frequency of lessons and the number of instructional minutes per lesson.

This work does not constitute the external evaluation but instead will serve as our formative evaluation to further refine the intervention for Stage 3. The results of the formative evaluation will be communicated to coaches and teachers and integrated into the professional development for future teachers. We anticipate that the formative evaluation based on teachers' and coaches' expert decision-making and results of the HLM analysis will not produce one clear cut instructional model that works uniformly well, but rather, we expect a number of possible effective instructional configurations to emerge. In the following year during Stage 3, we will develop and implement a number of designs that appear to work well and test them as part of a planned variation.

Stage 3: Planned Variation, July 2016 – June 2017). The second cohort of special education teachers is trained. Like the first cohort of 40 teachers, these 48 Special Education teachers will work with the same population of students and enroll in two graduate courses with the faculty; 12 teachers at each university. The first cohort of 40 teachers work with four students in Stage 3.

The 192 students will be randomly assigned to one of the instructional models developed from the first year. At the beginning of their second semester of training, the second cohort of teachers will join the first cohort, adding 48 more teachers to the project and 192 more students for the Planned Variation stage. Until we have experienced the Natural Variation phase, it is impossible to predict how many models will be trialed in Year 2 and how they will vary.

Stage 4: Replication. July 2017 – June 2018). In Stage 4, we will be able to identify one – two instructional models from Stage 3 that we will attempt to replicate. We will train a third cohort of 48 teachers (12 at each university, 136 teachers in all) who will

follow a similar training plan as the first two cohorts (See Table 3). See the Management Plan later in this narrative for a more complete description of a timeline for all grant activities.

Table 3. Four Stage Development Plan

Grant Period	Stage	Core Development Activities
Jan.2015 – June 2015	One	Initial lesson framework developed.
July 2015 – June 2016	Two	First cohort of teachers trained (n=40)
July 2016 – June 2017	Three	Second cohort of teachers trained (n=48)
July 2017 – June 2018	Four	Third cohort of teachers trained (n=48)

Our project represents a novel approach to a common, persistent problem: improving academic outcomes for students with disabilities. At the conclusion of our project, we will have developed a novel instructional model for special education students that can be validated and taken to scale. We include a logic model in Appendix D with our conceptual framework and to identify the key components and outcomes

Potential Risks to Project Success and Strategies to Mitigate

Each teacher needs to provide daily lessons on a one-to-one basis to four students between the ages of six and nine years old who is identified as learning disabled in accordance with state regulations and has a reading goal in their IEP. This is a narrow population but it is narrow by design. We do not expect that the resulting intervention will need teachers to teach four students each, that number is only important for our development work so that there is enough power in the design to draw reasonable conclusions about what may work.

We have partnered with school districts that have schools are large enough to participate in this study and the administrators have already indicated that their special education teachers will be able to implement our research design.

Attrition of schools, districts and students is always an issue for multi-year studies. In order to mitigate this risk, we will work in large schools where teachers have already identified more than four students who fit our target population. We will also request that participating school districts complete a Memo of Agreement. While MOAs are by nature not legally binding, we have found them helpful in past projects in that they clearly outline the commitments of both the university and the district and greatly enhance communication, particularly so when there is a change in district administration. See Appendix G for a sample MOA.

Ensuring the Success of the Project

A key to ensuring the success of the project is good communication between the partners and this is all the more so when the grant activities involve development work. As described earlier in this paper and in the Management Plan that follows, we have a four-stage plan to develop and test a lesson framework and this work will require close communication and monitoring.

Management Plan and Personnel

Monitoring Project Goals

There are numerous challenges to managing a multilevel project with four university training centers. We have assembled a team with many years of funded project experience and with experience providing professional development to teachers.

The team will work together to accomplish the project activities but as shown in the Table which follows each objective will have a key personnel taking the lead.

