Community for Advancing
Discovery Research in Education

Discovery Research K-12 (DR K-12): Descriptive Overview of Portfolio in Year Four

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Executive Summary

The National Science Foundation's Discovery Research K-12 (DR K-12) program supports high-quality research and development in science, technology, engineering, and mathematics (STEM) teaching and learning. The DR K-12 program largely funds investigators with previous NSF funding; 78.3 percent of projects are led by principal investigators with prior NSF awards.

The portfolio of DR K-12 projects span what NSF has characterized as a *cycle of research and development*[1]—a dynamic, ongoing process through which knowledge and products are conceived, developed, disseminated and revised—although a majority (65.1 percent) of DR K-12 projects are developing, refining, testing, and validating materials, measurement tools, and methods for STEM education.

Projects primarily focus on elementary, middle, and high school settings (41.7, 57.3, and 46.4 percent respectively, Exhibit 2.3), with 37.3 percent involving multiple grade bands. More than half of them (56.6 percent) address science topics (either exclusively or with other topic areas), 49.2 percent include a focus on mathematics either by itself or with another discipline, 7.5 percent address engineering, and 3.7 percent address computer and information science.

Projects in the DR K-12 portfolio are producing and/or researching a wide variety of resources for the educational community. More than half of the projects include a focus on teachers or professional development (66.4 percent) and almost half are developing or studying resources to be used directly with students (45.1 percent). In addition, 40.0 percent of the projects address education models. These models have a more indirect or distal influence on learning and instruction than resources or technologies. Slightly more than a quarter or the projects are developing or studying student assessments (29.5 percent), and 9.8 percent of projects are hosting or organizing conferences on educational topics.

The scope, designs, and methods of the research utilized in projects are also varied, reflecting the diversity of projects' goals and foci. For instance, many projects are designing or developing a resource, model or technology and they consequently incorporate 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 scaled-up interventions and thus tend to utilize research designs more appropriate for drawing causal conclusions such as randomized control trials.

Projects anticipate developing and disseminating a wide variety of products including, most commonly, products related to teacher professional development (55.3 percent), student learning (45.4 percent), and student assessments (20.3 percent).

[1] NSF DR K-12 Solicitation, NSF09602.

1. Overview of Approach

1.1 Introduction

The Discovery Research K-12 (DR K-12) program, funded by the National Science Foundation (NSF) Division of Research on Learning in Formal and Informal Settings (DRL), supports high-quality research and development in science, technology, engineering, and mathematics (STEM) learning and teaching. The portfolio of DR K-12 projects span what NSF has characterized as a *cycle of research and development*[2]—a dynamic, ongoing process through which knowledge and products are conceived, developed, disseminated and revised.

The *Community for Advancing Discovery Research in Education* (CADRE) was established 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. As part of its work, CADRE annually provides a descriptive overview of the DR K-12 portfolio, which includes the first five cohorts funded as of July 2011. The report characterizes the development and research in STEM education—on resources, models, and technologies—funded by the DR K-12 program.[3] The specific objectives of this portfolio overview are to:

1. Describe important characteristics of the projects in the DR K-12 portfolio;
2. Explain how grantees are working towards meeting the goals of the program;
3. Identify potential areas in which syntheses and targeted thematic studies can be conducted to deepen, broaden, or advance the field's understanding of specific aspects of STEM education;
4. Inform the support activities developed for grantees.

This overview is intended to describe the scope and depth of research and development DR K-12 has funded and to identify areas that could be advanced by further investigations by CADRE.

[2] NSF DR K-12 Solicitation, NSF09602.

[3] Previous annual reviews were summarized in two reports completed in 2009 and 2010.

1.2 Approach to Portfolio Review

In order to prepare this overview, CADRE collected materials from DR K-12 projects. These materials were reviewed and coded by a team of CADRE researchers using a protocol developed for systematically extracting specific pieces of information; these data were then analyzed across the portfolio of projects.

1.2.1 Projects in the Portfolio

There were 353 projects eligible for inclusion in this portfolio overview. An initial set of 353 awards were nominated by NSF or identified as projects funded during one of the DR K-12 award cycles prior to winter 2011. Twenty-one of these awards were linked because they funded a shared project. To avoid double-counting, only one project was retained in the analysis database for each linked set and the multiple awards were treated as a single project. For the purposes of this overview, the project principal investigator (PI) was the PI identified in the proposal, or the PI of the largest award. The award supporting CADRE was also removed from the analytic database.

