Community for Advancing Discovery Research in Education

Descriptive Overview of the Discovery Research K-12 (DR K-12) Portfolio: Projects Funded from 2007 to 2012

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Community for Advancing Discovery Research in Education

Alina Martinez
Brian Freeman
Daphne Minner
Laurie Bozzi
Caroline Callahan
Abt Associates, Inc.

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DR K-12 Portfolio Review

The Discovery Research K-12 (DR K-12) program, funded by the National Science Foundation's (NSF) Division of Research on Learning in Formal and Informal Settings (DRL), supports research and development in science, technology, engineering, and mathematics (STEM) education. Specifically, the program seeks to enhance the learning and teaching of STEM by funding "research projects that study the development, testing, deployment, effectiveness, and/or scale-up of innovative resources, models and tools."[1]

The *Community for Advancing Discovery Research in Education* (CADRE) was funded by a cooperative agreement, beginning in 2008, as the resource network that supports the DR K-12 community in advancing the state of research and evaluation in STEM education, and furthering the goals of the DR K-12 program.[2] As part of its work, CADRE annually conducts a review of the DRK-12 portfolio. The specific objectives of this review are to describe important characteristics of the projects in the DR K-12 portfolio; explore how grantees are working towards meeting the goals of the program; identify potential areas in which targeted thematic studies can be conducted to deepen, broaden, or advance the field's understanding of specific aspects of STEM education; and inform the support activities developed for grantees. This report, a key product of the review, provides a descriptive overview of the DR K-12 portfolio.

The current report, which is the fifth and final portfolio overview to be prepared by CADRE, describes important characteristics of the first six cohorts of DR K-12 projects that received their initial funding from 2007 to 2012.[3] It characterizes the development and research in STEM education—on resources, models, and technologies—funded by the DR K-12 program.

Approach to Conducting the Portfolio Review

CADRE's review of DR K-12 projects has relied on extant project documentation provided by Principal Investigators (PIs). CADRE operates under a cooperative agreement with NSF (rather than a contract), and therefore does not have access to the data and materials maintained at NSF. Consequently, CADRE solicited materials directly from PIs. Each year PIs of newly funded projects were asked to provide CADRE with their project's proposal and responses to review panel questions. Additionally, PIs of existing projects were asked to provide project updates via annual reports, publications, and other information about the project plans, activities, and achievements.

All newly submitted project materials (from both newly and previously funded projects) were systematically reviewed and coded by a team of CADRE researchers using a protocol designed to capture information on project attributes and characteristics as well as the DR K-12 program goals being addressed. Reviewers were trained and had supervised practice using a set of detailed coding definitions and instructions. Team leaders co-coded at least two projects with each reviewer to ensure a systematic approach and application of instructions and definitions across the team.

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1 NSF (2011). Discovery Research K-12 (DR-K12): Program Solicitation 11-588, p.2.

2 CADRE's partner organizations include the Education Development Center, Inc., Abt Associates, Inc., and Policy Studies Associates, Inc.

3 Previous reviews resulted in annual reports completed in 2009, 2010, 2011, and 2012.

The data across projects were analyzed to provide a descriptive picture of the landscape of DR K-12 projects. The following research questions guided the analyses:

- What are the characteristics of the investigators being funded?
- Which populations are the projects targeting?
- How are the projects distributed across disciplines?
- Where are the projects located on the cycle of research and development?
- Which DR K-12 program strands are being addressed?
- What types of educational resources are being developed or studied?
- Which research designs and data collection techniques are most prevalent?
- How do projects plan to disseminate their work?
- What types of educational resources do the projects expect to produce?

The materials reviewed and coded were created by investigators for purposes other than this review. Consequently, the information targeted in CADRE's review was reported in project materials in diverse and unsystematic ways across projects. As a result, the level of detail that could reliably be extracted and coded varied across projects and was at times limited. Specifically, details concerning research designs and methods tended to be limited, whereas details about the resources, models, and technologies being developed and/or studied tended to be more prevalent. In addition, most of the materials received from PIs reflected projects' proposed plans or their activities in the early stages of implementation. Consequently, the review was largely limited to projects' plans and goals rather than their accomplishments or implemented activities.