Table 4. Key Responsibilities, Timeline and Milestones

Objective	Key Responsibilities	Key Personnel
Objective 1 Develop an instructional format based on strong literacy theory for children with disabilities who are placed in restrictive environments for their beginning reading instruction	Develop five lesson elements, fluency instruction, word recognition, letter identification, phonemic awareness and decoding strategies, for the natural variation phase in Year 1. Redesign the lesson framework for Year 2 based on the outcomes from Year 1. Develop the intervention for the Year 3 Replication phase.	Rodgers D'Agostino
Objective 2 Provide professional development to four already-trained coaches at each university. (*n*=4)	Identify four literacy coaches at each institution. Between January and June 2015, the faculty work with the four coaches and with each other to develop the lesson framework.	Rodgers
Objective 3		

Conduct an internal, natural variation study to identify which features work best in concert to improve student's achievement levels	Collect and analyze data. Conduct interviews with teachers Provide findings to university partners at each stage of development (natural, planned, replication) to inform development of the intervention. Prepare reports and articles	D'Agostino
Objective 4 Prepare 136 Special Education teachers to deliver the intervention	Design recruitment materials Recruit candidates at partner schools Offer 2 graduate courses for the teachers to learn the instructional elements.	Rodgers
Objective 5 Conduct a rigorous outside project evaluation.	Coordinate between the external evaluator and the partners as needed. Provide information to the external evaluator about the project.	D'Agostino

Table 5 presents our annual performance targets and metrics to assess our progress.

Table 5. Annual Performance Targets and Metrics for Progress Assessment

Jan. 2015 – June 2015 Stage One	• As part of their professional development, four already trained literacy coaches at each university teach a student from the target population to help to develop the framework.

	• Faculty collaborate and work with the teacher leaders; an evidence-based lesson framework containing the five core components to deliver optimal reading instruction is developed for Year 1.
July 2015 – June 2016 Stage Two	• First cohort of special education teachers (n=40) are trained. • Each teacher works with 4 students (n=160). • Internal, natural variation study undertaken • External evaluation begins.
July 2016 – June 2017 Stage Three	• 12 more special education teachers at each university are trained; 48 teachers in all. • All special education teachers (n=88) work with 4 students (n=352). • Planned natural variation study undertaken.
July 2017 – June 2018 Stage Four	• 12 more special education teachers at each university are trained; 48 teachers in all. • Each special education teacher (n= 136 in all) works with 4 students (n= 544 in all). • Replication study undertaken.
July 2018 – Dec. 2018 Stage Five	• External evaluation complete. • Lesson framework complete. • Complete final reports. • Subcontracts closed and budgets finalized.

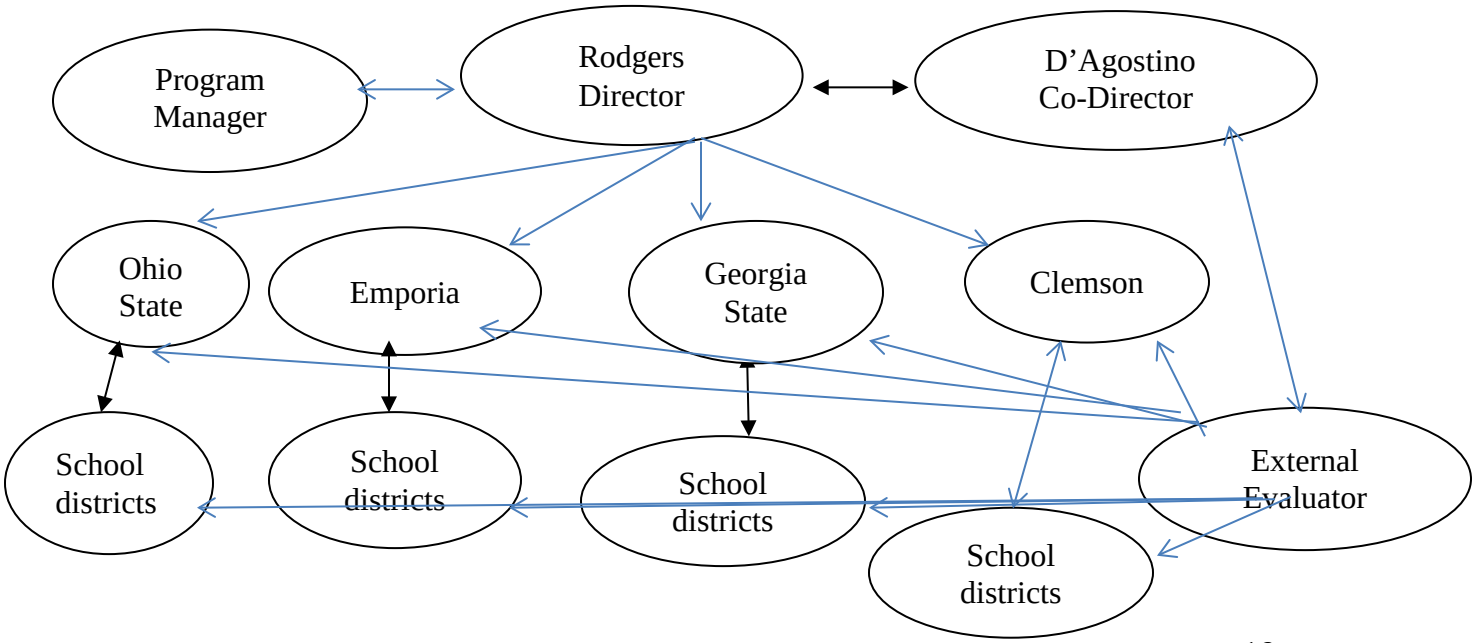
Commitment of Key Partners and Evidence of Support

