PUERTO RICO MATH AND SCIENCE PARTNERSHIP (PRMSP)
Annual Report - Award 0314557
September 1, 2011 – August 31, 2012

INTRODUCTION

During the PRMSP's (AlACiMa) 9th year, we have continued to work with 8 of the original secondary school (7-12 grades) AlACiMa Professional Mathematics and Science Resource Center (PMSRC) to empower the science and math teachers (resource teachers) who are in charge of them (i.e., subproject *Follow Up to Resource Centers: Empowering the Resource Teachers)*. Through our support, resource teachers have become science and math professional development (PD) designers and trainers for their peers, and have strengthened the provision of other services related to STEM education in the PMSRCs. In 2009, two of our best professional PMSRCs from AlACiMa became role models to 15 new Centers that were created with funding from the Puerto Rico Department of Education (PRDE, Federal Funds Title V-A). These 15 new PMSRCs had actively participated in the AlACiMa project before and have been providing their services for two years after their establishment with the support from the PRDE. This year, as we did in 2010-11, we received funding from the PRDE (Federal Funds Title II-A) to offer the Authentic Professional Development Program (APDP) that was originally developed by AlACiMa to K-9 teachers in 17 PMSRCs (2 from the original PRMSP and 15 new).

Another effort being implemented and evaluated during this year is the Puerto Rico Master Science Teachers Program (PRMSTP), which was in its final phase. The program was designed to prepare and certify as Master Science Teachers (MST) eight 7-12th grade science teachers, teaching in high-need school districts. It is expected that these fellows will serve as role models of exemplary teaching of science, experts in content knowledge, and leaders among their peers to promote improvements in students' academic achievement. This year teachers transferred to their classrooms what they learned in the Phase I & II courses, got certified as cooperating teachers, carried out action research projects and presented them at the 2012 National Science Teachers Association (NSTA) Conference.

We proposed and were granted a one year, non-cost extension of this award to follow up and enrich activities identified in the PRMSTP logic model to further enhance the attainment of expected outcomes. We want to enrich those teachers' experience by providing them the necessary tools, coaching and scenario to put into practice all the newly acquired competences, and validate their new leadership role among their peers, and school administrators. Our proposed plan encompasses two types of activities: (1) ones specifically designed as follow up of the PRMSTP certification, and (2) others carried out in conjunction with the Robert Noyce Master Math Teachers (MMT) project, and other NSF-funded scientific research projects within the context of the I^3 project Maximizing Yield Through Integration (MYTI): Science and Math Education in the Context of a Disposing Society (NSF-DUE 1038166) as PRMSP/PRMSTP is one of the collaborators in this project.

This additional year will be used to carry out the following specific tasks: (1) *Student-teachers pre practicum and practicum mentoring*. The MSTs will be authorized to receive and be mentors of pre service teachers in their classrooms and also to mentor new teachers. This kind of activities promotes the collaboration-interaction with education professionals and enriches the

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teacher preparation program. We want to accompany and support the master teachers in this new experience as mentors to pre service and new teachers. (2) *Professional development to become teacher trainers and science professional development designers*. The MSTs have begun to train teachers from the PRDE at our PMSRCs. To carry out their trainings, they work in disciplinary groups (biology, chemistry, and physics) to revise and adapt the training plans developed by the trainers (i.e., faculty and exemplary teachers) who coach them. As a follow up we want to carry out training sessions to enhance teachers' skills as effective trainers and as designers we propose that they write the teacher and student guides for the training they will offer. (3) *Coaching on presentations and publications*. The MSTs carried out different action research projects and presented them at the 2012 National Science Teachers Association (NSTA) Conference held at Indianapolis. The PRDE Science Program Director, Dr. Zamara Jiménez, recommended that they continue presenting their work in different conferences and publish them. We plan to support them in these initiatives. This opportunity will let the MST share their work amongst their peers and administrators, and provide evidence of the effectiveness of this initiative as well as to share their educational research finding with the education community. This is an innovation and major achievement among our teachers whose publication opportunities are limited. (4) *Science and Math Integration and Peer Coaching.* During 2012-2013 the MST and the MMT will be participants of the MYTI project in integrated math & science instructional units focused on concepts within the context of waste disposal. We propose to pair master science with master math teachers to coach each other in their respective disciplines. Participation in MYTI also involves planning and carrying out action research using waste disposal projects to teach students content knowledge.

In addition, this year we continued documenting processes and results from the AlACiMa main project. We finalized the editing of the handbook on how to use the Spanish version of the adapted and revised "Reformed Teaching Observation Protocol" (RTOP). We have called it PROEDUCAR, which is an acronym that stands for "Protocolo de Observación en la Educación Reformada", which literally means protocol for observing reformed education. It is available on our webpage at: http://alacima.uprrp.edu/. Two books documenting work done in AlACiMa are in its final editing stage and will be published in the near future.

As a summary, during Year 9 PRMSP (AlACiMa) worked on: **1)** supporting 8 of the original secondary school (7-12 grade) PMSRCs , **2)** supporting and offering APDP to K-9 teachers at 17 PMSRCs, **3)** implementing the PRMSTP to certify eight Master Science Teachers, **4)** integrating teachers from PRMSP to MYTI project, **5)** publishing on the Internet the PROEDUCAR handbook, **5)** editing a book to document AlACiMa's comprehensive evaluation process, and **6)** editing chronicles of teachers' action research projects.

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Follow On to Resource Centers: Empowering the Resource Teachers
Annual Evaluation Report: July 2011- June 2012

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This report describes the implementation and evaluation of the special subproject, called *Follow On to Resource Centers: Empowering the Resource Teachers*, carried out by PRMSP/AlACiMa. This subproject is in its third and final year of implementation. Its purpose is to strengthen eight of the original secondary school (7-12) AlACiMa Math and Science Professional Resource Centers by supporting the science and math teachers who are in charge of these centers (called resource teachers). It aimed to empower these teachers to become science and math professional development (PD) trainers of their peers, and to strengthen the provision of other services related to STEM education in the centers. The project's design includes two phases (See logic model in Fig. 1).

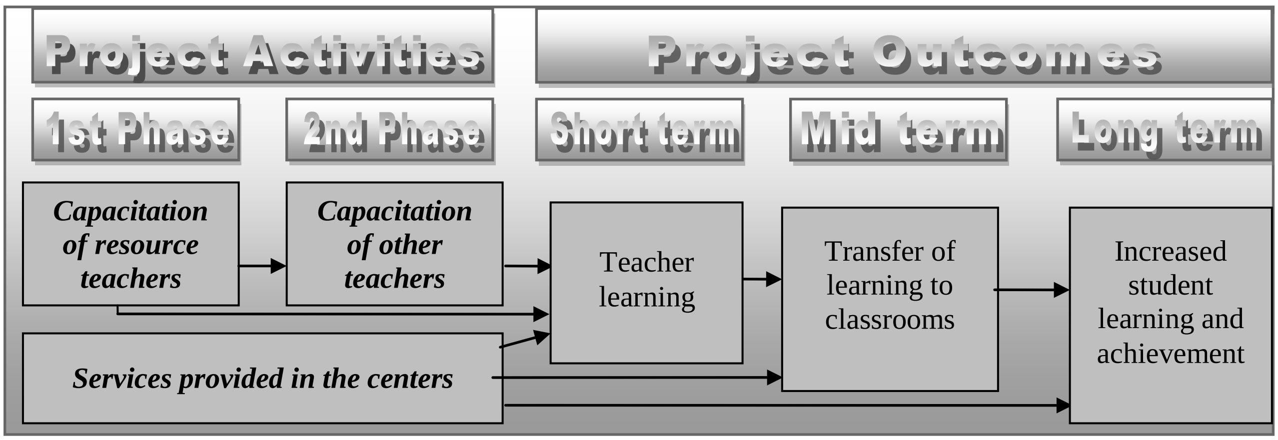

Figure 1. Logic model of the *PRMSP/AlACiMa Follow On to Resource Centers* subproject

1st Phase: Capacitation of Resource Teachers. During the first two years, this phase consisted of training-for-trainers' sessions (capacitation for capacitators, as called in AlACiMa in its Spanish equivalent) for resource teachers to become science and math PD trainers/capacitators of their peers. STEM faculty designed and implemented these training sessions focused on specific science and mathematics topics and evidence-based pedagogy. The resource teachers would then adapt these plans to train other teachers in the next phase. However, in this last year, the project implemented a change in this phase. The resource teachers themselves designed the capacitations for the 2nd phase working in disciplinary groups and having STEM faculty as consultants. The rationale of this decision was to empower further the resource teachers as trainers of their peers.