Additional projects were excluded because insufficient information was available for them. All of the materials used in project reviews were obtained from PIs or project staff or from publicly available materials.[4] PIs were asked to provide CADRE with their project's proposal, annual reports, project publications, and other information about the plans, activities, and achievements of their DR K-12 project. CADRE periodically asks PIs to update their materials.

In order to be included in the review, the project proposal at a minimum needed to be available to CADRE. Projects that did not meet this minimum standard were set aside from the analysis because reviewers did not have enough information to reliably code the project. Of the 332 eligible projects in the portfolio, 36 could not be included in the analysis because their PIs did not provide sufficient materials for review (10.9 percent). In all, 295 projects were included in the portfolio review (representing 321 awards in total when the linked awards are counted as well).

1.2.2 Projects Included in the Review Materials

The volume and detail of information available varied across projects. All 295 projects included in the analysis provided their initial project proposal narrative. Many projects also provided their responses to questions raised in the proposal process, and some projects made other materials available including annual reports, drafts of papers and presentations (published or in press), working papers and other documents.

The materials reviewed and coded for this analysis were created by investigators for purposes other than this review. Thus, the information CADRE sought was reported in diverse and unsystematic

[4] CADRE operates under a cooperative agreement with the NSF and does not have access to the data and materials maintained at NSF.

ways across projects. As a result, the level of detail that could reliably be extracted and coded was varied and at times limited. Specifically, details concerning research designs and methods were especially limited, whereas there was more detail about the resources, models, and technologies being developed and/or studied. In addition, most of the materials reflected projects' plans or activities in the early stages of implementation. Consequently, the review was largely limited to projects' plans and goals rather than their accomplishments or their implemented activities.

1.2.3 Methodological Approach

Trained researchers coded project materials using a review protocol designed to capture information on project attributes and characteristics as well as the DR K-12 program goals being addressed.[5] 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 sizes of the projects DR K-12 is funding?
- Who is being funded?
- What types of projects are being funded by DR K-12?
- Where is the program focusing its investment?
- What research is being conducted?
- How do projects plan to disseminate their work?
- What are projects anticipating producing for dissemination?

[5] The team of reviewers was trained and had supervised practice using a set of detailed coding definitions and instructions. The team leader co-coded at least two projects with each of the reviewers to ensure a systematic approach and application of instructions and definitions across the team.

2. Overview of Portfolio

Projects included in this overview were distributed across five cohorts corresponding to annual funding cycles beginning in 2007—cohort 1 (75 projects, 25.4 percent), cohort 2 (51 projects, 17.3 percent), cohort 3 (51 projects, 17.3 percent), cohort 4 (71 projects, 24.1 percent), and cohort 5 (47 projects, 15.9 percent). The 277 projects for which there was information on length of the grant awards lasted for an average of 45 months, ranging from two months (for producing conferences) to six years[6] (Exhibit 2.1).

Exhibit 2.1: Duration of DR K-12 Projects

	Duration (months)
N	277[a]
Mean	45
Standard deviation	15
Maximum	72[b]
Median	48
Minimum	2

[a] Eighteen grants were missing this information.
[b] Although the grants are funded for up to five years, the duration reported in projects ranged up to six years.

The DR K-12 program largely funds investigators with prior NSF funding (208 projects, 70.5 percent). Of the remaining projects, new PIs lead 48 projects (16.3 percent), and there was insufficient information to determine the prior award status for 39 projects (13.2 percent). When co-PIs are also considered, 231 of the projects (78.3 percent) have at least one key investigator who has received NSF funding in the past.

The institutional locations of DR K-12 projects, identified by the home institutions of principal and co- principal investigators, 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 four states. Exhibit 2.2 presents the number of projects located in each state, including 19 *Experimental Program to Stimulate Competitive Research* (EPSCoR) states.[7] The states hosting the largest number of projects are Massachusetts (61 projects), California (46 projects), New York (30 projects), Michigan (29 projects), and Colorado (17 projects).

[6] Although the grants are funded for up to five years, the duration reported in projects ranged up to six years.

[7] Twenty-six states, Puerto Rico, and the Virgin Islands are designated as Experimental Program to Stimulate Competitive Research (EPSCoR) states (http://www.nsf.gov/od/oia/programs/epscor/FY2012_Eligibility.pdf, accessed July 17, 2012).

