

## Supporting Statement A

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## Justification

The U.S. Department of Education (ED) requests OMB clearance for data collection related to the Regional Educational Laboratory (REL) program. ED, in consultation with REL Northeast and the Islands (REL-NEI) under contract 91990022C0013 has planned a study of the efficacy of a professional development program for seventh grade math teachers in the state of Connecticut. This program is referred to as the “Visual Access to Mathematics Professional Development” or VAM-PD. OMB approval is being requested for REL-NEI’s data collection for this project, including pre and post measures of student skills and attitudes, and teacher knowledge, beliefs, and feedback regarding instructional practice.

The study will also draw upon administrative data that the Connecticut State Department of Education (CSDE) collects, including student and teacher characteristics. Student characteristics include gender, race, ethnicity, MLL status, special education status, free and/or reduced lunch status, and performance on grade 6 and grade 7 state standardized assessments of math, and teacher characteristics include licensure information and years of experience. OMB approval is not being sought for this administrative data since these are collected by the state and not REL-NEI. There is a data sharing agreement being negotiated with CSDE now and we fully anticipate CSDE entering into an agreement to share this data. The data sharing agreement outlines the specific variables CSDE will share with REL NEI and the process both parties will use for transferring and obtaining this data. A copy of this agreement can be provided once it is finalized

### 1. Circumstances Necessitating Collection of Information

This data collection is authorized by the Educational Sciences Reform Act (ESRA) of 2002 (see Appendix A). Part D, Section 174(f)(2) of ESRA states that as part of their central mission and primary function, each regional educational laboratory “shall support applied research by . . . developing and widely disseminating, including through Internet-based means, scientifically valid research, information, reports, and publications that are usable for improving academic achievement, closing achievement gaps, and encouraging and sustaining school improvement, to—schools, districts, institutions of higher education, educators (including early childhood educators and librarians), parents, policymakers, and other constituencies, as appropriate, within the region in which the regional educational laboratory is located.”

### Statement of Need

Facilitating improved mathematics teaching and learning for multilingual learners (MLLs)<sup>1</sup> is a high-leverage need in Connecticut and across the country. Research shows that MLLs have fewer opportunities for rich mathematical learning opportunities than other students (for example, Varley

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<sup>1</sup> Throughout this proposal, we use multilingual learners (MLLs) as an asset-based term for students identified as English learners by their districts or schools. The Connecticut State Department of Education uses both multilingual learners and English learners as phrases to describe this student population.

Gutiérrez et al., 2011), and creating equitable learning opportunities for MLLs means they must have access to rich mathematical tasks (Moschkovich, 2013). Only 14 percent of MLLs in Connecticut met or exceeded proficiency in math on the 2018/19 state assessments as compared to 51 percent of their non-MLL counterparts (CSDE, 2021), and addressing learning opportunity gaps in mathematics for MLLs has become one of the state’s areas of priority. These challenges reflect the national landscape, with MLLs scoring significantly below non-MLLs on National Assessment of Educational Progress (NAEP) mathematics assessments. For grade 4 and grade 8 students, the difference in NAEP mathematics scale scores between MLLs and non-MLLs has been at least 20 points since 1996, when analyses by English learner (EL) status began; in 2017, the average grade 8 math score was 39 points—the equivalent of four grade levels—lower for MLLs than for non-MLLs (McFarland et al., 2019). These data suggest that business-as-usual instruction is not meeting MLLs’ needs, which in turn may be associated with decreased academic and career success for MLLs (NASEM, 2018).

Given this high-leverage need, the Connecticut State Department of Education (CSDE) aims to close gaps between students who are MLLs and monolingual students in math proficiency and to better prepare the state’s MLLs for high school completion and postsecondary success. During the next five years, REL Northeast & Islands (REL NEI) is partnering with CSDE and other stakeholders, through the Connecticut Partnership to Support Multilingual Learner Mathematics Outcomes, to work toward the long-term outcomes of increasing educators’ knowledge of instructional practices for MLLs in mathematics and increasing middle grade MLLs’ achievement in mathematics.

In addressing this high-leverage need, the partnership will attend to the high-leverage mathematical content focus of proportional reasoning; this focus was selected with input from partnership members. Proportional reasoning content, first introduced in grade 6, is central to grade 7 mathematics content standards (for example, National Governors Association & Council of Chief State School Officers, 2010); is associated with students’ later mathematics achievement (Empson et al., 2011; Siegler et al., 2012), and is “the most difficult to teach, the most mathematically complex, the most cognitively challenging, the most essential to success in higher mathematics and science” (Lamon, 2007, p. 629). Proportional reasoning is also rich with language, so opportunities abound for teachers to support MLLs’ language use.