2nd Phase: Resource Teachers as Trainers/Capacitators of Their Peers. In this phase, the resource teachers played the role of PD trainers of other science and math teachers from their own and nearby schools. To carry out their capacitations, this year the resource teachers used the training plans developed by themselves in disciplinary groups in consultation with STEM faculty. They trained their peers in the resource-center schools.

The resource teachers also provided other services in the resource centers throughout the academic year to enhance teacher and student math and science learning. They included lending

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curriculum materials and equipment and providing consultation or tutoring on content and educational practices.

Project Activities

We describe below the project activities for the implementation of both phases of this special project in its third year.

1st Phase: Capacitation of Resource Teachers

As previously explained, this year the resource teachers designed the capacitations to train their peers in the 2nd phase, instead of attending training-for-trainers capacitations by STEM professors.

Design of Capacitations' Sessions

In a three-day retreat in September, the resource teachers started planning the design of the next cycle of capacitations. Science teachers decided to work in two disciplinary groups (biology and chemistry/physics), while the mathematics teachers worked all as one group. Group members named a person/s that would be the leader in the development of each capacitation although all of them would collaborate in the design of each one. The groups made preliminary decisions regarding the topics of the three capacitations that they would design that were subject to revision in the development process carried out during the fall semester. Table 1 presents the topics they finally worked on (the physics/chemistry group decided to work on physics topics).

Table 1. Science and mathematics topics addressed in the capacitations designed by resource teachers' disciplinary groups in Yr. 3

Disciplinary group	No. of teachers in group	Science and Mathematics Topics		
		1st.	2nd.	3rd.
Biology	4	Meiosis	Mendelian genetics	Researching the ADN molecule
Physics/Chemistry	3	Newton Laws	Serial and parallel circuits	Work, potency and simple machines
Mathematics	7	Linear equations in two variables	Pythagoras theorem	Probability

Besides meeting at the September retreat, the resource teachers also met in four formal sessions at PRMSP/AlACiMa headquarters in a period covering from October 2011 to January 2012 (See attendance data in Table 2). Resource teachers from one of the centers did not participate in the design of training sessions due to commitments related to their graduate studies; therefore, teachers from seven centers participated. Rather high attendance rates were observed for most sessions, but perfect attendance was never attained. In addition to the formal sessions, the groups met informally and communicated electronically to complete the design of the capacitations.

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Table -2. ***Attendance of resource teachers to working sessions to design science and mathematics PD capacitations/trainings in academic year 2011- 2012***

Date	Attendance	
	Science teachers	Mathematics teachers
September 23-25 [Retreat]	6 (86%)	5 (71%)
October 29, 2011	6 (86%)	5 (71%)
November 19, 2011	5 (71%)	6 (86%)
December 17, 2011	6 (86%)	4 (57%)
January 21, 2012	6 (86%)	6 (86%)

Collaborative Evaluation Session

We used a collaborative empowerment evaluation approach in this project, in which the resource teachers and other AlACiMa staff actively participated in planning and implementing the evaluation. The rationale for this decision was to help program participants to become more self-determined persons. This evaluation model is especially pertinent for programs that have the empowerment of participants as a basic goal, as is the case of this special project. The purpose of the evaluation was thus three-fold: to share formative data for the improvement of the project, to document outcomes for accountability purposes, and to build evaluation knowledge among project staff and resource teacher participants.

At the beginning of the fall semester (September 24), we planned and implemented, in collaboration with project staff, a session to provide feedback to resource teachers about the evaluation results of the second cycle of capacitations in which they trained their peers. Six science and five math resource teachers attended the session. They examined the evaluation results in disciplinary groups. Results included: (1) teachers' post-activity reactions, (2) teacher learning in the capacitations, (3) teacher educational practices prior to starting the PD capacitation phase (base-line data), and (4) services provided in the centers.

Teachers worked in small-groups to review each set of results using reflective questions as guidelines. They identified strengths and weaknesses of the work done in planning, implementing and evaluating the capacitations, and other services rendered in the centers. After these small-group activities, the evaluators facilitated a whole-group discussion. In it, teachers identified what they could do to improve the capacitations in the next year cycle, in which they were going to design their training sessions. To frame these group discussions the evaluators used the principles derived from research on how people learn (Donovan, Bransford, & Pellegrino, 2000). The resource teachers were familiar with these principles since they participated last year in a training session about them. Besides explanations about its implication for education, it included the application of these principles to review a capacitation they received from STEM faculty. Therefore, at this time they were capable of using them as a framework to reflect on how to improve their capacitations to their peers.

Although in past years, we carried out several collaborative evaluation meetings, this year the teachers asked to use all the available time to design their trainings/capacitations for their peers. They decided in the September session to use the same evaluation methods and techniques they used in the previous years. They would create pre/post tests, in consultation with STEM faculty, to evaluate each one of the capacitations they were going to design. They would then administer

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them as well as the evaluative reaction forms, and the educational practices questionnaire (post measure) in these capacitation/training sessions.

2nd Phase: Resource Teachers as Trainers/Capacitators of Their Peers

The resource teachers offered three PD capacitations/workshops (five-hrs. duration each) to teachers from their own or nearly schools, during spring and summer 2012. They used the training plans developed by themselves in disciplinary groups (biology, chemistry/physics, math), in consultation with STEM faculty, to carry out their capacitations on the topics mentioned before. These trainings aimed to help teachers to deepen their content knowledge and sustain quality teaching. Seven center-schools were sites for the three PD capacitations in the cycle (See Table 3).

Table 3. ***Attendance to PD capacitations/trainings of science and mathematics teachers carried out by resource teachers on spring/summer 2012***

Center-Schools	*Attendance to Capacitations/Trainings*							
	First (March 10-June6)		*Second (May 12-June 7)*		*Third (May 26-June 8)*		*Mean no. of teachers/session*	
	Science	*Math*	*Science*	*Math*	*Science*	*Math*	*Science*	*Math*
Juan Quirindongo Morel	8	8	7	8	8	8	7.7	8.0
Francisco Gaztambide	4	6	5	7	5	6	4.7	6.3
Rafael Pont Flores	4	7	4	7	4	7	4.0	7.0
Laura Mercado	3	6	3	7	4	7	3.3	6.7
Generoso Morales	8	7	7	7	8	7	7.7	7.0
Eugenio Ma. de Hostos	10	10	8	11	9	10	9.0	10.3
Pablo Colon Berdecía	6	9	9	8	9	9	8	8.7
Totals	43	53	43	53	47	54	43.3	54

The table shows that assistance was rather stable for the three sessions across centers. However, only one school-center (Eugenio Ma. de Hostos) nearly met the established target of 10 math teachers and 10 science teachers in each center-school.