Exhibit 2.2: Geographical Distribution of Principal and Co-principal Investigators (n=278 projects)

Number of projects with at least one PI or co-PI in state	State
More than 20	CA, MA, MI, NY
11 to 20	CO, DC, IL, NC, NJ, OH, PA, VA
6 to 10	AZ, FL, MD, MO, NM, OR, TN, TX, UT, WA, WI
5 or fewer	AK, AL, CT, DE, GA, HI, IA, IN, KS, KY, LA, ME, MN, MS, MT, NE, NH, SC, WV

Exhibit reads: California and Massachusetts each have more than 20 projects located in their state when all of the PIs (and co-PIs) that are not missing this information are taken into account.

Notes: [a] Seventeen projects were missing information on the location of PIs and co-PIs.

2.1 Populations Targeted

2.1.1 Grade Levels

Projects primarily focus on elementary, middle, and high school settings (41.7, 57.3, and 46.4 percent respectively, Exhibit 2.3), with 37.3 percent involving multiple grade bands.[8] Only 6.8 percent of the projects work with pre-kindergarten students or teachers, while 4.7 percent of them target other grade levels such as doctoral students in scholar programs, and students in early college levels.

Exhibit 2.3: Grade Levels in Projects (n=295 projects[a])

	Number	Percentage
Pre-kindergarten	20	6.8%
Elementary school	123	41.7%
Middle school	169	57.3%
High school	137	46.4%
Other	14	4.7%

Notes: [a] The grades addressed in three projects could not be determined.

2.1.2 Populations Involved

The bulk of projects target teachers and students in K-12 classrooms (79.7 and 75.3 percent of projects, respectively). Far fewer (6.4 percent) include K-12 school administrators in their focus (Exhibit 2.4), or pre-service or alternative certification teachers (8.1 percent). Only a small number of projects highlight specific subgroups of students or teachers who work with specific subgroups of students including English Language Learners, special education students, low-performing districts, or other targeted populations (e.g., urban and rural schools, students from specific racial/ethnic groups).

[8] 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).

Exhibit 2.4: Populations Targeted by Projects (n=295 projects)

	Number	Percentage
Teachers	235	79.7%
Pre-service and alternative certification	*24*	*8.1%*
Students	222	75.3%
Special education	*5*	*1.7%*
English Language Learners	*25*	*8.5%*
Low performing schools or districts	*15*	*5.1%*
Other	*35*	*11.9%*
School administrators	19	6.4%
Doctoral students in scholars' programs	10	3.4%
Higher education faculty	15	5.1%
Informal education	5	1.7%
Other	29	9.8%

Few projects stray outside the K-12 school setting, with 3.4 percent of the projects involving doctoral students in programs designed to develop scholars and researchers in particular substantive areas, 5.1 percent focusing on higher educational faculty, and 9.8 percent targeting other groups including parents and families, discipline coaches (e.g., math coaches), curriculum developers, researchers, and policy makers.

2.2 Disciplines

Of the 295 projects in the portfolio, 41.0 percent are in science fields, 34.6 percent are in mathematics, 2.0 percent deal with engineering, and 0.7 percent cover computer and information science. Another 19.3 percent of the projects involve two or more of these disciplines. Exhibit 2.5 displays the distribution of these disciplines within the K-12 schooling levels as well.

Exhibit 2.5: Major Disciplines Addressed in Portfolio (n=295 projects)

	All grades	Elementary	Middle	High
Number of projects	**295**	**123**	**169**	**137**
Percentage of projects per grade addressing…				
Science	41.0%	28.5%	41.4%	41.6%
Mathematics	34.6%	42.3%	34.3%	30.7%
Multi-discipline [a]	19.3%	22.8%	17.8%	19.0%
Engineering	2.0%	2.4%	1.8%	4.4%
Computer and information science	0.7%	1.6%	1.2%	1.5%
Other disciplines [b]	2.4%	2.4%	3.0%	2.9%

Notes: [a] All projects that addressed more than one discipline were coded as "Multi-discipline.
[b] The discipline addressed in one project could not be determined.

Many of the 57 projects that address more than one topic area include a focus on science (11.5 percent of all projects in the portfolio, Exhibit 2.6). Science and math are a combined focus in 7.5 percent of the multidiscipline projects, and science, math, and engineering are addressed together in

another 2.4 percent of the projects. Science is combined with other disciplines in 1.7 percent of the projects, while mathematics is combined with other topics in the same percentage of projects (1.7 percent). Other combinations make up 6.1 percent of the projects. These include substantive areas that are not science, mathematics, or engineering specific (e.g., general STEM or technology concerns).