Identifying Projects for Inclusion in the Portfolio Review

An initial set of 413 awards were nominated by NSF or identified as projects funded during one of the DR K-12 award cycles prior to January 2013 (Exhibit 1). Multiple awards that funded a single project (i.e. collaborating institution proposals where the same proposal had been submitted by multiple institutions) were linked and treated as a single project to avoid double-counting; this reduced the set of awards by 30. For these linked awards, the person identified as PI in the proposal or the PI of the largest award was recorded as the project PI and others as co-PIs. The award supporting CADRE was also removed, leaving 382 independent projects eligible to be included in the portfolio review. However, to be included in the review, CADRE needed to have received, at a minimum, the project proposal from the PI. Thirty-one projects (8%) did not meet this minimum standard thus, were not included in the analysis—leaving 351 in the portfolio review.

Exhibit 1: Number of Projects Reviewed

	Number
Total projects	413
linked collaborative projects	*-30*
CADRE award	*-1*
Projects eligible to be coded	382
insufficient information to code	*-31*
Projects coded	**351**

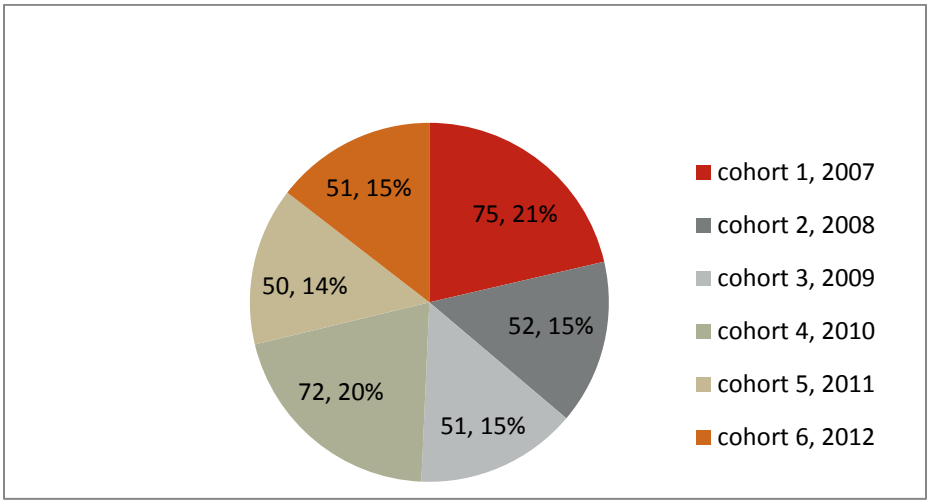
Findings

As described below, the DR K-12 portfolio encompasses a wide range of projects that are developing, refining testing and validating materials, tools, and methods for STEM education.

Grant Distribution

Projects were distributed relatively evenly across cohorts, although cohorts 1 and 4 each had about 20 more projects than in the other cohorts (Exhibit 2). The average length of grant awards was 44 months (3 years and 8 months), ranging from one month (for producing conferences) to seven years (presumably through not cost extensions). One-quarter of the projects had durations of was 59 months (4 years and 11 months).

Exhibit 2: Funded Projects by Cohort



The DR K-12 program largely funds investigators with prior NSF funding; 70 percent of the projects (n=244) are led by investigators who had received prior NSF funding. Of the remaining projects, new PIs lead 69 projects (20%), and there was insufficient information to determine the prior award status for 38 projects (11%). When co-PIs are also considered, 289 of the projects (82%) have at least one co-investigator who has received NSF funding in the past.

The institutional locations of DR K-12 projects, identified by the home institutions of PIs and co-PIs, are distributed across the country in 41 states and the District of Columbia. Individual projects are housed in as few as one and as many as five states. Exhibit 3 presents the number of projects located in each state, which include 19 *Experimental Program to Stimulate Competitive Research* (EPSCoR) states.[4] The states hosting the largest number of projects are Massachusetts (82 projects), California (57 projects), New York (42 projects), and Michigan (35 projects).

Exhibit 3: Geographical Distribution of Principal and Co-principal Investigators

Percent of projects with at least one PI or co-PI in state	State
5 % or more	CA, DC, MA, MI, NY, PA
3 to 4%	AZ, CO, IL, MD, NC, NJ, TX, VA, WA, WI
1 to 2%	FL, GA, IA, IN, MN, MO, MT, NM, OH, OR, TN, UT
Less than 1%	AK, AL, CT, DE, HI, KS, KY, LA, ME, MS, NE, NH, SC, WV

Note: N=350, missing =1

Populations Targeted

Projects focus on elementary, middle, and high school settings, with the highest concentration of projects in the middle grades (Exhibit 4). Thirty-six percent of projects involve multiple K-12 grade bands.[5]

Exhibit 4: Grade Levels in Projects

	Number	Percentage
High school	164	47
Middle school	198	56
Elementary school	143	41
Pre-kindergarten	23	7
Other	18	5

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=346, missing = 5

[4] Twenty-eight states, Puerto Rico, Guam, and the U.S. Virgin Islands are designated as Experimental Program to Stimulate Competitive Research (EPSCoR) states (http://www.nsf.gov/od/oia/programs/epscor/eligible.jsp, accessed March 6, 2013).