Evaluation Results

We present in this section the evaluation results for the first and the second phase of the 3rd. year of this special subproject, with reference and comparisons to its first two years, as appropriate. The evaluation design follows from the logic model shown in Figure 1 and includes data collection activities addressing elements of each of its components.

1st Phase: Training/Capacitation of Resource Teachers

Results presented below include: (1) resource teachers' reactions to the collaborative evaluation session mentioned above, (2) data about the provision of services in the resource centers during the length of the project, and (3) findings regarding three years of student achievement results for the eight participant resource-schools.

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Resource Teachers' Reactions

We used a post-activity reaction form to get the opinion of the resource teachers about the collaborative empowerment evaluation session carried out in September (See Table 4). We designed this form based on the principles that guide empowerment evaluations (Fetterman, 1994; Fetterman and Wandersman, 2005).

Table 4. ***Resource teachers' reactions to collaborative evaluation session on 2011.***

Item	***Mean***
Organization of session	
Time effectively distributed.	3.42
Good organization of the activity.	3.67
Characteristics of collaborative empowerment evaluations	
Contributed to the betterment of what we do in the centers	3.83
Facilitated empowerment regarding the centers' functioning	3.67
Promoted becoming empowered regarding the evaluation	3.67
Felt included in the evaluation process	3.75
Democratic processes used to arrive at conclusions and decisions	3.67
Just and equitable involvement of all participants	3.83
Own knowledge about centers and schools was valued	3.67
Emphasis given to getting evidence about achievement of objectives	3.83
Participation in this collaborative evaluation session will help me to:	
Be able to better perform my duties as a resource teacher	3.83
Contribute to enhance the organizational processes in my school	3.75
Share the responsibility of being accountable for the results of the work done in the project and the schools	3.83

Response format: Strongly disagree: 1, Disagree:2, Agree:3; Strongly agree:4.

As can be seen, resource teachers provided rather high ratings to items in the reaction form for the collaborative evaluation sessions (>3.65 out of 4), except for the `time distribution item'. In the open-ended questions, some teachers suggested that we could have dedicated less time to discussing the results if participants were more clear and concise, and could have saved some time by sending results via e-mail beforehand. Since this session took place during the retreat in which the teacher started planning the design of their capacitations, some teachers expressed that they would have liked to start this work earlier in the day. Nevertheless, most teachers expressed satisfaction with the work done, as shown in some examples of verbatim responses below (translated from Spanish):

- Best learning. "I learned how the project is functioning, and reflected on how to improve it."… "Analyze what happened in the capacitations and be able to react to the results." "Sometimes things do not appear to be what they are, data talks about what is really true."... "Make an effective evaluation of how the capacitations and centers are functioning; realize the importance of doing it well and make a necessary analysis to prepare us for the next capacitations."

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- Suggestions. “Document all that was discussed”… “Keep on doing this type of session they way it has been done.”… “Continue having the opportunity to know how my peers feel about the workshops they offer.”… “Present these results to the teachers we trained in the capacitations.”

It is important that some teachers expressed that the review and discussion of results helped them to reflect on how to improve the project, and especially to prepare for the next round of capacitations, since they were going to design and implement them in the subsequent academic year.

Services at Centers

Tables 5 and 6 present data about the recipients of services during the duration of this three-year project (2009-10; 2010-11; 2011-12). As observed, the number of in-service math and science teachers who received services stayed more or less the same in the last two years, after a considerable increase from yr. 1 to yr. 2 (See Table 5). The exception was *other types of services,* which mainly include using the equipment that is available in the centers, which nearly tripled from yr. 2 to yr. 3. Consistent with this result, the service that the highest number of teachers received in the last year was *counseling or tutoring in the use of technological equipment.* These results suggest that resource teachers emphasized the provision of services related to technology during the past year, a development that is consistent with student experiences nowadays and can thus have a positive impact in student motivation and achievement.

Table 5. ***Comparison of the number of in-service teachers who received services in the resource centers in the three years of the follow-on subproject***

Services	***Math***			***Science***			***Both***		
	Yr. 1	***Yr. 2***	***Yr. 3***	***Yr. 1***	***Yr. 2***	***Yr. 3***	***Yr. 1***	***Yr. 2***	***Yr. 3***
Counseling/tutoring in content and/or educational strategies	21	51	46	22	56	49	43	107	95
Counseling/tutoring in the use of technological equipment	20	56	60	21	50	54	41	106	114
Counseling/tutoring on use of curricular /manipulative material	10	49	50	16	65	53	26	114	103
Counseling/tutoring in math/science research	1	13	2	9	31	8	10	44	10
Lending equipment	11	47	48	14	46	41	25	93	89
Lending curricular materials	8	33	28	15	32	34	23	65	62
Other types of services*	1	18	31	3	13	58	4	31	89

*Other types of services include math and science teacher meetings, and, specially, using the equipment that is available in the centers to prepare curricular materials or lessons.

The in-service math and science teachers are the target population of this special project, so all centers provided services to this group during the last year. However, some resource teachers have expanded the pool of service recipients to include pre-service teachers (e.g., four centers in yr. 3) and K-12 students (e.g., six centers in yr. 3). Table 6 presents a summary of the service recipients from these two groups in the three-year duration of this project.

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Table 6. ***Comparison of the number of pre-service and K-12 students who received services in the resource centers in the three years of the follow-on subproject***

Services	*Pre-service Teachers* Yr. 1	Yr. 2	Yr. 3	*K-12 Students* Yr. 1	Yr. 2	Yr. 3
Counseling/tutoring in content and/or educational strategies	9	3	18	63	161	238
Counseling/tutoring in the use of technological equipment	1	1	8	251	112	551
Counseling/tutoring on use of curricular /manipulative material	13	0	11	56	42	95
Counseling/tutoring in math/science research	3	4	2	47	36	220
Lending equipment	3	0	3	67	149	80
Lending curricular materials	3	4	3	10	20	2
Other types of services*	0	0	0	0	30	25

*Other types of services include advising student science and math clubs, and collaborating with students on preparation of curricular materials using recyclable materials.

The number of pre-service teachers who received services tended to increase in the last year, after a decrease from yr. 1 to yr. 2. The service with a highest number of recipients in yr. 3 was *counseling or tutoring in content and/or educational strategies*. The number of K-12 students who received services from the resource teachers in the centers tended to greatly increased in the last year. The highest number received *counseling or tutoring in the use of technological equipment*. It is encouraging that the number of pre-service teachers, and specially K-12 students, who received services in the centers increased last year. Again, services related to technology increased.

Student Achievement

Student achievement for the eight secondary schools, that are resource centers participating in this project, was evaluated using data from the standardized tests called *Pruebas Puertorriqueñas de Aprovechamiento Académico* (PPAA, by its Spanish acronym; Puerto Rican Academic Achievement Tests, in English). The Puerto Rico Department of Education (PRDE) administers these tests annually to students from all public schools to comply with the '*No Child Left Behind Law*. The administration of the math tests started in 2003 for grades 3 to 8 and 11; the science tests' administration began in 2007 for 3rd, 8th and 11th grades. ETS (previously) and the Pearson Group (now) developed these tests based on PRDE's math and science content standards since their inception, and from 2009 on aligned them to grade expectations published in 2007. The 2009 administration provided the baseline for student achievement in this evaluation. Table 7 below presents results for spring 2009, 2010 and 2011 for the eight centers that operate in secondary schools (7-12) schools and participate in this special sub project (Data for spring 2012 is still not available).