Exhibit 2.6: Percentage of Projects per Grade that Address More than One Discipline (n=295 projects)

	All grades	Elementary	Middle	High
Number of projects	**295**	**123**	**169**	**137**
Percentage of projects per grade addressing…				
Science and mathematics	7.5%	10.6%	6.5%	8.0%
Science, mathematics, and engineering	1.7%	1.6%	2.4%	1.5%
Science and other	1.7%	2.4%	1.8%	2.2%
Mathematics and other	2.4%	2.4%	2.4%	2.9%
All other combinations	6.1%	2.4%	2.4%	4.4%

Exhibit reads: 7.5 percent of the 295 projects in the portfolio address topics in both mathematics and science fields (and no others). Considering each grade band separately, 10.6 percent of the 123 elementary school projects, 6.5 percent of the 169 middle school projects, and 8.0 percent of the 137 high school projects address both mathematics and science.

Exhibit 2.7 provides the percentages of projects that include a focus on each of the major STEM disciples either alone or in combination with other disciplines. Of the 295 projects in the portfolio, 56.6 percent address science topics (either exclusively or with other topic areas), 49.2 percent include a focus on mathematics either by itself or with another discipline, 7.5 percent address engineering, and 3.7 percent address computer and information science. Exhibit 2.7 displays the distribution of these disciplines within the K-12 schooling levels as well.

Exhibit 2.7: Major Disciplines Addressed in Portfolio (n=295 projects)

	All grades	Elementary	Middle	High
Number of projects	**295**	**123**	**169**	**137**
Percentage of projects per grade addressing…				
Science	56.6%	47.2%	55.0%	58.4%
Mathematics	49.2%	60.2%	49.1%	45.3%
Engineering	7.5%	7.3%	6.5%	9.5%
Computer and information science	3.7%	4.9%	3.6%	2.9%
Other disciplines	8.5%	8.1%	8.9%	9.5%

The 145 projects that address mathematics (either in isolation or in combination with other disciplines) include a range of specific mathematics disciplines (Exhibit 2.8). The specific mathematics topics addressed vary somewhat by grade. More than a quarter of the elementary school projects address general math topics (26.0 percent). The most common specific topics are early algebra, rational numbers and proportional reasoning, and whole number arithmetic (each 8.1 percent). Another 9.8 percent of the projects address topics that could not be identified based on the materials reviewed. These include projects addressing issues relevant to many specific topic areas, such as a conference on assessment practices that could be used in many math areas.

Among middle school projects, general math (or a range of math topics linked together) is addressed by 13.0 percent. The most common topics among these projects are rational numbers and proportional reasoning (9.5 percent), geometry, and fractions and decimals (7.7 percent each).

High school projects address a narrower array of topics, with the most common topics being elementary and intermediate algebra (10.9 percent), geometry, and higher algebra (7.3 percent each).

Exhibit 2.8: Percentage of Projects per Grade Addressing Mathematics Topics (n=295 projects)

	All grades	Elementary	Middle	High
Number of projects per grade *(including those that are multi-discipline)*	**295**	**123**	**169**	**137**
Percentage of projects per grade addressing…				
General mathematics	13.9%	26.0%	13.0%	11.7%
Multiple mathematics topics	12.5%	13.0%	12.4%	11.7%
Geometry	8.1%	5.7%	7.7%	7.3%
Elementary and intermediate algebra	7.1%	2.4%	6.5%	10.9%
Specific topics not identified	6.8%	9.8%	8.9%	8.8%
Rational numbers, proportional reasoning	6.1%	8.1%	9.5%	0.0%
Whole number arithmetic	4.7%	8.1%	5.9%	0.7%
Early algebra (elementary school)	3.4%	8.1%	2.4%	0.7%
Fractions and decimals	4.4%	7.3%	7.7%	0.0%
Measurement	3.7%	4.9%	3.6%	0.0%
Higher algebra	3.4%	0.8%	1.2%	7.3%
Problem solving, word problems, puzzles	3.1%	3.3%	2.4%	1.5%
Other mathematics topics	2.7%	0.8%	3.0%	3.6%
Statistics	1.7%	0.8%	1.8%	2.2%
Calculus	0.7%	1.6%	0.6%	0.7%
Pre-calculus	0.3%	0.0%	0.0%	0.7%

Exhibit reads: 13.9 percent of the 295 projects in the portfolio are in general mathematics. Considering each grade band separately, 26.0 percent of the 123 elementary school projects, 13.0 percent of the 169 middle school projects, and 11.7 percent of the 137 high school projects address general mathematics.

