Report on the Progress of the IN-STEP Pilot Program

2008-09

By

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I. Overview of IN-STEP

This is the second report on the progress of the Inquiry Based Science and Technology Education Program (IN-STEP), an innovative science education initiative being implemented in the lower secondary schools of Phang-nga province. Sponsored by MSD Thailand, a pharmaceutical company, and supported by funding from its parent company, Merck & Co., Inc., IN-STEP is being implemented by a public-private partnership led by the Kenan Institute Asia (K.I.Asia), which, besides MSD Thailand and Merck & Co., includes the Thai Ministry of Education (MOE), the Merck Institute for Science Education (MISE), the Educational Services Area Office (ESAO) in Phang-nga province, the Institute for the Promotion of Teaching Science & Technology (IPST), the National Science and Technology Development Agency, the Science Society of Thailand, Teachers College, Columbia University, and, most importantly, the science teachers and principals working in the lower secondary schools in Phang-nga. These organizations have worked together to develop a shared vision of good science teaching and to develop the IN-STEP design.

IN-STEP was launched in 2007 as a pilot project and is now in its third year. Over 50 schools and 120 science teachers are involved in the project. The intent is to improve science teaching and learning in Phang-nga, but also to learn about the supports needed to implement instructional reforms in Thailand. Based on the results of the pilot, the IN-STEP team will revise the project design and materials, and hopefully extend the project to other provinces in 2010 or 2011.

This report has three aims: first, to provide those interested in science education in Thailand with information on the progress of the pilot project; second, to share some of the lessons learned about improving science teaching and learning in Thailand; and, third, to provide the IN-STEP team with feedback from the second year of implementation. These multiple purposes result in a rather lengthy report. We hope that readers will be forgiving and seek out the parts of the report that most interest them.

The Components of IN-STEP. The IN-STEP program has seven key components:

- Curriculum modules organized around guided investigations that illuminate key concepts in the biological, physical, chemical, and earth sciences. Each module provides 6-10 weeks of instruction. Originally developed for the Science and Technology for Children (STC) curriculum in the United States, the modules have been translated into Thai and adapted for use in Grades 7, 8, and 9 in Thailand.[1]

[1] With support from MISE, K.I.Asia obtained the rights to use, translate, and adapt selected science curriculum modules developed by the U.S. National Academy of Sciences. Known as the Science and Technology for Children (STC) materials, each module is organized around a major topic in science, such as light or energy, machines, and motion, provides lessons that are developmentally sequenced to ensure student understanding, and contains all of the materials a teacher needs to use the inquiry approach to teaching science.

- Intensive professional development workshops for each module that introduce teachers to the science content and investigations included in the module. Teachers are receiving training in the use of three modules but this training is spread over three years. Each workshop lasts 5 days so teachers are receiving 15 days or approximately 120 hours of training during the program. Over 120 teachers have attended workshops to date.
- Opportunities for accomplished teachers to gain professional development experience by designing and delivering the workshops on the use of the curriculum modules. Other accomplished teachers are serving as mentors to teachers as they implement the modules. Overall, 45 Thai educators have been prepared to support the implementation of IN-STEP.
- Training for school principals to prepare them to support the participating teachers. Principals are receiving two days of training annually about inquiry based learning, effective instructional practices, observation and feedback, and how to encourage and support instructional reform.
- Support for teachers as they implement the modules from mentors and newly developed teacher networks intended to foster instructional improvement in science over time.
- Activities designed to build student and community interest in science such as annual science days and science camps that bring scientists and adults together with students to conduct projects focused on community problems.
- Careful documentation of the implementation by an evaluation team composed of researchers from K.I.Asia and IPST, and led by the Consortium for Policy Research in Education (CPRE) at Teachers College, Columbia. The primary purposes are to provide feedback to the IN-STEP team to improve the program and assess the impact of the program on teaching and learning.

The IN-STEP Theory of Action. The design of IN-STEP is based on the same theory of action guiding the highly respected and successful work of MISE in the United States. This theory has 12 elements that are described in greater detail in the first evaluation report, *IN-STEP: The Evaluation of the First Year* (2008).[2] The 12 elements are:

1. Collaborative design of the professional development.
2. Use of well-designed and tested instructional materials.
3. Engagement of provincial and school administrators.
4. Utilization of accomplished teachers as trainers
5. Curriculum-based professional development.
6. On-site implementation support.
7. Development of science leaders.
8. Ensuring sustained use of the materials.
9. Formative and summative evaluation.
10. Clear indicators of success.
11. Community engagement and support.
12. Development of capacity to sustain and scale the reforms.

[2] Consortium for Policy Research in Education (2008). *IN-STEP: The evaluation of the first year*. New York: author.

Based on the experience of MISE, implementation of these elements should produce sustainable changes in teaching practices, increased student engagement in science, and improvements in student achievement in science.