[5] Projects that specified age ranges rather than particular grade levels were classified as follows: Pre-K (ages 3-4); Kindergarten to 5th grade (ages 5-10); 6th to 8th grade (ages 11-13); 9th to 12th grade (ages 14-18).

The bulk of projects target teachers and students in K-12 classrooms (78 and 74% of projects, respectively). Only a small number of projects include a focus on preservice teachers, specific subgroups of students, or settings outside the K-12 schools (Exhibit 5).

Exhibit 5: Populations Targeted by Projects

	Number	Percentage
Teachers	275	78
Preservice teachers	*32*	*9*
Students	260	74
English Language Learners	*37*	*11*
Students in low performing schools or districts	*19*	*5*
Students in special education or with special needs	*7*	*2*
Low performing students	*4*	*1*
Other specific student populations	*38*	*11*
School administrators	26	7
Higher education faculty	22	6
Doctoral students	11	3
Informal education	7	2
Other populations	40	11

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=350, missing = 1

Disciplines

Most of the projects in the portfolio deal with science or math exclusively (Exhibit 6), and the remainder involve multiple disciplines. Science-only projects are slightly more common than math-only projects in the middle and high school grade bands, but math-only is more common in elementary school.

Exhibit 6: Major Disciplines Addressed by Projects

Percentage of projects …	All Grades (n=351)	Elementary (n=143)	Middle (n=198)	High (n=164)
Science only	39	31	39	40
Mathematics only	34	41	36	31
Multi-discipline	21	22	18	21
Engineering only	2	2	2	4
Computer and information science only	1	1	2	1
Other disciplines only	2	2	3	2

Note: N=349, missing = 2

Overall, 21 percent of projects address more than one topic area, and the combination of disciplines varies (Exhibit 7).

Exhibit 7: Projects that Involve Multiple Disciplines

Percentage of projects …	All Grades (n=351)	Elementary (n=143)	Middle (n=198)	High (n=164)
Any combination of multiple disciplines	**21**	**22**	**18**	**21**
Science and mathematics	7	9	6	7
Science, mathematics, and engineering	2	2	2	2
Mathematics and other subject [a]	1	1	2	1
Science and other subject [a]	1	2	2	2
All other combinations of subjects	9	8	7	9

Note: N=349, missing = 2

[a] Other subjects exclude all subjects listed in this table, social sciences, and statistical methods or research design.

Exhibit 8 provides the percentages of projects that include a focus on each of the major STEM disciplines either alone or in combination with other disciplines. A majority of projects (56%) address science topics, and just under half (49%) include a focus on mathematics. Among middle and high school projects, science is more prevalent than math, but the opposite is true for elementary school projects.

Exhibit 8: Major Disciplines Addressed

Percentage of projects …	All Grades (n=351)	Elementary (n=143)	Middle (n=198)	High (n=164)
Science	56	49	55	59
Mathematics	49	58	49	46
Engineering	10	8	8	12
Computer and information science	4	5	5	4
Social sciences	1	1	1	1
Statistical methods or research design	1	1	1	1
Other discipline	7	7	7	7

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=349, missing=2

The projects that address mathematics (either in isolation or in combination with other disciplines) include a range of specific mathematics topics (Exhibit 9), and these vary somewhat by grade. Almost a quarter of the elementary school projects (24%) address general math topics, compared to 12 percent of middle school projects and 11 percent of high school projects. The most common specific topic for elementary projects is whole number arithmetic (10%). Rational numbers and proportional reasoning, fractions and decimals, and early algebra are also common in elementary projects (8% each). Rational numbers and proportional reasoning is the most common middle school math topic (9%), followed by beginning and intermediate algebra (8%). High school projects address a narrower array of topics, with the most common topics being beginning and intermediate algebra (11%), higher algebra (7%), and geometry (6%).