The 167 projects addressing science (either in isolation or in combination with other disciplines) are not quite as varied as those addressing mathematics disciplines (Exhibit 2.9). Of the 295 projects in the portfolio, 19.7 percent involve biology, 13.6 percent involve geosciences (including environmental sciences), 9.2 percent involve physics, 8.1 percent involve physical science, 7.8 percent involve chemistry, 3.4 percent involve astronomy, and 4.1 percent address other science topics (e.g., science literacy or education in general, or the nature of science itself). Another 1.0 percent of the projects address topics that could not be identified based on the materials reviewed. These include projects addressing issues relevant to many specific topic areas, such as a conference on inquiry practices that can be used in many science areas.

Among elementary school projects, the most common topics are general science (14.6 percent), physical science (9.8 percent), biology (8.9 percent), geosciences (7.3 percent), physics (4.9 percent), or multiple topics (10.6 percent). Common middle school science topics include biology (17.2 percent), multiple topics (16.6 percent) and geosciences (16.6 percent). High school projects infrequently address general science (3.6 percent) and more often cover biology (24.8 percent),

multiple topics (21.2 percent), geosciences (16.1 percent), physics (12.4 percent), and chemistry (11.7 percent).

Exhibit 2.9: Science Topics Covered in Projects by Grade (n=295 projects)

	All grades	Elementary	Middle	High
Number of projects per grade *(including those that are multi-discipline)*	**295**	**123**	**169**	**137**
Percentage of projects per grade addressing…				
Biology	19.7%	8.9%	17.2%	24.8%
Multiple science topics	18.3%	10.6%	16.6%	21.2%
Geosciences	13.6%	7.3%	16.6%	16.1%
General science	9.8%	14.6%	6.5%	3.6%
Physics	9.2%	4.9%	8.3%	12.4%
Physical science	8.1%	9.8%	7.7%	4.4%
Chemistry	7.8%	2.4%	6.5%	11.7%
Other science topics	4.1%	2.4%	3.6%	2.2%
Astronomy	3.4%	2.4%	3.6%	3.6%
Specific topics not identified	1.0%	0.0%	1.2%	1.5%

Exhibit reads: 19.7 percent of the 295 projects in the portfolio include a biology focus. Considering each grade band separately, 8.9 percent of the 123 elementary school projects, 17.2 percent of the 169 middle school projects, and 24.8 percent of the 137 high school projects address biology.

2.3 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 FY2008 program solicitation[9] and revised in the FY2010 program solicitation.[10] The cycle posits a dynamic, ongoing process through which knowledge and products are conceived, developed, disseminated and revised. The components of the cycle are:

- **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;
- **Evaluate** effectiveness; study complex phenomena, generalize;
- **Synthesize** lines of work; identify new insights and questions to inform new research and development; set research and development agendas; and
- **Hypothesize**, study and clarify phenomena of interest; frame issues; operationalize goals and constructs; develop and propose theory; conduct basic research on learning.

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

9 NSF DR K-12 Solicitation, NSF08502.

10 NSF DR K-12 Solicitation, NSF09602.

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 of Research and Development* that it most emphasizes or that best characterizes its work (presented in Exhibit 2.10). Overall, the DR K-12 portfolio is heavily weighted toward developing, refining, testing, and validating materials, measurement tools, and methods for STEM education.

Exhibit 2.10: Projects' Placement on the Cycle of Research and Development (n=295 projects)

	Number	Percentage
Design, develop and test	192	65.1%
Implement, study efficacy, and improve	25	8.5%
Scale up and study effectiveness	13	4.4%
Synthesize and theorize	31	10.5%
Explore, hypothesize and clarify	34	11.5%

2.4 Educational Resources Being Studied or Developed in Projects

Projects in the DR K-12 portfolio are producing and/or researching a wide variety of resources for the educational community (Exhibit 2.11). More than two thirds of them include a focus on teachers or professional development (66.4 percent). One of the reasons that 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.