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Table 7. Student *achievement results from PPAA standardized tests for the project's eight center-schools (2009, 2010 and 2011 administrations)*

TESTS	Grade level	Spring 2009 N	Spring 2009 At or above proficiency (%)	Spring 2009 Below proficiency (%)	Spring 2010 N	Spring 2010 At or above proficiency (%)	Spring 2010 Below proficiency (%)	Spring 2011 N	Spring 2011 At or above proficiency (%)	Spring 2011 Below proficiency (%)
MATH	7	613	8.5	91.5	627	16.3	83.7	590	16.9	83.1
	8	535	3.0	97.0	558	8.2	91.7	576	15.1	84.9
	11	789	1.3	98.7	803	4.4	95.6	806	8.9	91.1
	Total	**1937**	**4.0**	**96.0**	**1988**	**9.2**	**90.8**	**1972**	**13.1**	**86.9**
SCIENCE	8	535	18.1	81.9	552	31.9	68.1	575	41.4	58.6
	11	777	46.7	53.3	799	48.6	51.4	798	52.4	47.6
	Total	**1312**	**35.1**	**64.9**	**1351**	**41.7**	**58.3**	**1373**	**47.8**	**52.2**

As observed, the percentage of students at or above the proficiency level is low for all grades and both subject matters (all less than 50%) at all three administrations, but these proficiency percentages are considerably higher for science than for mathematics. Remarkably, the percentage of students who scored at or above the proficiency level increased for all tested grades and subject matters from 2009 to 2011 in the eight participant center-schools.

To present a context in which to analyze the previous results, we show in Table 8 equivalent PPAA data for all secondary schools in the PRDE public educational system. If we compare data from tables 7 and 8 we can see that the percent of students from the eight participant center-schools who scored at or above the proficiency level is higher than those in the system at all tested grades for both mathematics and science (again, the proficiency percentages are higher for science than for math). To compare this data further, we calculated the annual increases in percentage points for the totals presented in these tables (from 2009 to 2010 & from 2010 to 2011). Notably, these annual increases are higher for the eight-center schools than for all secondary schools in the system for both math (5.2 & 3.9 vs. 2.2 & 2.0, respectively) and science (6.6 & 6.1 vs. 4.1 & 5.5, respectively). These results are remarkable; although we are aware that total attribution to this special project is not warranted, we can conclude that the project probably contributed to them.

Table 8. *Student achievement results from PPAA standardized tests for all secondary schools in the public school system (2009, 2010 and 2011 administrations).*

TESTS	Grade level	Spring 2009 N	Spring 2009 At or above proficiency (%)	Spring 2009 Below proficiency (%)	Spring 2010 N	Spring 2010 At or above proficiency (%)	Spring 2010 Below proficiency (%)	Spring 2011 N	Spring 2011 At or above proficiency (%)	Spring 2011 Below proficiency (%)
MATH	7	41,956	4.2	95.8	41,422	5.6	94.4	40,965	6.7	93.3
	8	39,564	3.5	96.5	38,424	7.2	92.8	37,495	8.5	91.5
	11	30,624	2.3	97.7	30,963	3.6	96.4	30,048	7.7	92.3
	Total	**112,144**	**3.4**	**96.6**	**110,809**	**5.6**	**94.4**	**108,508**	**7.6**	**92.4**

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TESTS	Grade level	Spring 2009 N	Spring 2009 At or above proficiency (%)	Spring 2009 Below proficiency (%)	Spring 2010 N	Spring 2010 At or above proficiency (%)	Spring 2010 Below proficiency (%)	Spring 2011 N	Spring 2011 At or above proficiency (%)	Spring 2011 Below proficiency (%)
SCIENCE	8	38,484	18.0	82.0	37,928	22.6	77.4	37,204	26.7	73.3
	11	30,053	36.1	63.9	30,608	39.2	60.8	29,815	46.5	53.5
	Total	**68,537**	**25.9**	**74.1**	**68,536**	**30.0**	**70.0**	**67,019**	**35.5**	**64.5**

2nd. Phase. Resource Teachers as Trainers/Capacitators

We present in this section results for the following: (1) quality of the math and science capacitations by resource teachers, (2) teacher learning derived from these PD training sessions, and (3) transfer of evidence-based educational practices to these teachers' classrooms.

Quality of the Math and Science Capacitations

To assess the quality ascribed to the capacitation/training sessions by the math and science teachers trained by the resource teachers, we used post-activity reaction forms created in AlACiMa to collect quantitative and qualitative data. As previously explained, the resource teachers designed and implemented three capacitations.

Quantitative results. In Table 9 we show results for the three capacitations provided by science resource teachers on biology and physics topics. Results suggest that science teachers were very satisfied with these training sessions ($\geq$3.75 for any single session, and $\geq$3.88 for the overall score, out of a max. of 4). These results were relatively similar to those observed last year (corresponding scores for science last year were 3.88 and 3.92). It is noteworthy that the master teachers designed the capacitations themselves at this time.

Table 9. ***Results from teacher post-activity reaction forms for capacitations carried out by science resource teachers in 2012***

Item	*Science Capacitations in Yr.3*							
	Biology				***Physics***			
	1st (n=16)	*2nd (n=19)*	*3rd (n=20)*	***Overall Mean*** *(N=55)*	*1st (n=26)*	*2nd (n=24)*	*3rd (n=27)*	***Overall Mean*** *(N=77)*
Capacitations' organization and objectives								
Time was distributed effectively	4.00	4.00	3.95	3.98	3.88	3.75	3.88	3.84
Good organization was observed	3.93	4.00	4.00	3.98	4.00	3.83	4.00	3.95
Objectives of activity were achieved	3.98	3.99	4.00	3.99	3.95	3.95	3.99	3.96
Characteristics of effective learning environments								
During the capacitation, I felt comfortable to share my thoughts, concerns and doubts.	4.00	4.00	4.00	4.00	3.92	3.88	4.00	3.93
The session included an exploration of my previous knowledge.	4.00	4.00	4.00	4.00	3.96	3.92	4.00	3.96

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Item	Science Capacitations in Yr.3							
	Biology				Physics			
	1st (n=16)	2nd (n=19)	3rd (n=20)	Overall Mean (N=55)	1st (n=26)	2nd (n=24)	3rd (n=27)	Overall Mean (N=77)
The capacitation promoted and valued my active participation in the learning process.	4.00	4.00	4.00	4.00	3.96	3.92	4.00	3.96
The questions of the capacitator motivated me to think critically and investigate	4.00	4.00	4.00	4.00	4.00	3.92	3.96	3.96
I was actively engaged in thought provoking activities involved the critical assessment of procedures.	4.00	4.00	4.00	4.00	4.00	3.92	3.96	3.96
The capacitation helped me develop coherent conceptual understanding of this content.	4.00	4.00	4.00	4.00	4.00	3.92	4.00	3.97
The capacitator assessed my learning during the session.	4.00	4.00	4.00	4.00	3.92	3.88	4.00	3.93
Time was provided to reflect about my learning and transfer to classroom.	4.00	4.00	4.00	4.00	3.96	3.88	4.00	3.95
I am going to implement what I have learned in this capacitation in my classroom practice.	4.00	4.00	4.00	4.00	3.88	3.88	4.00	3.92
Total	**3.99**	**4.00**	**4.00**	**4.00**	**3.95**	**3.91**	**3.98**	**3.94**

Response format: Strongly disagree:1, Disagree:2, Agree:3; Strongly agree:4.

Table 10 shows results from the post-activity reaction forms for the three capacitation-sessions carried out by mathematics resource teachers in Yr. 3.