Exhibit 9: Mathematics Disciplines Addressed

Percentage of projects …	All Grades (n=351)	Elementary (n=143)	Middle (n=198)	High (n=164)
Any mathematics topic	**49**	**58**	**49**	**46**
Multiple mathematics topics	13	14	15	10
General mathematics	13	24	12	11
Beginning and intermediate algebra	7	3[b]	8	11
Geometry	7	6[c]	7	6
Specific mathematics topics, not identified	7	10	9	9
Rational numbers, proportional reasoning	6	8	9	0
Whole number arithmetic	5	10	6	1
Fractions and decimals	4	8	7	0
Measurement	4	6	4	0
Early algebra (elementary school)	3	8	2	1
Higher algebra (high school+)	3	1[b]	2	7
Statistics	3	1[a]	2	4
Problem solving, word problems, puzzles	2	3	2	0
Calculus	1	1[b]	1	1
Pre-algebra	1	0	2	1
Pre-calculus	0	0	0	1
Other mathematics topics	6	4	6	6

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=349, missing=2
[a] This project involves elementary school students collecting and analyzing statistical data.
[b] These projects involve both elementary and secondary students.
[c] Several of these projects involve both elementary and secondary students. The remaining projects were reviewed to confirm that they involved geometry taught to elementary school students.

The projects addressing science (either in isolation or in combination with other disciplines) are not quite as varied as those addressing mathematics disciplines (Exhibit 10). More than two-fifths of projects (41%) involve the use of scientific inquiry procedures, 21 percent involve biology, 14 percent involve environmental sciences, and 13 percent involve geosciences. Projects with specific science disciplines are concentrated at the secondary levels; elementary school projects are more likely to involve general science.

Exhibit 10: Science Disciplines Addressed

Percentage of projects …	All Grades (n=351)	Elementary (n=143)	Middle (n=198)	High (n=164)
Any science topic	**56**	**49**	**55**	**59**
Multiple science topics	45	35	41	46
Use of scientific inquiry procedures	41	32	40	39
Biology	21	12	18	26
Environmental sciences	14	6	16	19
Geosciences	13	9	15	15
Physics	10	7	9	13
General science	9	15	7	4
Chemistry	8	3	7	12
Physical science	8	10	7	4
Specific science topics, not identified	5	5	7	5
Astronomy	3	3	4	3
Other science topics	5	3	5	5

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=349, missing=2

In summary, the DR K-12 portfolio has somewhat more projects that include a focus on science than math and they are heavily weighted toward life and earth sciences, especially at the middle and high school levels. Many science projects also focus on the use of scientific inquiry procedures. The portfolio also has a fair number of projects that address multiple disciplines. In addition, the math projects in the portfolio are dispersed across the range of possible math topics, and these vary by grade level.

Research and Development Cycle

The *cycle of research and development (*formerly called the *cycle of innovation and learning)* was introduced in the DR K-12 program in the fiscal year 2008 (FY2008) program solicitation[6] and revised in the FY2010 program solicitation.[7] The cycle posits a dynamic, ongoing process through which knowledge and products are conceived, developed, disseminated and revised. The components of the cycle are:

- **Synthesize** lines of work; identify new insights and questions to inform new research and development; set research and development agendas;
- **Hypothesize**, study and clarify phenomena of interest; frame issues; operationalize goals and constructs; develop and propose theory; conduct basic research on learning;
- **Design**, develop, test, validate, and refine materials, measurement tools, and methods, in specific contexts;
- **Implement** innovations; study why interventions have the impacts they have with particular groups; and
- **Evaluate** effectiveness; study complex phenomena, and generalize.

6 NSF DR K-12 Solicitation, NSF 08-502.

7 NSF DR K-12 Solicitation, NSF 09-602.

While all projects are expected to address multiple aspects of the cycle, most emphasize one or two components of the cycle over others. The aggregate representation of the DR K-12 projects across the stages provides a sense of the DR K-12 program's contribution to advancing the STEM education field overall. For this purpose, each project was classified according to the stage in the cycle that it most emphasizes or that best characterizes its work (Exhibit 11). Overall, the DR K-12 portfolio is heavily weighted toward developing and testing materials, measurement tools, and methods for STEM education.

Exhibit 11: Project Placement on the Cycle of Research and Development

	Number	Percentage
Design, develop and test	218	62
Explore, hypothesize, and clarify	51	15
Implement, study efficacy, and improve	35	10
Synthesize and theorize	33	9
Scale-up and study effectiveness	14	4

Note: N=351 projects.