Almost half of the projects are developing or studying resources to be used directly with students (45.1 percent). Almost as many projects address education models (40.0 percent). 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 (29.5 percent), 9.8 percent of projects plan (or planned) to host or organize conferences or meetings on educational topics, 9.2 percent of projects are conducting syntheses of existing research, theories, or practices, and 1.0 percent address another type of educational resource. Each type of resource is discussed in more detail below.

Exhibit 2.11: Number and Percentage of Projects Creating, Revising or Researching Resources, Models, Technologies, and Activities (n=295 projects)

	Number	Percentage
Resources for teachers or professional development	196	66.4%
Resources for student learning	133	45.1%
Models	118	40.0%
Student assessments	87	29.5%
Conferences	29	9.8%
Conducting syntheses	27	9.2%
Other	3	1.0%

Most of 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 are in large part delivered via computers or the internet (Exhibit 2.12). A fifth of the projects in the full DR K-12 portfolio are working with resources that provide students opportunities to learn through interacting with a virtual environment, online laboratory, cyber game, or other interactive online experiences (20.3 percent). Fifteen percent of the projects include tools to support or encourage online interactions, networking, and collaborating among students and between students and teachers, STEM experts, and others. A similar percentage involve online courses or tutoring (14.9 percent), and 12.9 percent include resources presented online or via computers for students containing information to be used in STEM educational activities. Finally, 8.8 percent of projects include other types of computer or internet resources.

Exhibit 2.12: Number and Percentage of Projects Creating, Revising or Researching Resources for Students including the use of Computers and Technology (n=295 projects)

	Number	Percentage
On-line gaming, interactive learning, or virtual environment	60	20.3%
Online networking or collaborating tool	45	15.3%
Online course, class or tutoring	44	14.9%
Information resources	38	12.9%
Other	26	8.8%

As mentioned above, 29.5 percent of the projects are studying or developing student assessments. Nineteen percent of the assessments are included as part of a curriculum being studied or developed (Exhibit 2.13), 9.2 percent are stand-alone assessments, and 1.7 percent involve other aspects of assessment. Another 1.7 percent of the assessment types could not be determined.

Exhibit 2.13: Number and Percentage of Projects Creating, Revising or Researching Student Assessments (n=295 projects)

	Number	Percentage
Assessment in a curriculum	56	19.0%
Stand-alone assessment	27	9.2%
Other type of student assessment	5	1.7%

Notes: [a] The assessment type of five projects (1.7 percent) could not be identified.

Two thirds of the projects in the DR K-12 portfolio include resources for teachers or professional development (66.4 percent). Almost a half of all projects include a professional development component either in the form of a course or a single or small number of sessions or meetings (41.4 percent, Exhibit 2.14). Almost a third 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 (31.9 percent). A quarter of the projects include informational resources for teachers on education, instruction, and/or STEM topics (26.1 percent). Almost a fifth of the projects involve supporting collaboration or networking among teachers or between teachers and students, STEM experts, or others, 11.2 percent include teacher supervision or mentoring, and 10.2 percent include a focus on curriculum for professional development courses. Finally, 9.2 percent of the projects address other types of resources for teachers or professional development.

Exhibit 2.14: Number and Percentage of Projects Creating, Revising or Researching Resources for teachers and professional development activities (n=295 projects)

	Number	Percentage
Professional development course or session(s)	122	41.4%
Stand-alone instruction, manuals, guides	94	31.9%
Information resource	77	26.1%
Networking	56	19.0%
Supervision or mentoring	33	11.2%
Curriculum for a professional development course or class	30	10.2%
Other type of teacher practice	27	9.2%

The focus of the teacher resources are diverse (Exhibit 2.15). The teaching resources in 30.8 percent of the projects provide teachers information on how to use specific curricula, resources, or activities with students, or how to lead specific activities. A quarter of the projects address specific instructional practices, 19.3 percent provide information on STEM topics, 12.9 percent address student learning and development, 9.5 percent provide information to teachers about how to lead activities or use resources that are not part of a specific curriculum, and 2.0 percent address other types of teacher professional development topics.

Exhibit 2.15: Content or purpose of teacher practice or professional development activities produced or studied in projects (n=295 projects)

	Number	Percentage
How to use specific curriculum, resources, or equipment	91	30.8%
Instructional practices	74	25.1%
STEM topics	57	19.3%
Student development, how students learn	38	12.9%
How to lead activities or lessons or use materials (not as part of a curriculum)	28	9.5%
Other[a]	6	2.0%

[a] The focus of two projects could not be identified (0.7 percent).