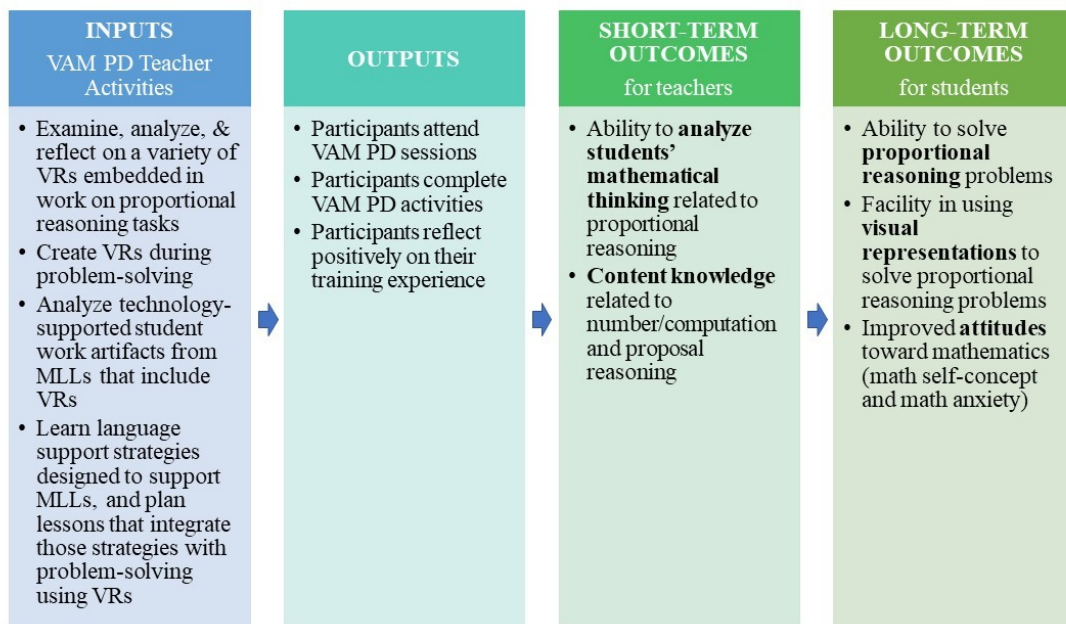
Furthermore, a focus on addressing this need through teacher professional learning is important because many teachers have not had access to training and support to develop their understanding of how to implement best practices for MLLs *in the context* of content areas. A review of 75 peer-reviewed empirical studies about teaching MLLs in mathematics (de Araujo et al., 2018) identified a lack of research on facilitating teacher learning and the need to strengthen connections between EL-focused teacher learning initiatives and mathematics-focused efforts. Partners at the CSDE and at Connecticut professional organizations who are focused on mathematics teaching and learning and/or on MLLs also have noted that business-as-usual professional learning practice for teachers in Connecticut has lacked an integrated language and mathematics content focus. The majority of students identified as MLLs in the state of Connecticut are taught mathematics by general education classroom teachers (CSDE, 2020). In response, our study proposes to leverage Visual Access to Mathematics professional development (VAM PD) (DePiper, et al., 2021b, Louie et al., 2022, DePiper et al., 2019 & DePiper, et al., 2021a) to provide needed resources to general education

teachers with MLLs in their classrooms, as opposed to teachers who provide ESL services or bilingual education (such as push in, pull out).

In line with these needs for MLLs in mathematics instruction, CSDE and other Connecticut partners have indicated a need for resources and professional learning for mathematics teachers in Connecticut related to meeting the needs of MLLs in their classes. An important next step is therefore to identify how professional learning programs that draw on existing research about best practice for MLLs in mathematics can fill this gap in resources for teachers. As part of the REL-NEI partnership with Connecticut, we propose an applied research study that will evaluate the impacts of the existing evidence-based VAM PD program for teachers and their students in Connecticut.

### Overview of Study Design

The purpose of the study is to evaluate the efficacy of the Visual Access to Mathematics Professional Development (VAM PD) program on teacher and student outcomes. The efficacy study is based on the following logic model:



The study will address the following research questions related to the impact of the program, with questions 1, 1a, and 2 designated as confirmatory:

- **RQ1)** What is the impact of VAM PD on students’ proportional reasoning ability, facility in using visual representations (VRs) to solve proportional reasoning problems, and mathematics attitudes?
  - **RQ1a)** To what extent does VAM PD’s effectiveness differ for multilingual learners (MLLs) vs. non-MLLs?
- **RQ2)** What is the impact of VAM PD on teachers’ ability to analyze student thinking related to proportional reasoning and teachers’ content knowledge of number/computation, particularly proportional reasoning?
  - **RQ2a)** To what extent do these teacher outcomes relate to the student outcomes described under **RQ1**?

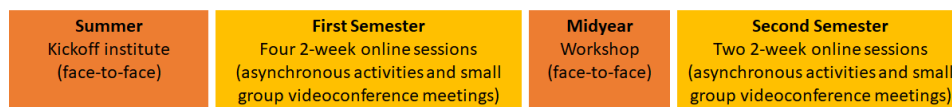
A third research question pertains to program implementation:

- **RQ3)** To what extent is VAM PD implemented with fidelity, in terms of the provision of the PD and teacher participation in the PD?

The study will randomly assign schools to either participate in the VAM PD for 7<sup>th</sup> grade math teachers (treatment group) or implement business as usual professional development for 7<sup>th</sup> grade math teachers (control group).

VAM PD is an 8-month online and face-to-face professional learning experience designed to support middle grades mathematics teachers who have both multilingual learners and monolingual students in their classes. The PD starts with a 3-day face-to-face Summer Institute and continues during the school year with a combination of synchronous and asynchronous online activities and face-to-face workshops (figure 1).