DR K-12 Program Strands

The solicitations for DR K-12 proposals outline the general categories of projects that the program seeks to support by specifying areas or *program strands* that will be funded. These strands have been revised and refined over the life of the DR K-12 program. The FY2012 program solicitation includes four strands:[8]

- **Assessment Strand:** projects that develop and study valid and reliable assessments of student and teacher knowledge, skills, and practices.
- **Learning Strand:** projects that develop and study resources, models and tools to support all students' STEM learning, enhance their knowledge and abilities, and build their interest in STEM fields.
- **Teaching Strand:** projects that develop and study resources, models and tools to help pre- and in-service teachers provide high quality STEM education for all students.
- **Scale-up and Sustainability Strand**: projects that develop and study factors that contribute to successful implementation, scale-up, and sustainability of proven, high-quality innovations in schools and districts in a cost effective manner.

While projects may address multiple strands, most focus on one. Half of the projects in the portfolio are in the learning strand, and a third of them are in the teaching strand (Exhibit 12). Relatively few projects address the assessment strand or scale-up and sustainability strand.

[8] NSF DR K-12 Solicitation, NSF 11-588.

Exhibit 12: DR K-12 Challenge Strands Addressed

	Number	Percentage
Learning	178	51
Teaching	121	34
Assessment strand	47	13
Scale-up and sustainability	17	5
Other	9	3

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=350, missing=1

Educational Resources Being Studied or Developed

Projects in the DR K-12 portfolio are producing and/or researching a wide variety of resources for the educational community (Exhibit 13). More than two-thirds of them include a focus on teachers or professional development (67%). One of the reasons this percentage is high is because many projects working with resources for students include components designed to train teachers how to deliver the resources to students. This is discussed in more detail below.

More than half of the projects are developing or studying resources to be used directly with students (56%). Two-fifths of the projects address education models (40%); these are resources that have a more indirect or distal influence on learning and instruction than resources or technologies. Projects that focus on models are developing or researching materials that provide foundational information or guidance for teaching, educational materials, or curriculum. These can include, for example, the development of learning progressions, curriculum frameworks, and topic area standards.

More than a quarter of the projects are developing or studying student assessments (28%).[9] A smaller share of projects plan to organize conferences or meetings on educational topics or conduct syntheses of existing research, theories, or practices. Each type of resource is discussed in more detail below.

[9] This number includes not just projects that applied to the assessment strand, but all projects that were studying or developing student assessments even if the assessment was part of a larger curriculum.

Exhibit 13: Project Foci

	Number	Percentage
Resources for teacher/professional development	235	67
Resources for student learning	198	56
Computer or internet activities and resources	*154*	*44*
Curriculum	*126*	*36*
Other student learning	*77*	*22*
Models	141	40
Student assessments [a]	100	28
Conferences	44	13
Syntheses	30	9
Other	26	7

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=351.
[a] This number includes not just projects that applied to the assessment strand, but all projects that were studying or developing student assessments even if the assessment was part of a larger curriculum.

The student learning projects are producing or studying curricula, activities, or materials to be used in the classroom or for other types of learning experiences. Prominent among these are those projects studying or developing resources for students that include the use of computers or the internet (Exhibit 14). Over a fifth of the projects in the full DR K-12 portfolio (21%) are working with resources that provide students opportunities to learn through interacting with a virtual environment, online laboratory, cyber game, or other interactive online experience. Less than one-fifth of the projects (15%) include tools to support or encourage online interactions, networking, and collaborating among students and between students and teachers, STEM experts, and others. A smaller group involve online courses or include resources presented online or via computers for students containing information to be used in STEM educational activities (11% for each).

Exhibit 14: Computer or Internet Activities and Resources for Students

	Number	Percentage
Any computer or internet activities and resources	**154**	**44**
Online gaming, interactive learning, or virtual environment	75	21
Online networking or collaborating tool	52	15
Information resource	40	11
Online course or class	40	11
Online tutoring	4	1
Other	27	8

Note: Coding of multiple categories was permitted. N=351 projects.

As mentioned previously, 28 percent of the projects are studying or developing student assessments. There are almost twice as many projects that involve assessments linked to a particular curriculum (18%) as compared to stand-alone assessments (10%, Exhibit 15).

Exhibit 15: Student Assessments

	Number	Percentage
Any student assessments	**100**	**28**
Assessment in a curriculum	63	18
Stand-alone assessment	35	10
Other type of student assessment	5	1

Note: Coding of multiple categories was permitted. N=346, missing=5

More than two-thirds of the projects in the DR K-12 portfolio (67%) include resources for teachers or professional development. Forty-three percent of the projects in the portfolio include the development of (or research on) manuals, guides, and other forms of instructional materials meant for teachers to use on their own (Exhibit 16). Almost one-third of all projects (32%) include a full professional development course, and almost a fifth of the projects involve supporting collaboration or networking among teachers or between teachers and students, STEM experts, or others.