Among projects studying or developing models (Exhibit 2.16), the most common types of models are demonstration projects, or models of ideal educational practices for others to learn from or emulate (12.9 percent). These are followed by learning progressions, which are designed to model the timing and sequence a series of topics or concepts are learned (10.5 percent). Curriculum frameworks and professional development frameworks are featured in 8.5 and 8.1 percent of projects, respectively. Finally, various STEM standards are addressed in 2.7 percent of the projects, and 6.8 percent of projects involve other types of educational models.

Exhibit 2.16: Models Produced or Studied in Projects (n=295 projects)

	Number	Percentage
Models or demonstrations of ideal educational practices	38	12.9%
Learning progression	31	10.5%
Curriculum frameworks	25	8.5%
Teacher professional development frameworks	24	8.1%
Other	20	6.8%
Standards	8	2.7%

2.5 Distribution across Areas of Interest

The DR K-12 projects are distributed across the wide range of substantive areas presented above. Exhibit 2.17 displays the number of projects within each major discipline that are developing, revising, or studying a resource, model or technology by grade. Details about the specific types of resources, models and technologies are presented. The largest numbers of projects are developing, revising, or studying resources in mathematics or science.

Exhibit 2.17: Number of Projects in Major Discipline Areas Developing or Studying Selected Types of Educational Resources, by Grade Band (n=295)

	Mathematics			Science			Engineering			Other		
	Elem.	*Middle*	*High*	*Elem.*	*Middle*	*High*	*Elem.*	*Middle*	*High*	*Elem.*	*Middle*	*High*
Resources for teachers or professional development	46	57	37	36	63	57	7	8	7	9	12	5
Resources for student learning using computers or internet	14	19	19	27	53	47	2	6	6	6	10	4
Student assessments	17	24	17	12	35	26	0	3	1	2	8	4
Models	38	41	26	21	32	31	4	4	5	6	9	5
Syntheses	8	11	7	9	6	9	2	2	2	2	3	4
Conferences	14	15	13	7	8	7	1	1	1	4	4	3

2.6 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 diverse 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.

Slightly more than half of the projects use both qualitative and quantitative methods (51.5 percent); 15.6 percent use only qualitative methods and 13.6 percent use only quantitative methods. Overall, 65.1 of the projects have plans to conduct quantitative research and 67.1 percent are using qualitative approaches (Exhibit 2.18).

Almost one fifth of the projects in the portfolio (19.0 percent) are planning 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). Almost a quarter of the projects (23.1 percent) are planning to make pre-post comparisons without comparison groups. Almost 22 percent of the projects are planning to use quasi-experimental designs in which groups are formed in order to make comparisons, but random assignment is not used. Almost nine percent of the projects are planning to use quantitative methods to develop descriptions of educational settings or groups, and 6.4 percent of projects are using correlational methods to explore trends or draw contrasts across subgroups or explore relationships among educational characteristics.

Exhibit 2.18: Projects' Research Designs (n=295 projects)

	Number	Percentage
Quantitative	192	65.1%
Randomized control trial	*56*	*19.0%*
Quasi-experimental design (with comparison group)	*64*	*21.7%*
One group (pre/post)	*68*	*23.1%*
Correlational	*19*	*6.4%*
Descriptive	*25*	*8.5%*
Could not be classified	*6*	*2.0%*
Qualitative	198	67.1%
Design research	111	37.6%
Measurement/assessment development	71	24.1%
Examination of research quality or progress	49	16.6%
Longitudinal research	36	12.2%
Synthesis	23	7.8%
Could not be classified	13	4.4%

Some of the projects incorporate other more specialized research designs or methods into their plans. More than a third of the projects (37.6 percent) plan to use design-research methods (e.g., small-scale, often qualitative research methods that actively guide work designing resources or technologies). Almost a quarter of the projects have explicit plans to conduct extensive measurement development (24.1 percent). More than 10 percent of the projects plan to conduct longitudinal research, collecting outcome data at three of more points in time (12.2 percent), and less than 10 percent are conducting meta-analyses, literature reviews, or syntheses of existing research and theories (7.8 percent).

Both student and teacher outcomes are being investigated in the research conducted across projects (Exhibit 2.19). Two thirds (66.4 percent) of the projects in the portfolio are researching student outcomes including achievement, performance, or content knowledge, and attitudes, beliefs, or behavior (e.g., engagement, usage of materials, etc.). Similarly, 65.1 percent of the projects are researching teacher outcomes including classroom practices or instruction, attitudes or beliefs, pedagogical content knowledge, and content knowledge. Fewer projects are investigating administrator or academic coach outcomes t (6.1, and 1.7 percent, respectively).