Figure 1. VAM PD Structure, Goals, and Sessions



Goals
<p><b>Teachers will increase their:</b></p> <ul style="list-style-type: none"> <li>• Knowledge of how to create and use visual representations for mathematical problem solving in ratio and proportion content.</li> <li>• Ability to analyze visual representations to understand the mathematical thinking of students who are MLLs. This includes increasing their ability to identify, describe, and interpret evidence of student thinking.</li> <li>• Ability to plan lessons that integrate support for MLLs’ use of visual representations in ratio and proportion problem solving and for their mathematical communication.</li> <li>• Mathematical knowledge to support teaching of ratio and proportion content integrated with Standards for Mathematical Practice.</li> </ul>

<b>VAM PD Session</b>	<b>Mathematical and Visual Representation Focus</b>	<b>Other Core Activities</b>
Summer Kickoff Institute	Introduction to Visual Representations; Fraction Magnitude and Number Lines; Fraction Operations and Visual Representations (VRs); Rates and Ratios and Double Number Lines	Building mathematical learning community; orientation to VAM PD assets-based perspective on developing student strengths; modeling of language strategies integrated with mathematics; understanding and use of VRs including tape diagrams, number lines, and double number lines; analyses of MLL student work; structured lesson and curriculum planning to integrate strategies to support MLLs
Online Session 1	Mixing Paints Ratio Tasks and Double Number Lines	Selecting focus MLL students; analyzing MLL student work; noticing mathematical thinking and communication; exploring language access strategies; planning and classroom implementation of strategies
Online Session 2	Percentages and Partial Diagrams	Exploring partial diagrams and matching activities as scaffolds for access and classroom discussion; planning and classroom implementation of strategies
Online Session 3	Percent Change and Visual Representations	Learning about co-constructed word banks and use of differentiated questions; planning and classroom implementation of strategies
Online Session 4	Double Number Lines and Coordinate Graphs	Analyses of MLL student work; planning and classroom implementation of strategies
Midyear Workshop	Connecting Visual Representations to Symbolic Approaches	Analyzing MLL student work; learning about strategies for clarifying vocabulary
Online Sessions 5 and 6	Rates and Proportions and Summarizing and Reflecting on Learning	Discussion of sorting tasks as scaffolds for learning and communication; Final lesson project to bring together learning across the PD; Reflection on learning

The PD content for teachers incorporates research about use of VRs (for example, Woodward et al., 2012) and about integration of language support into mathematics for MLLs (for example, Baker et al., 2014). This prior research informs VAM PD content on ratio and proportional reasoning, recognizing that proportionality has been called the “cornerstone of higher mathematics and the capstone of elementary concepts” (Lesh, Post, & Behr, 1988, p. 98). The design of VAM PD builds

on evidence-based teacher PD strategies by focusing heavily on content, engaging in active and job-embedded learning, supporting teacher collaboration, modeling effective practice, providing coaching and expert support, and offering ongoing opportunities for feedback and reflection (Darling-Hammond et al., 2017; Lynch et al., 2019; Loucks-Horsley et al., 2010). By using evidence-based practices related to mathematics instruction and instruction for MLLs and related to professional learning for teachers, the VAM PD is hypothesized to have impacts for teachers and their students that will address the high-leverage need.

The project will include two analyses: 1) an *impact* analysis with confirmatory impact questions focused on student learning outcomes, and confirmatory and exploratory impact questions focused on teacher outcomes, and 2) an *implementation* analysis, designed to document the implementation of the VAM PD intervention to teachers in the treatment condition. The implementation analysis will provide useful information needed to interpret the findings regarding the impact of the program.

### **Overview of Data Collection**

The impact analysis on student learning outcomes will use student performance on four measures related to math, all of which have been previously psychometrically validated. Student measures will be administered in the fall and the spring of the 2023-24 school year and will provide a pre- and post-source of data with which to compare the performance of students served by teachers in the treatment group with performance of students served by teachers in the treatment group. Data collection for this study is not regularly recurring data collection and at this time there are no plans for a follow-up study.

Similarly, the impact analysis on teacher outcomes will use teacher performance on three measures related to mathematical understanding and instruction, all of which have been previously psychometrically validated. Teacher measures will be administered in the summer of 2023 (prior to VAM PD sessions) and the spring of 2024 and will provide a pre- and post- source of data with which to compare performance of teachers in the treatment group with the performance of teachers in the treatment group.

The implementation analysis will use extant data records from VAM PD implementation to document the number of hours of VAM PD attended, as well as the number of VAM PD assignments completed by each teacher participant in the treatment group. In addition, all teacher participants (e.g. treatment and control groups) will complete questions about the curriculum that they used, their 2023/24 mathematics PD experiences and their use of key classroom practices from VAM PD. This descriptive information about classroom context will provide information about service contrast that may be helpful in explaining results related to impacts on students who were taught by participating teachers.

REL NEI will administer all teacher measures electronically to all participating teacher (e.g. treatment and control groups) in the summer of 2023 prior to the first VAM PD session, and again in the spring of 2024 following the final VAM PD session. A copy of all teacher measures is included in attachment A.



REL NEI will administer three student measures electronically to all students served by participating teachers (e.g. treatment and control groups) in the fall of 2024 before any proportional reasoning content has been introduced, and again in the spring of 2023 following the final VAM PD session. In addition to completing three measures electronically, students will also complete one measure on paper. A copy of all student measures is included in attachment A.