Exhibit 16: Teacher Professional Development Mode

	Number	Percentage
Any teacher professional development	**235**	**67**
Stand-alone instruction, manuals, guides, or information resources	151	43
Full course	112	32
Networking or collaborating	67	19
Supervision or mentoring	44	13
One or two sessions, classes, or meetings	39	11
Curriculum for a course or class	37	11
Other teacher professional development structure	24	7

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=351 projects.

The content of the teacher professional development activities varies across projects (Exhibit 17). The teaching resources in 30 percent of the projects provide teachers information on how to use specific curricula, resources, or activities with students, or how to lead specific activities. Almost as many projects (28%) address specific instructional practices. Somewhat fewer projects (one-fifth of the total) provide information on STEM topics.

Exhibit 17: Teacher Professional Development Content

	Number	Percentage
Any teacher professional development	**235**	**67**
How to use specific curriculum, activities, resources, or equipment	104	30
Instructional practices	97	28
STEM topics	70	20
Student development or how students learn	46	13
How to lead activities or lessons not part of a specific curriculum	34	10
Other teacher professional development content	10	3

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=349, missing=2

Among projects studying or developing models (Exhibit 18), the most common types of models are demonstration projects, or models of ideal educational practices for others to learn from or emulate, along with learning progressions, which are designed to model the timing and sequence a series of topics or concepts are learned (12% each).

Exhibit 18: Models

	Number	Percentage
Any models	**141**	**40**
Model or demonstration of ideal educational practice	42	12
Student learning progression	42	12
Teacher professional development frameworks	31	9
Student curriculum frameworks	28	8
Standards	10	3
Other type of model	28	8

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=351 projects.

Distribution across Areas of Interest

The DR K-12 projects are distributed across the wide range of substantive areas presented above. Exhibit 19 displays the number of projects within each major discipline that are developing, revising, or studying a resource, model or technology by grade. The largest numbers of projects are developing, revising, or studying resources in mathematics or science, with few in engineering.

Exhibit 19: Project Foci by Discipline and Grade

	Mathematics			Science			Engineering			Other		
	Elem	*Middle*	*High*	*Elem*	*Middle*	*High*	*Elem*	*Middle*	*High*	*Elem*	*Middle*	*High*
Teacher professional development	52	70	46	44	71	64	9	10	10	9	13	6
Student learning using computers or internet	16	25	25	31	63	57	2	9	8	6	12	8
Student assessments	18	26	18	16	40	30	0	5	2	3	9	4
Models	42	50	32	26	39	34	5	5	8	7	12	8
Syntheses	10	14	9	8	7	10	2	2	2	2	3	4
Conferences	17	20	16	14	13	12	4	3	3	3	4	2

Note: N=335, missing=16. Sixteen projects do not appear in the table because they were not coded as one of the listed foci, disciplines, or grade levels.

Research Conducted

Most of the projects in the DR K-12 portfolio incorporate plans to conduct research, but the scope of the work and the types of designs and methods are varied in ways that reflect the diversity of projects' goals and foci. Many projects, for instance, are designing or developing a resource, model or technology and are consequently incorporating design research approaches that involve small-scale field tests, extensive iterative revisions, formative evaluation activities, and pilot studies. Other projects are studying the impacts of resources, models or technologies that are being scaled up and used in larger settings. These projects tend to utilize research designs more appropriate for drawing causal conclusions such as randomized control trials.

The diversity in the portfolio makes it difficult to succinctly characterize the research designs and methods in detail. In addition, most of the materials available for coding across projects were limited to those associated with projects' initial proposals or reports from their early years of work. Consequently, reviewers were restricted to coding projects' plans and goals (rather than implemented or completed designs) at whatever level of detail they found available in project materials. With this caveat in mind, the research proposed (and to a lesser extent conducted) in projects is described below. For the sake of clarity projects' characteristics of projects' research are described in the present tense though they include information drawn from proposal, plans, as well as completed projects.

Sixty-six percent of the projects in the portfolio plan to conduct research using some quantitative methods and 70 percent are using some qualitative approaches (Exhibit 20). Slightly more than half of the projects use *both* qualitative and quantitative methods (54%) while 16 percent exclusively use qualitative methods and 13 percent use only quantitative methods.

Of the projects using quantitative methods, one-quarter plan to incorporate pre-post comparisons without control groups. Almost as many projects (22%) plan to use quasi-experimental designs in which groups are formed in order to make comparisons, but random assignment is not used. Fewer than one-fifth of the projects in the portfolio (18%) plan to incorporate experimental designs into their research (e.g., randomly assigning study participants to groups which are compared to one another after one or more of the groups receives an intervention and the others do not).