Table 10. ***Results from teacher post-activity reaction forms for capacitations carried out by mathematics resource teachers in 2012***

Item	Math Capacitations			
	1st (n=54)	2nd (n=51)	3rd (n=55)	Overall mean (n=160)
Capacitations' organization and objectives				
Time was distributed effectively	3.89	3.94	4.00	3.94
Good organization was observed	3.93	3.96	4.00	3.96
Objectives of activity were achieved	3.97	3.98	4.00	3.98
Characteristics of effective learning environments				
During the capacitation, I felt comfortable to share my thoughts, concerns and doubts.	3.98	4.00	4.00	3.99
The session included an exploration of my previous knowledge.	3.96	4.00	4.00	3.99
The capacitation promoted and valued my active participation in the learning process.	3.98	4.00	4.00	3.99
The questions of the capacitator motivated me to think critically and investigate	3.98	4.00	4.00	3.99
I was actively engaged in thought provoking activities involved the critical assessment of procedures.	3.98	3.98	4.00	3.99

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Item	Math Capacitations			
	1st (n=54)	*2nd (n=51)*	*3rd (n=55)*	***Overall mean*** *(n=160)*
The capacitation helped me develop coherent conceptual understanding of this content.	3.98	4.00	4.00	3.99
The capacitator assessed my learning during the session.	3.98	4.00	4.00	3.99
Time provided to reflect about learning strategies used and ways to transfer them to my classroom.	3.96	4.00	4.00	3.99
I am going to implement what I have learned in this capacitation in my classroom practice.	3.98	4.00	4.00	3.99
Total	**3.96**	**3.99**	**4.00**	**3.98**

Response format: Strongly disagree:1, Disagree:2, Agree:3; Strongly agree:4.

Results suggest that, similar to science teachers, mathematics teachers were very satisfied with the training received (≥3.89 for any single session, and ≥3.94 for the overall scores, out of a max. of 4). These results were slightly higher than those observed last year were (corresponding scores last year for math were 3.82 and 3.86), a tendency similar to that observed from Yr. 1 to Yr. 2. Again, it is important to notice that the math resource teachers designed the capacitations themselves at this time. However, they produced similar or slightly better reactions from teachers than when they adapted the ones designed by STEM faculty.

Qualitative results. As in earlier years, expressions from both the math and science teachers collected this year in the open-ended part of the post-activity reaction forms confirmed what the quantitative results indicated (translated from Spanish):

> The workshop was excellent…. Good organization, time-management and delivery… Very good session, even though I knew about the topic I was able to learn more … An excellent learning opportunity… All the workshops were excellent, dynamic and practical to use with students… Very good activities, simple and at the student level… The activities can be adapted both to intermediate and to high school level; I liked them very much… All the activities are pertinent for different grades and are aligned with content standards.

The reaction form also inquires about the learning teachers planned to transfer to their classrooms. Most teachers said they would teach the content matter focused on the sessions using the activities and instructional techniques used in capacitations. Moreover, many teachers explicitly mentioned evidence-based educational strategies used in the sessions to promote learning with understanding, which they plan to transfer to their classrooms. Some examples of what math teachers commented are the following:

> Use exploration and application exercises to plan a lesson… Use examples from real life to initiate a topic like linear functions… Interpret everyday life situations referring to linear equations in two variables… Work with real life problems to identify variables, slope and intercept… Demonstrate the way of determining the distance between two points with the Pythagoras theorem using examples from everyday life so that student can better understand it … Identify teaching methods that are pertinent and easier for students and go one-step at a time to facilitate understanding… Use concrete materials, like the

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> geoboard, to teach concepts like the Cartesian plane and linear equations… Provide more activities linked to students' real life so they can see the usefulness of math.

Many science teachers also paid attention to this kind of practices and talked about how they planned to use them in their classrooms:

> Now I will discuss the topic 'circuits in series and in parallel' using concrete examples since I taught it before only in theory … Use lab activities to study Newton Laws because they predict and explain many phenomena in nature and in our daily lives… Present examples of common machines using lab experiences for students to apply and practice the formulas… I will adapt activities, like those for meiosis and its relation with syndromes, to the needs of my students. … I will give more emphasis to the topic of genetics using activities as the construction of a model of a creature based on random characteristics… Make connections between concepts… Make students work on cooperative groups … Play a less active role as a teacher, use more inquiry techniques… Use experimental activities and the design of models as a way of assessing student learning… Have students participate in discussions, clarify their doubts, and foster a relaxed and happy environment.

These comments suggest that math and science teachers who participated in the capacitations carried out by the resource teachers were able to identify several attributes of effective learning environments (see Donovan, Bransford, & Pellegrino, 2000). Moreover, they are planning to use them in their classrooms.

Teacher Learning

Resource teachers created tests to use as pre/post measures to evaluate learning achieved by teachers in the capacitations. These tests included both multiple choice and open-ended items (scored using rubrics). Many of the items tested characteristics of learning with understanding, namely, to relate, apply/extend or explain/justify concepts or ideas (Carpenter et al., 2004). Table 10 presents the number of items in each test and the maximum number of points assigned to the test. The number of points for each item depended mainly on its difficulty, whether it included more than one part, and whether it was a close or open-ended question (the latter usually had a larger point-value).

Table 10. Data regarding tests taken by science and mathematics teachers on capacitations given by resource teachers in the project's 3rd. year

Content matter	No. of Items and Points in the Tests of the Science/Math Capacitations								
	1st.			2nd.			3rd.		
	Topic	I[1]	P[2]		I	P	Topic	I[1]	P[2]
Biology	Meiosis	10	15	Mendelian genetics	10	15	Researching the ADN molecule	8	8
Physics	Newton Laws	18	20	Work and simple machines	15	15	Serial and parallel circuits	17	17
Mathematics	Linear equations in two variables	17	30	The Pythagoras theorem	8	22	Probability	8	22

I[1] : No. of items in test; P[2]: No. of maximum number of points in test.

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Figures 1 and 2 below show the comparison between the pre and posttest measures for these capacitation/training sessions. As seen, the mean percent of correct answers increased from pre to post in all sessions, regarding both science and mathematics topics.

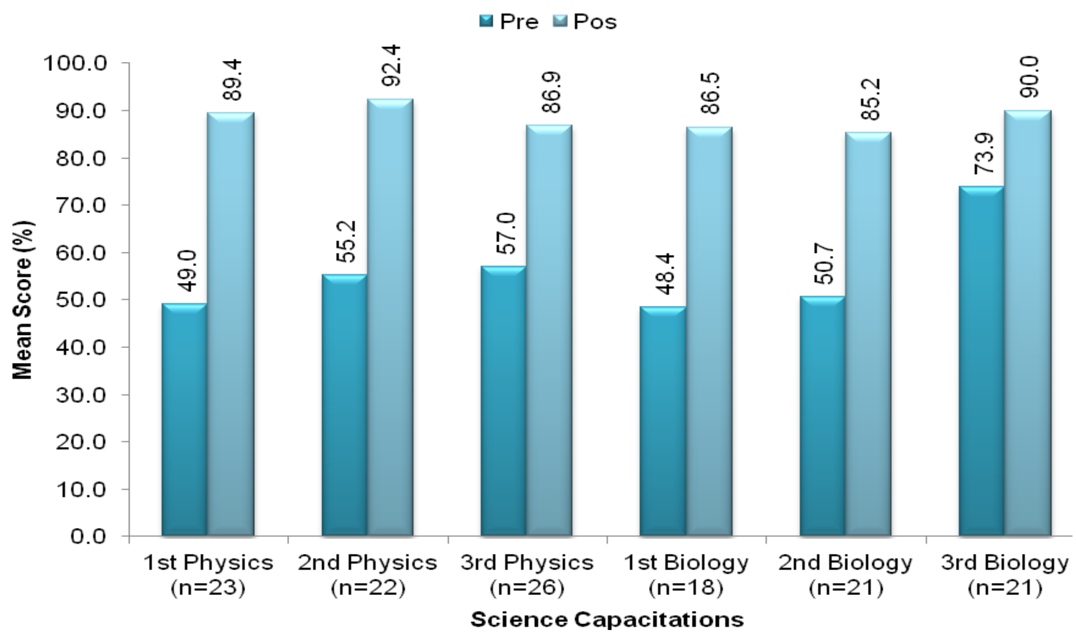

***Figure 1.* Comparison between pre and post-test measures for teacher learning on science topics in the 3rd. yr. of capacitation/training sessions carried out by science resource teachers**.