**Table 1. Timeline for Data Collection**

Timeframe	Data Collection
Summer 2023	Administer teacher measures (pre-)
Fall 2023	Administer student measures (pre-)
Spring 2024	Administer teacher measures (post-) and student measures (post-)

The data collection timeline described in Table 1 assumes that OMB approval will be received prior to these data collection periods. If OMB approval is not received, no data collections will occur.

In addition to the data collection described here, additional student- and teacher- level data will be provided by the CSDE to support the impact analyses and interpretation. This data will include teacher characteristics (e.g. license/credential information) and student-level demographic data (for example, gender, race, ethnicity, MLL status, special education status, free and/or reduced lunch status, and performance on grade 6 and grade 7 state standardized assessments of math). The collection of this administrative data from CSDE does not require OMB clearance.

**2. How, by Whom, and for What Purpose Information Is to Be Used**

The results of this study will be used by state and district decision-makers to inform decisions regarding the types of professional development opportunities to provide to improve teaching and learning for all students including MLLs. The study will result in a report intended for district and state leaders who are responsible for supporting high quality teaching and learning for all students, including MLLs. Researchers will also facilitate discussions of the results with state and district leaders, and present findings at a practitioner focused conference.

**3. Use of Automated, Electronic, Mechanical, or Other Technological Collection Techniques**

The data collection plan reflects sensitivity to issues of efficiency, accuracy, and respondent burden. To address the study’s research questions, the contractor will collect data using electronic data collection tools when possible. The electronic tools include the following:

- An electronic data collection tool (e.g. Alchemer) that allows for the secure collection of informed consent from teacher participants.

- A secure electronic file transfer protocol site that allows CSDE, schools, and teachers to transfer administrative records to ED's contractor in an efficient and secure way.
- Online data collection tools (e.g. Alchemer) that allow for the secure collection of teacher and student measures, giving participants the opportunity to respond directly and eliminating the need for third-party data entry. All tools used by participants will be confirmed by IES as being 508 compliant before they are used.
- E-mail systems maintained by schools/districts and the contractor that allow for sharing unique links to electronic data collection forms for teachers and students.
- Mailed copies of all materials needed for student assessments, with return shipping provided.
- An electronic data collection tool (e.g. TeKnoclips.org) that allows for the collection of teacher survey responses to the Classroom Video Analysis assessment.

#### **4. Efforts to Avoid Duplication of Effort**

To the extent possible, this project relies on extant administrative data that is available on students, teachers, and schools. For example, student demographic characteristics, teacher preparation, and school characteristics will be provided by the state in order to minimize burden on individual participants. However, in order to rigorously understand the impact of VAM PD on teacher and student outcomes, additional data collection will be necessary, including surveys that are completed by treatment and control group teachers, as well as measures of student learning. Schools do not currently collect such implementation data on the program, and this type of information is not available from any other data source.

#### **5. Sensitivity to Burden on Small Entities**

This data collection has been designed with the understanding that some of the schools participating in this study will be small, possibly serving only grades 6-8 in one building, with 40 or fewer students per grade. To be sensitive to the capacity of small entities, we have worked with the state to ensure data collection is efficient and reasonable. Our state partners have agreed to provide demographic data that is already available, in order to take this reporting burden off small schools. Similarly, six of the eight information collections requiring OMB clearance will be electronic to reduce the length of time it takes respondents to comply. The requested data represents the absolute minimum amount of information required to meet the study objectives.

#### **6. Consequences to Federal Program or Policy Activities if the Collection Is Not Conducted or Is Conducted Less Frequently Than Proposed**

The Education Science Reform Act of 2002, Part D, Section 174 states that the central mission and primary function of the RELs includes supporting applied research and providing technical assistance to

state and local education agencies within their region (20 U.S.C. 9564). Failure to approve the data collections related to the evaluation of VAM PD will jeopardize this attempt to study this intervention and thereby prevent the REL-NEI contractor from fulfilling its mission.

This project also has the potential to inform researchers, practitioners, and policymakers more broadly. The Visual Access to Mathematics PD intervention not only incorporates the evidence about effective interventions for students and teachers described above but also has demonstrated important impacts on teacher outcomes through the use of rigorous designs (DePiper et al., 2021a, DePiper et al., 2021b, Louie et al., 2022) and therefore provides a good context for deepening the level of understanding concerning the impact of PD on student, and especially multilingual learner (MLL) student, outcomes in mathematics. The proposed efficacy study will add to the current knowledge by clarifying both student and teacher impacts in efforts to address MLLs' needs in Connecticut. Connecticut partners from CSDE and various professional organizations are interested in understanding how VAM PD addresses content-area teacher' needs for professional learning related to teaching MLLs' at the middle grades. This study will provide an evidence base for their decisions, and those of educational leaders elsewhere, about use of a PD program that incorporates evidence-based practices for MLLs in middle grade mathematics. Without this study, practitioners and policy makers will have less information on which to base decisions about professional development opportunities to support MLLs in mathematics.

## 7. Special Circumstances

This request for OMB clearance does not include any of the stipulated special circumstances and thereby fully complies with regulations.