Exhibit 2.19: Selected Outcome Domains in Projects Collecting Data (n=295 projects)

	Number	Percentage
Students	196	66.4%
Achievement/performance	*181*	*61.4%*
Attitudes/beliefs	*92*	*31.2%*
Behavior	*54*	*18.3%*
Teachers	192	65.1%
Classroom practices	*148*	*50.2%*
Attitudes and beliefs	*98*	*33.2%*
Pedagogical content knowledge	*99*	*33.6%*
Content knowledge	*72*	*24.4%*
Administrators	18	6.1%
Coaches	5	1.7%

2.7 Dissemination Activities

DR K-12 solicitations require that projects include a dissemination plan as part of their project description, however 11.9 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 (80.4 percent), and more than half specify the potential target audience or end users (68.1 percent), or identify their dissemination partners (57.7 percent). More than a third of the projects plan to incorporate input from their targeted users into their research or development plans (40.4 percent). Few projects, however, discuss their sustainability strategies, plans for developing a more formal dissemination plan, or the challenges anticipated (10.0, 2.3, and 1.5 percent, respectively).

Exhibit 2.20: Details Included in Dissemination Plan of Those Projects with Plans (n=260 projects)

	Number	Percentage
Identifies what will be disseminated	209	80.4%
Identifies potential adopter or end user	177	68.1%
Identifies dissemination partners	150	57.7%
Includes end-user input in design or development of research	105	40.4%
Addresses strategies for sustainability	26	10.0%
Intends to develop a formal dissemination plan	6	2.3%
Identifies dissemination challenges	4	1.5%

Projects reported plans for disseminating their work via a wide variety of vehicles (Exhibit 2.21). Projects most commonly plan to disseminate their work through presentations or poster sessions (73.9 percent of projects) and journal articles (70.8 percent). Many projects (60.3 percent) are also planning to disseminate their work or materials via existing or newly created websites. Less common dissemination strategies include professional networks (26.1 percent) workshops (17.6 percent), commercial publication or distribution of materials (14.9 percent), and books or chapters in books (7.8 percent). Projects also identify a wide range of other dissemination mechanisms including videotapes, briefings to Congress, and meetings with school districts.

Exhibit 2.21: Anticipated Vehicles of Dissemination (n=295 projects)

	Number	Percentage
Presentations/poster sessions	218	73.9%
Journal articles	209	70.8%
Websites	178	60.3%
Professional networks	77	26.1%
Workshops	52	17.6%
Commercial publication	44	14.9%
Books or book chapters	23	7.8%
White papers or unpublished reports	21	7.1%
Popular media	20	6.8%
Newsletter	17	5.8%
Webinars	14	4.7%
CDs/DVDs	9	3.1%
Other	80	27.1%
Could not be classified	15	5.1%

2.8 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 (55.3 percent), student learning (45.4 percent), and student assessments (20.3 percent, Exhibit 2.22). Products relating to teacher professional development include curriculum and/or materials, activities, and technologies. Products related to student learning include curriculum and/or materials, activities, technologies, and assessments.

Exhibit 2.22: Selected Anticipated Products (n=295 projects)

	Number	Percentage
Teacher professional development	**163**	**55.3%**
Course, meetings	89	30.2%
Curriculum and/or materials	24	8.1%
Supervision or mentoring	22	7.5%
Stand-alone instruction, manuals, guides,	86	29.2%
Information resources	52	17.6%
Networking, collaborating	45	15.3%
Other	13	4.4%
Student learning	**134**	**45.4%**
Curriculum and/or materials	69	23.4%
Computer or Internet activities and resources	99	33.6%
On-line gaming, interactive learning, or virtual environment	*46*	*15.6%*
Online course, class, or tutoring	*33*	*11.2%*
Information resource	*23*	*7.8%*
Online networking or collaborating tool	*33*	*11.2%*
Other computer or Internet activities and resources	*15*	*5.1%*
Other activities, materials, or equipment for student learning	73	24.7%
Student assessments	**60**	**20.3%**
Assessment in a curriculum	14	4.7%
Stand-alone assessment	4	1.4%
Other		
Conferences	29	9.8%
Conference proceedings	33	11.2%
Syntheses	19	6.4%
Standards	5	1.7%