Statistically significant differences (smaller than .001) were identified in all the post-pre comparisons (scores compared using paired t-tests). These results are encouraging especially because they show statistically significant growth in both science and math. Additionally, the percentages in the post-tests (correct answers all larger than 85% in science and 82% in math) are better than those of year 2 were (post-test correct answers smaller or equal to 78%).

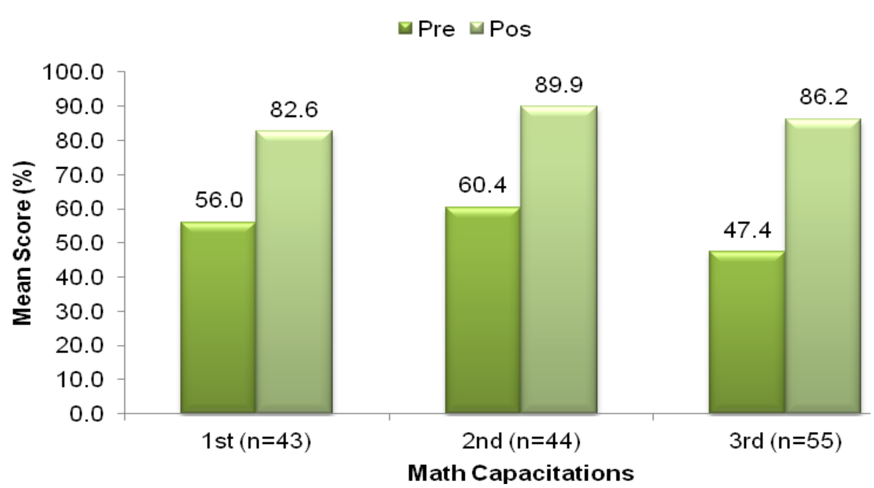

***Figure 2.* Comparison between pre and post-test measures for teacher learning on mathematics topics in the 3rd yr. of capacitation/training sessions carried out by math resource teachers**.

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Teacher Transfer to the Classrooms

We used the AlACiMa K-12 Teachers Questionnaire to evaluate the usage of best educational practices by teachers who attended the capacitations offered by resource teachers. It is a self-report measure derived from the CETP Core Evaluation K-12 Survey (Lawrence, Huffman & Appeldoorn, 2002). In this report, we present analyses regarding change in usage of these practices utilizing two different baseline measures, one prospective and another retrospective.

We consider that prospective and retrospective measures have strengths and weaknesses, so methodological artifacts can influence results derived from both types. The prospective baseline have the advantage of referring to information about present events, while the retrospective ones refer to a period in the past so faulty recall can affect the latter. However, we have observed that depth of understanding can influence teacher answers on instruments that assess innovative educational practices; the more teachers are exposed to the innovative practices, the more accurate their answer to questions about their use can be. A good example to illustrate this point is the item ‘new information is based on what students already know about the topic’. Teachers who use traditional methods may think that they meet this criterion by covering topics in the order that the curriculum or the textbook follow (e.g., multiplication before division). However, after attending PD capacitations based on evidence-based educational practices (e.g., National Research Council, 2000, 2005), they can have a different understanding. They would know that for each new topic teachers must draw out the preexisting understandings that their students bring with them, specially their informal comprehension about how the world functions. Teachers must then work actively with this knowledge in the class to foster students’ learning with understanding. Therefore, in our case, teachers would probably understand better the correct intent of the questionnaire’s items in 2012 than in 2010 or 2011, so this could represent a strength for the retrospective baseline and a weakness for the prospective one. For these reasons, we decided to collect and present both prospective and retrospective comparisons.

For the prospective analyses, we used results from the administration of the questionnaire in Yr. 1 or 2, depending on whether it was the first time a teacher attended a cycle of the annual capacitations by resource teachers. Scores for first-timers from the first (2010) or second (2011) year are the prospective baseline for this analysis. In the 3^{rd}. year (2012), we obtained the retrospective scores by using a version of the CETP Core Evaluation K-12 Survey that includes two set of answers (pre/post). Instructions ask participants to answer how they teach their classes formerly (before a specific date) and currently. For the retrospective analyses, we used the former answers as baseline and the latter as the post measure for the same subjects who had prospective scores.

Table 11 presents results for frequency of use of instructional practices. As seen, both comparisons showed statistically significant improvements in usage of evidence-based practices at the total level. Evidence of this finding is that the post measures are significantly higher than the pre ones when the total sums of scores are compared both prospectively (2010/11 pre) and retrospectively (2012 pre). Moreover, when all teachers are grouped, regardless of subject matter, statistically significant improvements are shown in all comparisons based on the retrospective baseline and in most (8 out of 11) of the ones based on the prospective baseline. Notably, the 2012 pre scores tend to be lower, so the differences for the retrospective comparisons are larger, and its statistical significance stronger. This pattern is more obvious, however, for science teachers since many prospective comparisons involving science teachers’ scores are not statistically significant at the item level (8 out of 11) while the equivalent ones for

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the retrospective comparisons are. The only prospective comparisons in which science teachers showed significantly more frequent use at present were *using and making models*, *data collection and analysis* and *presentations for understanding*. It is important to notice that the capacitations for science teachers included these practices. Remarkably, math teachers showed significantly more frequent use of best instructional practices in all the comparisons using the retrospective baseline and in almost all (9 out of 10) that are based on the prospective baseline. Due to the consistency between these two sets of results, we can conclude that the evidence about positive improvement in usage of best instructional practices is more solid for math teachers than for science teachers.

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Table 11. Prospective (2010/11baseline) and retrospective (2012 baseline) pre/post comparisons for teachers' usage of instructional practices in their classrooms (N=61)