Appendix G contains letters of support from our partnering school districts and from the three university partners, Georgia State University, Clemson University, and Emporia State University. The impact on numbers of teachers and students will be small due to the development nature of this project. Appendix G also contains a sample MOA.

Procedures for Ensuring Feedback and Continuous Improvement

Though each member of the project will communicate with individuals at various levels of the system, members will have primary lines of communication in order to operate in an efficient manner. As depicted in the figure, Dr. Rodgers (Director) will interact continuously with the Program Manager to monitor the budget and the implementation plan. The Co-Director will work with the external evaluator to ensure that IRB guidelines are followed and to support efficient data collection. Drs. D'Agostino and Rodgers will work closely with each other and the partner university faculty to discuss issues related to development, and the partners will spend considerable time and effort recruiting eligible teachers. The external evaluator, Dr. Konstantopoulos will work to ensure data collection in cooperation with Dr. D'Agostino.

Figure. Procedures for Feedback and Support



Experience Managing Projects

The Ohio State University personnel will include Associate Professor Emily Rodgers as project director, Professor Jerome D'Agostino as co-director, and a Program Manager who will be hired if the project is funded. The external evaluator is Spyros Konstantopoulos from Michigan State University. One university faculty member will lead the development work at the partnering universities: Dr. Annie Opat at Emporia State, Dr. Susan Duncan at Georgia State and Dr. Celeste Bates at Clemson. As the resumes included in Appendix F demonstrate, all personnel bring a great deal of experience with successfully managing funded projects and working with school districts to provide professional development for teachers.

Project Director. Emily Rodgers, Associate Professor in the School of Teaching and Learning in the College of Education and Human Ecology at The Ohio State University, is currently the project co-director for a $45 million i3 Scale Up grant (2010 – 2015). Dr. Rodgers was a classroom teacher and a special education teacher for nine years before earning her Ph.D. from Ohio State in 1998 with a specialization in early reading and reading difficulties. Her research interests include reading difficulties and teacher professional development. She studies teaching and learning with a particular focus on understanding scaffolding processes in the contexts of teaching young children having great difficulty learning to read and coaching teachers.

As project co-director for a successful i3 scale-up grant, Dr. Rodgers has gained a great deal of relevant experience including recruiting schools, working with the private sector to raise matching funds and collaborating and communicating with multiple

university partners and an external evaluator to successfully carry out the project objectives for the scale-up grant.

She has published numerous articles and book chapters about teaching and coaching, including a co-authored volume published by Teachers College Press, *The Effective Literacy Coach*. She has served as a reviewer for four journals including *The Reading Teacher, Journal of Literacy Research, Reading Research Quarterly* and *Educational Evaluation and Policy Analysis*. She served as a consultant on two IES funded projects including a federally funded study of teacher professional development to develop rubrics for teacher practice.