Exhibit 20: Research Designs

	Number	Percentage
Qualitative	244	70
Quantitative	232	66
One group (pre/post comparison)	*89*	*25*
Quasi-experimental design (with comparison group)	*78*	*22*
Randomized control trial	*62*	*18*
One group (descriptive analyses)	*30*	*9*
One group (correlational analyses)	*26*	*7*
Design research	135	38
Implementation of an intervention, resource or tool	112	32
Measurement/assessment development	91	26
Evaluation of research quality or progress	84	24
Longitudinal research	52	15
Synthesis	24	7
Other research design	2	1

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=339, missing=12.

Some of the projects incorporate other more specialized research designs or methods into their plans. Almost two-fifths of the projects (38%) plan to use design-research methods (e.g., small-scale, often qualitative research methods that actively guide work designing resources or technologies). Implementation variation was proposed to be studied in 32 percent of the projects. Approximately a quarter of the projects have explicit plans to conduct extensive measurement development—which includes testing of the reliability, validity, and usability of measures and assessments. Almost a quarter had plans to use an external evaluator to assess the quality of the research being conducted.

Projects used a range of data collection techniques (Exhibit 21). Interviews (64%) and observations (63%) were the most common techniques, followed by assessments or tests of performance or knowledge (56%) and surveys (52%).

Exhibit 21: Data Collection Techniques

	Number	Percentage
Interviews	224	64
Observations	222	63
Tests of performance or knowledge	195	56
Surveys	183	52
Document or artifact reviews	123	35
Diaries, journals, records, or activity logs kept by study subjects	91	26
Extant records	72	21
Focus groups	64	18
Computer usage data	57	16

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=339, missing=12

Both student and teacher outcomes are being investigated in the research conducted across projects (Exhibit 22). Two-thirds (67%) of the projects in the portfolio are researching student outcomes, nearly all of which measure student achievement or performance. Similarly, 65 percent of the projects are researching teacher outcomes, with the majority focused on classroom practices.

Exhibit 22: Outcome Domains

	Number	Percentage
Students	235	67
Achievement or performance	*219*	*62*
Attitudes or beliefs	*118*	*34*
Behavior	*71*	*20*
Retention or graduation	*7*	*2*
Other student outcome domain	*7*	*2*
Teachers	228	65
Classroom practices	*179*	*51*
Pedagogical content knowledge	*119*	*34*
Attitudes or beliefs	*115*	*33*
Content knowledge	*86*	*25*
Other teacher outcome domain	*19*	*5*
Administrators	22	6
Other outcome domain	23	7

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=339, missing=12

In the DR K-12 portfolio, qualitative research methods such as interviews and observations are somewhat more common that quantitative research methods such as surveys or assessments, but a majority of projects have a mixed methods research design. Student achievement and teacher classroom practices are the outcomes most often measured.

Dissemination Activities

DR K-12 solicitations require that projects include a dissemination plan as part of their project description, however 10 percent of the projects either did not include this information in the materials provided or there were too few details for reviewers to classify. In the plans provided, most of the projects identify the materials that they would disseminate (74%, Exhibit 23), and more than half specify the potential target audience or end users (62%) or identify their dissemination partners (53%). Almost two-fifths of the projects (39%) plan to incorporate input from their targeted users into their research or development plans.

Exhibit 23: Dissemination Plans

	Number	Percentage
Identifies what will be disseminated	260	74
Identifies potential adopter or end user	218	62
Identifies dissemination partners	186	53
Includes potential adopter or end user input in design, development, or research	137	39
Addresses strategies for sustainability after the grant	38	11
Intends to develop formal dissemination plan	9	3
Identifies dissemination challenges	6	2

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=351 projects.

Projects reported plans for disseminating their work through a wide variety of vehicles (Exhibit 24). Projects most commonly plan to disseminate their work through presentations or poster sessions (76%) and journal articles (74%). Many projects (62%) are also planning to disseminate their work or materials via existing or newly created websites.

Exhibit 24: Anticipated Vehicles of Dissemination

	Number	Percentage
Presentations or poster sessions	268	76
Journal articles	259	74
Websites	217	62
Professional networks	109	31
Workshops	69	20
Commercial products or publications	58	17
Reports	42	12
Popular media	30	9
White or working papers	30	9
Newsletters	28	8
Books or book chapters	27	8
Webinars	18	5
CDs or DVDs	17	5
Blogs	8	2
Social Media	7	2
Other dissemination vehicles	9	3

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=336, missing=15

Nearly three out of four DR K-12 projects identify the products they plan to disseminate, typically through conference presentations or journal articles.