## 8. Federal Register Announcement and Consultation

### a. Federal Register Announcement

A 60-day notice was published in the Federal Register (**Vol. 88 FR 3397, January 19, 2023**), providing an opportunity for public comments. One non-substantive comment was received. A 30-day notice was published (Vol. 88 FR 18303, March 28, 2023) to further solicit comments, with none received. ED will respond to both public and OMB questions, if any, and summarize the responses under 8a.

### b. Consultations Outside the Agency

ED and/or the REL-NEI contractor have consulted with the following groups on the availability of data, the soundness of the evaluation design for addressing evaluation questions, and the clarity of measures:

- Subject Matter Experts (SMEs) in research methodology and REL-NEI's core areas of emphasis, which was assembled by the REL NEI contractor. The SME reviewed the proposal for this research study, and provided feedback, recommendations, and suggestions. The REL NEI was required to provide a summary of feedback received and responses to SME feedback.

- An external peer review contractor to examine whether it is reasonable to expect that the intervention is capable of producing impacts, the analytic approach for examining teacher and student level outcomes, and the degree to which findings address the RQs and conclusions are supported by the data. The project plans were approved by an external review contractor, which is part of the REL program, in October of 2022.
- The data collection instruments and procedures in this project have all been reviewed and determined exempt by the American Institutes for Research (AIR) Institutional Review Board (IRB).

## 9. Payment or Gift to Respondents

To motivate teachers to participate, we will provide \$100 to each teacher upon their completion of the fall 2023 data collection activities and \$225 upon their completion of the spring 2024 data collection activities, for a total of \$325 per teacher. We will also inform them that data collection activities are anticipated to require no more than 4.5 hours outside of regular contract hours. As illustrated in the burden table, we estimate that teachers will spend no more than one hour and forty five minutes completing the three teacher measures at each time period (e.g., pre and post), for a total of 3.5 hours. In addition, we have estimated that teachers will spend no more than 1 hour total to support the administration of the student assessments. These incentives will be offered to all teachers in the study, regardless of whether they are in the intervention or the comparison group. The monetary amount was determined by calculating an hourly wage based on Bureau of Labor Statistics data regarding secondary teacher salaries in Connecticut. In light of the fact that CSDE has identified a statewide shortage of mathematics teachers for grades 4 through 12 (Russell-Tucker, 2021), we elected to base our incentives on the 90<sup>th</sup> percentile secondary teacher salary (\$103,740), which amounts to a \$72.04 hourly wage assuming 180 8-hr workdays. In addition, teachers in the intervention condition will spend approximately 7 hours outside of regular contact hours preparing for classroom implementation of instructional activities associated with their VAM PD participation; this time will also be compensated at the same hourly wage. The same compensation will be provided to teachers in the comparison condition in the subsequent school year, when the intervention is provided to those teachers after the conclusion of the study described here.

## 10. Data Confidentiality

ED's contractor for REL-NEI will follow the policies and procedures required by ESRA of 2002, Title I, Part E, Section 183. This requires "All collection, maintenance, use, and wide dissemination of data by the Institute" to "conform with the requirements of section 552 of title 5, United States Code, the confidentiality standards of subsection (c) of this section, and sections 444 and 445 of the General Education Provision Act" (20 U.S.C. 1232g, 1232h). These citations refer to the Privacy Act, the Family Educational Rights and Privacy Act, and the Protection of Pupil Rights Amendment.

In addition, for student information, ESRA states:

The Director shall ensure that all individually identifiable information about students, their academic achievements, their families, and information with respect to individual schools, shall remain confidential in accordance with section 552a of title 5, United States Code, the confidentiality standards of subsection (c) of this section, and sections 444 and 445 of the General Education Provision Act.

Subsection (c) of section 183 requires the Director of IES to “develop and enforce standards designed to protect the confidentiality of persons in the collection, reporting, and publication of data.”

Subsection (d) of section 183 prohibits disclosure of individually identifiable information as well as making the publishing or communicating of individually identifiable information by employees or staff a felony. All documents, consent forms, instruments, notification letters, and email reminders will provide the following language to inform research participants of the penalties to researchers for disclosing individually identifiable information.

Per the policies and procedures required by the Education Sciences Reform Act of 2002, Title I, Part E, Section 183, responses to this data collection will be used only for statistical purposes. The reports prepared for this study will summarize findings across the sample and will not associate responses with a specific school, district, or individual. Any willful disclosure of such information for nonstatistical purposes, except as required by law, is a class E felony.

The contractor for REL-NEI will protect the confidentiality of all information collected for the study and will use it for research purposes only. To protect confidential data, only the contractor’s data management staff, investigators, and research staff will have access to the data files on a “need-to-know” basis. Any identifiable variables, raw data, or derived variables will be stored in encrypted files on a secure data management site. Access to this site will be limited to staff assigned to the project. Any data obtained for this study will be used only for statistical and descriptive analyses. All identifiers will be destroyed as soon as they are no longer required. Study reports will not identify the name of any specific analysis unit (e.g., students, school staff members, or schools). In no case will information be reported when the total number for a quantity represents fewer than four cases. Moreover, any data that permit identity disclosure, when used in combination with other known data, will not be published or made available in restricted-use files.