Dr. Rodgers has co-directed OSU's Reading Recovery network since 1998, working with up to 130 coaches in 8 different states over the last 12 years. She has collaborated with the Ohio Department of Education since that time to co-direct the Ohio Reading Recovery network of teacher leaders and teachers and designing and delivering professional development to coaches.

Project Co-Director. Jerome V. D'Agostino, Professor of Quantitative Methods in the Education and Human Ecology College at The Ohio State University, will serve as the co-director of the project. Dr. D'Agostino earned his Ph.D. in 1997 from The University of Chicago in Measurement, Evaluation, and Statistical Analysis (MESA). He specializes in program development and evaluation and assessment construction.

Most recently, Dr. D'Agostino is the director of the $45 million i3 Scale-Up grant for Reading Recovery (2010-2015). In that capacity he has successfully directed the grant activities across 19 partnering universities. All project objectives are being met.

In addition, Dr. D'Agostino has been either a principal investigator or co-investigator on several state- or federally-funded projects. He has considerable experience managing large grant budgets and distributing grant resources to participants.

Dr. D'Agostino also has orchestrated evaluations of literacy and science programs, and interventions targeted for underprivileged children and families. He has extensive experience working with educators to develop formative assessments to monitor learning, and he has conducted workshops throughout the country on classroom grading and test score interpretation for teachers. Much of his work has involved classroom observations and teacher interviews and he has helped schools in Chicago and Arizona that had been identified for Title I program improvement. He has served on state testing technical review committees, and was awarded a Spencer/National Academy of Education Postdoctoral Fellowship to study teacher tests. He presently serves on the editorial board for the *Journal of Psychoeducational Assessment* and *Reading Research Quarterly*. His research has been funded by the National Science Foundation, United States Department of Education, and Spencer Foundation.

Evaluation

The formative evaluation model described earlier that will be a key aspect of the Cohort 1 design will be led by the co-director, Dr. D'Agostino, and will be separate from the external evaluation. The participating teachers will use the on-line data entry portal developed by The International Data and Evaluation Center (IDEC) at OSU to enter all of the teacher survey or log and student data. Each year, a data file will be provided to Dr. Konstantopoulos by IDEC so that he can conduct the external analyses.

A randomized-trial experiment within each school will be conducted in all three years in which teachers implement the intervention. Because the treatment will be implemented in fairly large schools, the schools will have the necessary number of students needed to produce sufficiently reliable overall treatment and school-specific effect estimates. Eight eligible children will be identified per school and ranked from lowest to highest based on pretest scores. The lowest two children will be randomly assigned to either the treatment or control group, and each remaining pair of students also will be randomized to groups in this fashion, creating four block-randomized student pairs. This model allows for some attrition to occur per school. That is, if a student from a pair leaves the school, the pair is dropped. If more than two pairs are dropped, the school will be removed from the study.

School, Teacher and Student Numbers

In Year 1 (Stage Two, 2015-16) there will be 40 teachers in 40 schools working with 160 children. Thus, 320 children will be randomly assigned to either treatment or control, eight children total per school. In Year 2 (2016-2017) there will be 48 new teachers in 48 schools. Assuming a 10 percent attrition rate from the first cohort, the new teachers are expected to join 36 teachers from Year 1. Thus, we anticipate 84 teachers in 84 schools in the study in Year 2, offering the intervention to 336 children with 336 control students. In Year 3, expecting a 10 percent attrition rate from the first two cohorts, we anticipate that about 75 teachers will continue to offer the intervention and be joined by 48 new teachers, resulting in a sample of 123 teachers in schools offering the treatment to 488 children with 488 control students.

Measures

The treatment and control students from each randomized pair will be administered a standardized, external literacy test, such as the Iowa Test of Basic Skills, after the treatment student is exited from the intervention. The chosen test will yield scores in multiple literacy domains such as Alphabetics, Word Knowledge, Fluency, Comprehension, and Total Reading Achievement.