Instructional practices	*Mathematics (n=26)* 2010/11 Pre	2012 Pre	2012 Post	*Science (n=35)* 2010/11 Pre	2012 Pre	2012 Post	*All Teachers (N=61)* 2010/11 Pre	2012 Pre	2012 Post
Students voice in decisions	3.33** (0.48)	2.80*** (0.89)	3.75 (0.44)	3.39 (0.70)	2.91** (0.89)	3.31 (0.69)	3.37 (0.62)	2.86*** (0.89)	3.48 (0.64)
Based on prior knowledge	3.65* (0.56)	3.37*** (0.68)	3.89 (0.32)	3.63 (0.65)	3.41*** (0.61)	3.81 (0.47)	3.64* (0.61)	3.39*** (0.63)	3.84 (0.42)
Time allowed for deep learning	3.85 (0.37)	3.35* (0.75)	3.70 (0.47)	3.77 (0.43)	3.35*** (0.55)	3.74 (0.51)	3.80 (0.40)	3.35*** (0.63)	3.73 (0.49)
Inquiry & problem solving	3.48 (0.59)	2.78*** (0.88)	3.56 (0.51)	3.46 (0.51)	2.97*** (0.66)	3.48 (0.57)	3.47 (0.54)	2.89*** (0.74)	3.51 (0.54)
Group work with one grade	3.19* (0.57)	2.95** (0.62)	3.47 (0.51)	3.17 (0.62)	3.00** (0.77)	3.32 (0.60)	3.18** (0.59)	2.98*** (0.71)	3.38 (0.57)
Discussion teacher talks less	3.00*** (0.63)	2.89** (0.81)	3.37 (0.60)	3.17 (0.62)	2.71*** (0.78)	3.32 (0.60)	3.10*** (0.62)	2.78*** (0.79)	3.34 (0.59)
Use & make models	2.85*** (0.88)	2.84*** (0.90)	3.47 (0.51)	3.46* (0.56)	3.03*** (0.60)	3.68 (0.48)	3.20*** (0.77)	2.96*** (0.73)	3.60 (0.49)
Real world problems/ activities	3.20** (0.65)	2.89*** (0.66)	3.58 (0.51)	3.35 (0.54)	3.10*** (0.65)	3.48 (0.57)	3.29** (0.59)	3.02*** (0.65)	3.52 (0.54)
Data collection & analysis	2.58*** (0.58)	2.42*** (0.69)	3.11 (0.46)	3.21* (0.73)	2.97*** (0.71)	3.48 (0.57)	2.95*** (0.74)	2.76*** (0.74)	3.34 (0.56)
Connection other STEM fields	3.00*** (0.71)	2.63** (0.90)	3.37 (0.60)	3.40 (0.55)	2.93*** (0.58)	3.60 (0.50)	3.23*** (0.65)	2.82*** (0.73)	3.51 (0.54)
Presentations for understanding	3.00* (0.91)	2.74** (0.93)	3.37 (0.60)	3.09*** (0.72)	2.97*** (0.68)	3.59 (0.50)	3.05*** (0.80)	2.88*** (0.79)	3.50 (0.55)
Total	**3.19*** (0.34)**	**2.98*** (0.59)**	**3.54 (0.26)**	**3.38** (0.34)**	**3.08*** (0.42)**	**3.52 (0.28)**	**3.30*** (0.35)**	**3.04*** (0.49)**	**3.53 (0.27)**

Response format: Strongly disagree:1, Disagree:2, Agree:3; Strongly agree:4.
* p<.05; ** p<.01; *** p<.001 (Significant differences identified using t-tests for dependent groups).
Note: Contrary to the general practice, asterisks were placed in the pre data because the post measures are the same for both comparisons.

We also compared the pre/post usage of assessment techniques and processes using prospective (2010/11 pre) and retrospective (2012 pre) baselines (See Table 12). Results are generally similar to those observed for instructional practices: most comparisons at the total level show statistically significant improvements in usage of evidence-based practices. That is, at the total sum of scores' level all the post measures are significantly higher than the pre ones in the retrospective analyses and most of the prospective ones (11 out of 12). Similarly, for the group

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of all teachers, all comparisons based on the retrospective baseline and most (7 out of 17) of the prospective ones showed statistically significant improvements. Once more, the 2012 pre scores tend to be lower and the statistical significance of the differences stronger. This pattern is again especially notable at the item level for science teachers since the only prospective comparison in which science teachers showed significantly more frequent current use of assessment techniques was student use of *reflective diaries to explain learning*. However, similar to math teachers' usage of instructional practices, science teachers showed a significant improvement in the use of all assessment processes in both the prospective and the retrospective analyses. Remarkably again, math teachers showed a consistent pattern of increased use of both assessment techniques and processes in most prospective comparisons (13 out of 17) and in all the retrospective ones.

Table 12. Prospective (2010/11baseline) and retrospective (2012 baseline) pre/post comparisons for teachers' usage of assessment practices in their classrooms (N=61)

Instructional practices	*Mathematics (n=26)* 2010/11 Pre	2012 Pre	2012 Post	*Science (n=35)* 2010/11 Pre	2012 Pre	2012 Post	*All Teachers (N=61)* 2010/11 Pre	2012 Pre	2012 Post
				Assessment technique					
High thinking level probl.	3.92* (1.23)	3.95* (1.40)	4.57 (0.51)	4.26 (0.86)	3.74*** (1.05)	4.42 (0.87)	4.11* (1.05)	3.82*** (1.19)	4.48 (0.74)
Portfolios	1.88 (0.82)	1.71 (1.06)	2.13 (1.42)	2.69 (1.18)	1.91* (0.98)	2.55 (1.25)	2.34 (1.11)	1.83** (1.00)	2.37 (1.33)
High thinking multiple choice	2.88*** (1.51)	3.00** (1.61)	3.88 (1.08)	3.91 (0.95)	3.82** (1.04)	4.15 (0.76)	3.48*** (1.31)	3.50*** (1.34)	4.04 (0.91)
Written research reports	1.27 (0.45)	1.29* (0.90)	1.43 (0.95)	2.34 (0.97)	1.52*** (0.80)	1.91 (0.98)	1.89 (0.95)	1.43*** (0.84)	1.71 (0.99)
Oral present. to explain ideas	2.00 (0.98)	2.10* (1.04)	2.54 (1.02)	2.83 (1.07)	2.70*** (0.88)	3.22 (0.71)	2.48** (1.10)	2.46*** (0.99)	2.93 (0.91)
Comic strips to assess learning	2.31* (1.19)	2.48* (1.36)	2.96 (1.11)	2.94 (1.08)	2.52** (1.23)	2.97 (1.19)	2.67 (1.17)	2.50*** (1.27)	2.96 (1.14)
Concrete poems w explanations	2.04 (1.08)	1.76* (1.09)	2.17 (1.13)	2.66 (1.24)	2.58** (1.23)	3.03 (1.24)	2.39 (1.20)	2.26*** (1.23)	2.67 (1.26)
Refl. diaries to explain learning	2.15* (1.46)	2.14* (1.39)	3.00 (1.44)	2.54** (1.40)	2.79** (1.52)	3.21 (1.54)	2.38*** (1.43)	2.54*** (1.49)	3.12 (1.49)
Open ended conceptual qs.	3.19** (1.55)	3.24* (1.48)	3.96 (1.16)	4.17 (1.07)	3.85* (1.30)	4.09 (1.07)	3.75 (1.37)	3.61** (1.39)	4.04 (1.01)
Rubrics to check learning	2.77** (1.45)	2.81** (1.57)	3.61 (1.08)	3.71 (1.20)	3.52** (1.28)	3.88 (1.17)	3.31* (1.38)	3.24*** (1.43)	3.77 (1.13)
Graphic org. to show learning	3.08* (1.35)	3.10*** (1.51)	3.75 (0.99)	4.17 (1.04)	3.67*** (1.11)	4.15 (0.82)	3.70 (1.30)	3.44*** (1.30)	3.98 (0.91)
Essay to descr. reasoning	1.50* (0.91)	2.00* (1.34)	2.29 (1.27)	2.83 (1.22)	2.42*** (1.23)	2.88 (1.27)	2.26 (1.28)	2.26*** (1.28)	2.64 (1.29)
Total	2.42** (0.72)	2.46** (0.94)	3.02 (0.59)	3.25 (0.66)	2.92*** (0.68)	3.39 (0.63)	2.90** (0.79)	2.75*** (0.81)	3.24 (0.63)
				Assessment processes					
Ass. res. used to modify teaching	3.64** (0.49)	3.09*** (0.87)	3.70 (0.70)	3.56** (0.61)	3.21*** (0.69)	3.79 (0.42)	3.59** (0.56)	3.16*** (0.76)	3.75 (0.55)
Ass. res. for stud. reflection	3.73* (0.45)	3.23*** (0.87)	3.79 (0.41)	3.53** (0.66)	3.15*** (0.70)	3.76 (0.44)	3.62* (0.58)	3.18*** (0.77)	3.77 (0.42)
Ass. of prior	3.28**	3.00***	3.67	3.32**	3.06***	3.64	3.31***	3.04***	3.65