All members of the study team have obtained their certification on the protection of human subjects in research, and REL-NEI staff members will also have federal security clearances. The REL study team will submit to the NCEE security officer a list of the names of all people who will have access to respondents and data. All staff members working on the project who have access to the data or to respondents will be required to sign a confidentiality pledge and affidavits of non-disclosure. The project team will track new staff and staff who have left the study and ensure that additional signatures will be obtained or clearances will be revoked.

Teacher participants and student guardians will be informed that project staff are committed to keeping data confidential, and that participation in the data collection activities is voluntary. The instructions for all online surveys will reiterate these points.

### 11. Additional Justification for Sensitive Questions

No questions of a highly sensitive nature appear in any instrument. In addition, participants will be informed that their responses are voluntary, and they may decline to answer any question.

### 12. Estimates of Hour Burden

The annualized number of responses is 36,784. Annualized reporting burden associated with this data collection is 11,280.96 hours. This burden estimate includes the time required for completing consent forms and completing all student and teacher level measures (e.g., reporting). This request does not involve any burden related to record keeping or third-party disclosure. For each data collection, the burden was estimated based on the contractor’s performance of similar collections and confirmed through pilot testing with former educators. To be conservative, the reporting burden estimates assume response rates of 100 percent.

**Table 2. Hour Burden Estimates**

<b>CONSENT FORMS</b>					
<p>All teachers participating in the study will receive consent forms to participate in the study. Parents or guardians for all students in each participating teachers’ 7<sup>th</sup> grade math class will receive an information sheet describing the study and asking them to return the form if they do not want their child(ren) to participate in the student data collection activities. The burden calculation assumes 40 students per teacher (for a total of 4000 students).</p> <p><i>For the purpose of calculating burden, the initial consent form burden requires an estimate of 5 minutes of time per respondent.</i></p>					
<b>Instrument</b>	<b>Person Incurring Burden</b>	<b>Number of Respondents</b>	<b>Responses per Respondent</b>	<b>Hours per Response</b>	<b>Total Burden (Hours)</b>
1. Teacher Consent Forms	Teachers	112	1	0.08	8.96
2. Parent Information Letter	Parents	4000	1	0.08	320
<b>TEACHER MEASURES</b>					
<p>All teachers participating in the study will be asked to complete three measures in the summer of 2023 and again in the spring of 2024. Two of these measures (Diagnostic Teachers Assessments in Mathematics and Science, Number/Computation Form (DTAMS), and the Classroom Video Analysis (CVA) will be identical at each timepoint. The third measure will include slightly different items at each time point, and as such as been listed twice in the rows below.</p> <p><i>The DTAMS is estimated to take no longer than 1 hour to complete at each time point.</i></p> <p><i>The CVA is estimated to take no longer than 30 minutes to complete at each time point.</i></p> <p><i>Each survey (e.g. pre and post) is estimated to take no longer than 15 minutes to complete.</i></p>					
<b>Instrument</b>	<b>Person</b>	<b>Number of</b>	<b>Responses</b>	<b>Hours per</b>	<b>Total</b>

	Incurring Burden	Respondents	per Respondent	Response	Burden (Hours)
3. Diagnostic Teachers Assessments in Mathematics and Science (DTAMS, Number/Computation Form)	Teachers	112	2	1.00	224
4. Classroom Video Analysis (CVA) assessment	Teachers	112	2	0.50	112
5. Teacher Characteristic Survey (pre)	Teachers	112	1	0.25	28
6. Teacher Characteristic Survey (post)	Teachers	112	1	0.25	28

**STUDENT MEASURES**

All students in each participating teachers' 7<sup>th</sup> grade math class(es) will be asked to complete four measures in the fall of 2023 and again in the spring of 2024.

*The Proportional Problem Solving (PPS) measure is estimated to take no longer than 50 minutes to complete.*

*The Visual Representation (VR) Measure is estimated to take no longer than 15 minutes to complete.*

*The Math Self Concept scale is estimated to take no longer than 7 minutes to complete.*

*The Math Anxiety scale is estimated to take no longer than 7 minutes to complete.*

Instrument	Person Incurring Burden	Number of Respondents	Responses per Respondent	Hours per Response	Total Burden (Hours)
7. Proportional Problem Solving (PPS) measure	Students	4000	2	0.83	6640
8. VR Measure	Students	4000	2	0.25	2000
9. Math Self Concept	Students	4000	2	0.12	960
10. Math Anxiety	Students	4000	2	0.12	960
<b>TOTAL</b>		<b>20,560*</b>		<b>3.48**</b>	<b>11,280.96</b>

Table Notes:

\*The total number of respondents in this table is the sum of the number of respondents for each information collection activity. Because some individuals will participate in more than one information collection activity, the total number of respondents in the table exceeds the total number of unique individuals who will respond.

\*\*The hours per response was rounded to the second decimal place for display only. Therefore, the total burden may not equal the product of the displayed hours per response and number of respondents.

### 13. Estimate of Total Cost Burden to Respondents or Record-Keepers

There are no start-up costs for this collection.

The total cost to respondents collectively across the entire study is \$33,353.88 (see Table).