Power Estimation

The design is conceptually a two-level block randomized design where teachers (or schools since there is one selected teacher per school) are the blocks and random assignment takes place within each teacher. Pre-test scores are used to match students in pairs within each teacher. Students within each matched pair are randomly assigned to the treatment or the control condition. Teachers (the blocks) are treated as random effects.

Often one resorts to prior research findings to generate an expected effect size, but this can be difficult to accomplish for innovative development-stage interventions with no research directly on the program. The WWC offers some guidance in defining effects. According to its criteria, a 0.25 effect size or greater is considered to be “substantively important” (WWC, 2007). Yet this value is arbitrarily chosen and does not consider the context of the intervention. Indeed, as stated in the Significance section, many of the interventions for learning disability students have produced null effects or very small effects (except for the PALS program that produced effects from 0.36 to 0.75). The normative effect size in the context of interventions for students with learning disabilities is a near zero effect.

In terms of setting an expected benchmark for the proposed intervention, we will anticipate a 0.25 effect, but lower effect sizes in this context may be beneficial as well.

In the first year of the study our sample will include overall 40 teachers and 320 students. Suppose that the intraclass correlation among teachers is 0.20 (i.e., 20 percent of the variance in achievement is between teachers) and that student level predictors explain nearly one-third of the achievement variance. Given these estimates we will be able to detect an effect size of 0.25 standard deviations (SD) with an 80 percent chance (i.e., power of 0.80). In the second year our sample will include 84 teachers and 672 students. We will be able to detect an effect size of 0.17 SD with an 80 percent chance (i.e., power of 0.80) all other things being the same.

In the third year our sample will include 123 teachers and 984 students. We will be able to detect an effect size of 0.14 SD with an 80 percent chance (i.e., power of 0.80) all other things being the same. Thus, the lowest detectable effect will be at the WWC expectation of 0.25 in the first study year, and will decrease due to larger sample sizes in the last year to 0.14. Even a treatment effect of the latter value will be useful in the area of educating students with learning disabilities given the normatively weak effects produced by extant programs.

Data Analyses

Analyses will be conducted separately for each of the three years (thus, yearly study replication) and based on all three years of data. Hierarchical linear modeling (HLM) will be employed to take into account the nesting of students within teachers. The overall average treatment effect will be computed, and the variation in teacher effects will be examined as well. Because there will be one teacher offering the treatment per school, the school effects in a sense are equivalent to teacher effects. It will be expected that teachers will vary the emphasis on the five lesson components and the amount of

time spent per lesson. Variables that capture the instructional differences will be developed from responses to a teacher survey or log. Those instructional variables will be used to predict variation between teachers to understand the instructional configurations that led to the greatest and least student outcomes and to develop the most powerful and beneficial instructional approach.

Within each year a two-level model for student *i* in teacher *j* is

$$y_{ij} = \beta_{00} + \beta_{01}T_{ij} + \mathbf{B}_{02}\mathbf{X}_{ij} + \mathbf{B}_{30}\mathbf{Z}_j + u_{0j} + \varepsilon_{ij}$$

where y is the outcome variable, T is a binary indicator for the treatment (control being the reference group), **X** is a matrix of student level predictors such as prior scores, SES, etc, **Z** is a matrix of teacher level predictors that capture instructional differences, u is a teacher random effect and ε is a student random effect. The variance of u captures the nesting of students within teachers. All student level variables will be treated as fixed at the second level. The most important regression coefficient is β_{01} that estimates the treatment effect. All other betas will estimate the effects of student and teacher predictors on student outcomes. To control for potential differences across teachers (since random assignment was at a lower level) we will group-mean center (at the teacher mean) level-1 predictors especially the treatment. This type of centering is equivalent to controlling for teacher fixed effects (i.e., dummies) (Konstantopoulos, 2009).

Within each study year, separate HLM models will be computed for each outcome variable provided by the chosen literacy achievement battery. Similar HLM models will be used to analyze the data across years; however, those models will also include dummies for student cohorts (e.g., third and second cohort versus first cohort). Interactions between treatment and cohorts will also be explored.