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	Mathematics (n=26)			Science (n=35)			All Teachers (N=61)		
Instructional practices	*2010/11 Pre*	*2012 Pre*	*2012 Post*	*2010/11 Pre*	*2012 Pre*	*2012 Post*	*2010/11 Pre*	*2012 Pre*	*2012 Post*
learning	(0.61)	(0.77)	(0.48)	(0.68)	(0.66)	(0.49)	(0.65)	(0.70)	(0.48)
Assess own learn. w rubrics	2.68** (0.80)	2.67*** (0.80)	3.29 (0.62)	2.91*** (0.67)	2.85*** (0.80)	3.55 (0.56)	2.81*** (0.73)	2.78*** (0.79)	3.44 (0.60)
Assess own performance	3.73* (0.45)	3.29** (0.72)	3.79 (0.41)	3.44** (0.61)	3.36*** (0.70)	3.85 (0.36)	3.57** (0.56)	3.33*** (0.70)	3.82 (0.38)
Total	3.41** (0.38)	3.08*** (0.59)	3.65 (0.28)	3.36*** (0.39)	3.14*** (0.59)	3.72 (0.31)	3.38*** (0.38)	3.12*** (0.59)	3.69 (0.30)

Response format: Strongly disagree:1, Disagree:2, Agree:3; Strongly agree:4.
* p<.05; ** p<.01; *** p<.001 (Significant differences identified using t-tests for dependent groups).
Note: Asterisks are placed in the pre data because the post measures are the same for both comparisons.

Even though any of the methodological artifacts mentioned above could be at play in the results presented above, we observed relatively consistent results in comparisons involving both prospective and retrospective baselines. Results are especially solid, due to the consistent finding of statistically significant improvements, for mathematics teachers' usage of both instructional and assessment practices, and for science teachers' use of assessment processes. However, both types of findings tended to point in the same direction for the two groups of teachers, that is, that teachers use more frequently best practices after attending the capacitations offered by master teachers than before. Notably, results thus suggest that attending these capacitations positively influenced teachers' practices in their classrooms.

Conclusions and Recommendations

Following are some conclusions and recommendations based on evaluation results presented above.

Capacitation of Resource Teachers

As previously explained, instead of training sessions for resource teachers, this phase included the design of the training/capacitation sessions that these teachers would offer to their peers from their school and other nearby schools in the project's 3rd. and last year.

Quality of collaborative evaluation session for math and science resource teachers. The evaluators carried out this session at the beginning of the fall semester to offer feedback about evaluation results to resource teachers. Quantitative results from post-activity reaction forms suggest that resource teachers considered that the session was well organized, their objectives met and its environment showed characteristics of a collaborative empowerment process. In the qualitative data, they generally supported this opinion. They also highlighted that the review and discussion of the previous year's evaluation results would help them to plan the capacitations they were going to design and offer to their peers.

Services provided in the centers. We presented data about the three-year duration of this special subproject (2009-10, 2010-11 & 2011-12) regarding the number of recipients of different kinds of services in the centers. Results indicated that the number of math and science in-service teachers who received services stayed more or less the same from yr. 2 to yr. 3, after increasing from the 1st. to the 2nd. year. However, they received more services involving the use of technology. This group of in-service teachers are the target population of this special project (all

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school-centers provided services to them), but some resource teachers expanded the pool of service recipients in the centers to include pre-service teachers (e.g., four centers in yr. 3) and K-12 students (e.g., six centers in yr. 3). Greater numbers of students received services this last year, especially services involving the use of technology. It is encouraging that resource teachers emphasized the provision of services related to technology use in the centers for both in-service and K-12 students.

Student achievement. We used data from the standardized tests administered in the Puerto Rico public school system from the spring 2009, 2010 and 2011 administrations to evaluate student achievement. The general tendency for secondary students in the system is that proficiency levels are low for all grades and both math and science (all less than 50%), although higher for science than for mathematics. Nevertheless, in the eight center-schools participating in this special project, the percentage of students who scored at or above proficiency increased for all tested grades and both subject matters from 2009 to 2010 and from 2010 to 2011. Remarkably, student achievement for these schools also excel when seen in the context of those from all secondary schools in the public school system, since their annual increases in achievement are consistently higher. Although we recognize that total attribution of these results to the impact of this special project is unjustified, we think that the project contributed to them. Its predecessor, the bigger PRMSP/AlACiMa project in which these schools participated, also probably contributed to these positive results.

Resource Teachers as Trainers/Capacitators

Quality of the math and science capacitations. Quantitative results from post-activity reaction forms indicate that math and science teachers who attended the 3rd cycle of capacitations given by the resource teachers were very satisfied with the training sessions. They gave very high ratings to items that assess the organization, the attainment of objectives and the educational environment of the sessions. As in earlier years, expressions from both the math and science teachers, collected in the open-ended part of the post-activity reaction forms, confirmed what the quantitative results indicated. Their qualitative comments also suggested that the participants were able to identify attributes of effective learning environments in the capacitations and indicated that they were planning to implement them in their classrooms. Furthermore, third-year results were similar or higher than those for the first two years were. This finding suggests that the resource teachers improved through time in their role as PD trainers, as assessed by their peers.

Teacher learning. The math and science teachers trained by resource teachers showed statistically significant improvements in content learning in the pre/post assessments of the 3rd. cycle of capacitations. These results are encouraging because not only they showed statistically significant growth, but also that the percent correct answers in the post-tests were better than those from the 2nd were. These findings again suggest that the resource teachers improved through time in their role as PD trainers. That this improvement tendency was maintained in the 3rd. year is remarkable since these science and math teachers designed the capacitation sessions themselves, instead of adapting the plans designed by STEM faculty. We consider that this gradual improvement in their performance as trainers is probably due, not only to the experience accumulated, but also to the reflective activities in which they reviewed evaluation results in the collaborative empowerment evaluation sessions.

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Teacher transfer. To evaluate change in self-report usage of best educational practices (instruction and assessment) by teachers attending the capacitations, we used two types of baseline data: prospective and retrospective. We collected the prospective one the first year a teacher attended a cycle of the annual capacitations provided by resource teachers (2010 or 2011), while the retrospective one was gathered in 2012 (the project's 3rd. year) at the same time as the collection of post data. Both types of comparisons showed statistically significant improvements in usage of evidence-based practices when analyzed at the items' aggregated level and for all teachers as a group. However, significance was stronger in the retrospective analyses since the 2012 pre scores tended to be lower than those of 2010/2011. This pattern was especially notable for science teachers since many comparisons using the prospective baseline were not statistically significant while the equivalent ones for the retrospective comparisons were. Notably, math teachers showed statistically significant improvements in the use of best practices in most prospective comparisons and in all the retrospective ones for both instructional and assessment practices. Science teachers showed similar results regarding assessment processes. Due to the consistency between prospective and retrospective results, evidence about these positive improvements is especially solid. Nevertheless, findings for science and math teachers for both types of analysis tend to point in the same direction, that is, that teachers use more frequently best educational practices after attending the capacitations offered by master teachers than before. Remarkably, results thus suggest that attending these capacitations positively influenced science and math teachers' practices in their classrooms.

This special three-year subproject aimed to empower resource teachers to become science and math professional development (PD) trainers of their peers, and to strengthen the provision of other services related to STEM education in the centers. Results presented above indicate that these aims were met. Resource teachers improved through the years in their role of capacitators, as evidenced by teachers' reports and performance (regarding content learning and usage of best educational practices). The provision of services to teachers and K-12 students also improved. Based on these results, and those of previous years, we conclude that empowering teachers to become PD trainers is a fruitful strategy. We recommend that it is used in future educational reform efforts. Similarly, we recommend that collaborative approaches be used to evaluate projects in which the empowerment of participants is sought.

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