**Table 3. Estimates of Annualized Costs for Respondents**

Tasks	Type of Respondent	Total Burden Hours	Hourly Wage Rate *	Monetary Cost of Burden
Staff consent form	Teachers	8.96	\$72.04	\$645.48
Parent information letter with consent form	Parent or guardian	320	\$23.42	\$7494.40
Teacher Measures DTAMS CVA Pre-Survey Post-Survey	Teachers	392	\$72.04	\$25,214.00
Student Measures PPS VR Measure PISA Math Self Concept PISA Math Anxiety	Students	10,560	\$0	\$0
<b>Total</b>		<b>11,280.96</b>		<b>\$33,353.88</b>

\*The hourly wage rates for parents and school staff are based on mean wage rates in Connecticut reported by the Bureau of Labor Statistics (2021). For parents, the overall median hourly wage rate in Connecticut is used (\$23.42). To estimate an hourly wage rate for teachers, we divided the 90th percentile secondary teacher salary (\$103,740) by 180 8-hour work days. Because students will take the survey and assessment during school hours, it is assumed that no costs will result from students participating in the data collection.

*Note.* The total burden hours and wage rates were rounded for display only. Therefore, the total monetary cost may not equal the product of the displayed burden hours and the wage rate.

### 14. Estimates of Annualized Cost to the Federal Government

The annualized cost to the federal government for all project activities is \$433,311. The estimated total cost for the five-year project is \$2,166,566.



**15. Reasons for Program Changes or Adjustments**

This is a new study.

**16. Plan for Tabulation and Publication and Schedule for Project**

The project will result in a 15-page report and a 1-page summary. In addition to the report, we will create an infographic for Connecticut district leaders about impacts of VAM PD for teachers and students. We will also create a video for district leaders that provides information about VAM PD and includes footage of VAM PD participants. With a CSDE partner, we will co-author a blog featuring findings and experiences and will share it via the newsletter and social media. We will also share findings in a webinar for district leaders that will be recorded and archived on the REL-NEI website, and we will plan to present findings at a practitioner-focused conference. Partnership leads and members will support dissemination, including through connections with the Connecticut mathematics and MLL organizations, as well as through the REL-NEI Governing Board.

We will provide one Restricted Use file, with all teacher and student data aggregated to the school level. All restricted use files are required to be reviewed by IES’ Disclosure Review Board. The Disclosure Review Board (DRB) comprised of members from each NCES Division, representatives from the Statistical Standards Program, and a member from each of the Institute of Education Sciences (IES) Centers. The DRB will review disclosure risk analyses conducted by the REL contractor to ensure that data released do not disclose the identity of any individual respondent. The DRB approves the procedures used to remove direct identifiers from restricted-use data files.

The project schedule is presented below:

Activity/Milestone	2022											
	01	02	03	04	05	06	07	08	09	10	11	12
Submit proposal and data management plan						D					F	
Submit IRB application										D	F	
Submit OMB										D		
	2023											
Finalize OMB						F						
Support recruitment/execute data sharing agreements	X	X	X	X	X	X	X					
Random assignment							X					
Collect pre-data								X	X	X	X	
Implement VAM PD								X	X	X	X	X
	2024											
Implement VAM PD	X	X	X	X								
Collect post-data			X	X	X	X						

Conduct analysis						X	X	X	X	X	X	X
	2025											
Conduct analysis and draft report	X	X	X	X	X	X						
Submit report							D					
	2026											
Report published	X	X	X	X	X	X	F					

D = Draft; F = Final; X = Months in which activity will occur

**17. Approval Not to Display the Expiration Date for OMB Approval**

Approval not to display the expiration date for OMB approval is not requested.

**18. Exception to the Certification Statement**

No exceptions to the certification statement are being sought.

**References**

Baker, S., Lesaux, N., Jayanthi, M., Dimino, J., Proctor, C. P., Morris, J., Geva, E., Kieffer, M. J., Lina-Thompson, S., Russell, R., Gersten, R., Haymond, K., McCallum, D., & Newman-Gonchar, R. (2014). *Teaching academic content and literacy to English learners in elementary and middle school* (NCEE 2014–4012). [http://ies.ed.gov/ncee/wwc/publications\\_reviews.aspx](http://ies.ed.gov/ncee/wwc/publications_reviews.aspx)

CSDE [Connecticut State Department of Education]. (2020). *Demographic trends of Connecticut’s English Learners (Sys 2015-16 through 2019-20)*. Connecticut State Department of Education. <https://portal.ct.gov/-/media/SDE/Performance/Research-Library/EL-DEMOGRAPHICS-10012020.pdf>

CSDE [Connecticut State Department of Education]. (2021). *EdSight insight to education data portal: Connecticut State report card 2015–2020*. [https://edsight.ct.gov/SASStoredProcess/guest?\\_program=%2FCTDOE%2FEdSight%2FRelease%2FReporting%2FPublic%2FReports%2FStoredProcesses%2FConnecticutReportCard&\\_district=State%20of%20Connecticut&\\_select=Submit](https://edsight.ct.gov/SASStoredProcess/guest?_program=%2FCTDOE%2FEdSight%2FRelease%2FReporting%2FPublic%2FReports%2FStoredProcesses%2FConnecticutReportCard&_district=State%20of%20Connecticut&_select=Submit)

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development*. Palo Alto, CA: Learning Policy Institute.