Anticipated Products

In their proposals and reports, projects anticipated that they would develop and disseminate a wide variety of products including, most commonly, products related to teacher professional development

(54%, Exhibit 25) and student learning (48%). Since a fair number of projects are studying resources rather than developing or revising them, the figures in Exhibit 25 are somewhat smaller than those in Exhibit 13 through 18.

Exhibit 25: Anticipated Products

	Number	Percentage
Teacher professional development products	**189**	**54**
Stand-alone instruction, manuals, guides, or information resources	125	36
Full course	75	21
Networks	49	14
Curriculum for a course or class	31	9
One or two sessions, classes, or meetings	27	8
Supervision or mentoring	26	7
Other teacher professional development products	10	3
Student learning products	**168**	**48**
Computer or Internet activities and resources	92	26
On-line gaming, interactive learning, or virtual environments	*57*	*16*
Online networking or collaborating tool	*39*	*11*
Online course or class	*29*	*8*
Information resource	*25*	*7*
Online tutoring	*4*	*1*
Other computer or internet activities and resources	*15*	*4*
Curriculum	31	9
Other activities, materials or equipment used for student learning	74	21
Models	**43**	**12**
Model or demonstration of ideal educational practice	16	5
Teacher professional development frameworks	13	4
Student learning progression	12	3
Student curriculum frameworks	9	3
Standards	6	2
Other type of model	3	1
Student assessments	**36**	**10**
Stand-alone assessment	24	7
Assessment in a curriculum	10	3
Other type of assessment	4	1
Syntheses	**19**	**5**
Conferences	**11**	**3**
Other anticipated products	**24**	**7**

Note: Categories do not sum to 100 percent because coding of multiple categories was permitted. N=351 projects.

Summary

This report has described the characteristics of projects in the DR K-12 portfolio drawing on data from 351 projects funded in the first six cohorts. The major trends identified addressing each research question posed at the start of the report are summarized below.

What are the characteristics of the investigators being funded?
The DR K-12 program largely funds investigators with previous NSF funding; 70 percent of projects are led by principal investigators with prior NSF awards. Projects are funded in institutions across 41 states and the District of Columbia. The states hosting the largest number of projects are Massachusetts, California, New York, and Michigan.

Which populations are the projects targeting?
Projects include elementary, middle, and high school settings (41, 56, and 47% respectively, Exhibit 4), with 36 percent involving multiple grade bands. Most projects focus on K-12 teachers and students as is intended by the program solicitation.

How are the projects distributed across disciplines?
More than half of the projects (56%) address science topics, 49 percent include mathematics, 10 percent address engineering, and 4 percent address computer and information science. Among middle and high school projects, science is more prevalent than math, but the opposite is true for elementary school projects.

Where are the projects located on the cycle of research and development?
While there are DR-K12 projects that address each aspect of this cycle, the majority (62%) focus on *designing, developing, and testing* of educational materials for students or teachers and associated assessment tools.

Which DR K-12 program strands are being addressed?
Half of the projects in the portfolio are in the learning strand, and one-third of the projects are in the teaching strand.

What types of educational resources are being developed or studied?
Projects in the DR K-12 portfolio are producing and/or researching a wide variety of resources for the educational community. Two-thirds of the projects include a focus on teachers or professional development (67%) and more than half are developing or studying resources to be used directly with students (56%). In addition, 40 percent of the projects address education models. Slightly more than a quarter of the projects are developing or studying student assessments (28%), and 13 percent of projects are hosting or organizing conferences on educational topics.

Which research designs and data collection techniques are most prevalent?
Sixty-six percent of the projects have plans to conduct research using some quantitative methods and 70 percent are using some qualitative approaches. Of the projects using quantitative methods, one-quarter are planning to make pre-post comparisons without control groups. Almost as many projects (22%) are planning to use quasi-experimental designs. Less than one-fifth of the projects in the portfolio (18%) are planning to incorporate experimental designs into their research.

How do projects plan to disseminate their work?
Nearly three out of four DR K-12 projects identify the products they plan to disseminate, typically through conference presentations or journal articles.

What types of educational resources do the projects expect to produce?
Projects anticipate developing and disseminating a wide variety of products with the most common being related to teacher professional development (54%), student learning (48%), and models (12%).