De Araujo, Z., Roberts, S. A., Wiley, C., & Zahner, W. (2018). English learners in K–12 mathematics education: A review of the literature. *Review of Educational Research, 88*(6), 1–41.

DePiper, J. N., Nikula, J., & Louie, J. (2019). Shifts in self-efficacy for teaching English learners: Emergent findings from mathematics teacher professional development. In S. Otten, A. G. Candela, Z. de Araujo, C. Haines, & C. Munter (Eds.), *Proceedings of the forty-first annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 547–551). St. Louis: University of Missouri.

- DePiper, J. N., Louie, J., Nikula, J., Buffington, P., Tierney-Fife, P., & Driscoll, M. (2021a). Promoting teacher self-efficacy for supporting English learners in mathematics: Effects of the Visual Access to Mathematics professional development. *ZDM Mathematics Education*, 53(2), 489–502.  
<https://eric.ed.gov/?id=EJ1295914>
- DePiper, J. N., Nikula, J., Buffington, P., Louie, J., & Tierney-Fife, P. (2021b). *Learning to attend to and interpret multilingual learners' mathematical thinking: A professional development story*. Manuscript submitted for publication.
- Empson, S. B., Levi, L., & Carpenter, T. P. (2011). The algebraic nature of fractions: Developing relational thinking in elementary school. In J. Cai & E. J. Knuth (Eds.), *Early algebraization: A global dialogue from multiple perspectives* (pp. 409–428). New York: Springer.
- Lamon, S. J. (2007). Rational numbers and proportional reasoning: Toward a theoretical framework. In F. Lester (Ed.), *Second handbook of research on mathematics teaching and learning* (pp. 629–668). Charlotte, NC: Information Age.
- Lesh, R., Post, T. R., & Behr, M. (1988). Proportional reasoning. In *Number concepts and operations in the middle grades* (pp. 93–118). National Council of Teachers of Mathematics, Lawrence Erlbaum Associates.
- Loucks-Horsley, S., Stiles, K. E., Mundry, S., Love, N., & Hewson, P. W. (2010). *Designing professional development for teachers of science and mathematics*. Thousand Oaks, CA: Corwin.
- Louie, J., Neumayer DePiper, J., Nikula, J., Buffington, P., Tierney-Fife, P., & Driscoll, M. (2022). *Teacher self-efficacy with visual representations: Effects of the Visual Access to Mathematics professional development*. Manuscript submitted for publication.
- Lynch, K., Hill, H. C., Gonzalez, K. E., & Pollard, C. (2019). Strengthening the research base that informs STEM instructional improvement efforts: A meta-analysis. *Educational Evaluation and Policy Analysis*, 41(3), 260–293.
- McFarland, J., Hussar, B., Zhang, J., Wang, X., Wang, K., Hein, S., Diliberti, M., Forrest Cataldi, E., Bullock Mann, F., & Barner, A. (2019). *The condition of education 2019* (NCES 2019-144). National Center for Education Statistics.
- Moschkovich, J. (2013). Principles and guidelines for equitable mathematics teaching practices and materials for English language learners. *Journal of Urban Mathematics Education*, 6(1), 45–57.  
[https://ell.stanford.edu/sites/default/files/Moschkovich%20JUME%202013\\_0.pdf](https://ell.stanford.edu/sites/default/files/Moschkovich%20JUME%202013_0.pdf)
- NASEM [National Academies of Sciences, Engineering, and Medicine]. (2018). *English learners in STEM subjects: Transforming classrooms, schools, and lives*. Washington, DC: The National Academies Press.
- NGA & CCSSO [National Governors Association Center for Best Practices & Council of Chief State School Officers]. (2010). *Common core state standards: Mathematics*.  
[http://www.corestandards.org/assets/CCSSI\\_Math\\_Standards.pdf](http://www.corestandards.org/assets/CCSSI_Math_Standards.pdf)
- Russell-Tucker, C.M. (2021, April 14). *Designation of Certification Shortage Areas, 2021-22 School Year* [Memorandum]. Connecticut Board of Education. [https://portal.ct.gov/-/media/SDE/Digest/2020-21/ShortageAreaMemo\\_Superintendents\\_4\\_14\\_21-signed.pdf](https://portal.ct.gov/-/media/SDE/Digest/2020-21/ShortageAreaMemo_Superintendents_4_14_21-signed.pdf)

- Siegler, R. S., Duncan, G. J., Davis-Kean, P. E., Duckworth, K., Claessens, A., Engel, M., Susperreguy, M. I., & Chen, M. (2012). Early predictors of high school mathematics achievement. *Psychological Science*, 23, 691–697.
- Varley Gutiérrez, M., Willey, C., & Khisty, L. L. (2011). (In)equitable schooling and mathematics of marginalized students: Through the voices of urban Latinas/os. *Journal of Urban Mathematics Education*, 4(2), 26–43.
- Woodward, J., Beckmann, S., Driscoll, M., Franke, M., Herzig, P., Jitendra, A., Koedinger, K. R., & Ogbuehi, P. (2012). *Improving mathematical problem solving in grades 4 through 8: A practice guide* (NCEE 2012–4055). [http://ies.ed.gov/ncee/wwc/publications\\_reviews.aspx#pubsearch/](http://ies.ed.gov/ncee/wwc/publications_reviews.aspx#pubsearch/)