II. The Major Project Activities in 2008 and 2009.

This report covers the period of April 2008 to August 2009. During that period, the major IN-STEP activities in rough chronological order were:

1. **The 2008 Professional Development Workshops** which were conducted by teams of teacher trainers under the supervision of MISE professional developers. These teams design workshops to develop IN-STEP teachers by:

    - Having them personally experience the lessons in the science modules:
    - Deepening their content knowledge and strengthening their instructional practices;
    - Developing assessment tasks for the purpose of analyzing student thinking; and,
    - Sharing effective classroom management strategies.

    The first Professional Development Workshop was organized in March 2007 with 43 teachers attending from 22 schools. In April 21-25, 2008, 22 IN-STEP teacher trainers and seven MISE experts delivered training to 68 teachers through six workshops focused on different curricular modules. The modules addressed were: Energy Machines and Motion I (EMM I), Light (L), Earth in Space (EIS), Energy Machines, and Motion II (EMM II), Properties of Matter I (POM I), and Human Body Systems I (HBS I).

2. **Establishing Centers for Material Distribution and Replenishment:** To ensure that the replenishment and distribution of the science modules system runs smoothly, K.I.Asia collaborated with the Phang-nga ESAO to renovate an old building to serve as the IN-STEP materials resource center. The program hired a Ph.D. science education student to help manage the materials replenishment. Due to the increasing number of IN-STEP modules in use and the limited space at the resource center, IN-STEP set up a second material resource center at Rajprachanukrao35 School.

3. **Supporting Use of IN-STEP Materials:** The IN-STEP team visited schools to provide guidance on implementing the modules as well as to gather feedback and learn about issues facing the teachers. Beginning in June 2009, special assistance is being provided to teachers experiencing difficulty with use of the modules.

4. **Workshops for Mentors:** IN-STEP recruited master teachers to serve as mentors to the teachers. The mentors are volunteers who have received training in

mentoring strategies. The first workshop in June 2007 covered their responsibilities, the classroom observation process, and student misconceptions in science. In February 2009, the mentoring workshop focused on cooperative learning and development of teacher networks.

5. **Workshops for Principals.** To ensure support from principals for IN-STEP, and prepare them to provide support to teachers, two workshops were conducted in 2008. These workshops provided opportunities for principals to become familiar with the IN-STEP materials and to discuss good instructional practices in science. The importance of changing policies such as the time allocations for teaching science was discussed.

6. **The IN-STEP Science Camps:** The first 'Fun Science Camp' was held in 2007. Students and teachers from 18 schools participated. Twenty-one volunteers from MSD were assigned as mentors for students. Students participated in five main activities including observations in the local community, Astronomy, a Think Rally, a Science Show, and a Science Career Clinic. Through carefully designed activities, students practiced inquiry skills, and creative thinking skills through open-ended questions generated by their own interest. A second two-day camp was held in May 2008. The students were highly positive about the two science camps, and their ratings of the various camp activities averaged 3.52 in 2008 (on a four-point scale), and 3.47 in 2009.

7. **The Science and Local Wisdom Project**. In addition to the science camp, K.I.Asia raised funds from the Kenan Charitable Trust to support a Science and Local Wisdom project. Groups of 10 students from each of 20 IN-STEP schools have formed clubs to carry out projects with two teachers from each school acting as their mentors. The projects will test the efficacy of traditional approaches to solving common problems facing community members. K.I.Asia will provide training for the teacher mentors and students to help them apply science concepts learned from IN-STEP. A camp was conducted to help students design and launch their projects and the students were engaged and enthusiastic. Like the IN-STEP science camps, this camp also received high evaluations from the students.

8. **2008 Professional Development Design Workshop:** One of IN-STEP's goals is to build local capacity to conduct high-quality professional development by developing Thai teacher trainers. To this end, accomplished teachers are recruited to design and deliver the IN-STEP workshops. Professional development design workshops are organized every October with the following objectives:

   - Provide professional development reflective of current research and effective practices;
   - Provide time and resources for the Instructional Teams to plan IN-STEP Professional Development Workshops;
   - Develop agendas/schedules and activities for the IN-STEP Professional Workshops; and,

- Refine and revise translated instructional materials.

Seventeen teacher trainers participated in the third Professional Development Design Workshop in October 2008. This included a two-day workshop on inquiry learning for 21 Phang-nga teacher trainers who had little experience with this learning approach.

9. **2009 Professional Development Workshop:** Forty-seven teachers participated in the third round of professional development workshops. Nineteen attended for the first time. The teachers selected from workshops on four modules: Energy, Machines, and Motion I, Properties of Matter I and II (combined), Human Body Systems I and II (combined), and Catastrophic Events. However, participation in the workshops was lower than anticipated, resulting in cancellation of some workshops and combination of others. One reason for this unexpected decline in participation is that some teachers had to attend a new curriculum workshop scheduled by the ESAO during the same time period. Late notification about the workshop also may have affected attendance, but other factors also may be affecting teacher participation. These are discussed later in this report.

Table 1
Data Sources for the Evaluation

Source	Number of Participants	Number of Response	Response Rate
Survey at 2008 Instructional Team Retreat	36	34	94%
Survey at 2008 Workshop	68	66	97%
Survey at 2009 Workshop	47	46	97%
Observations 2008	35	35	NA
Interviews 2008	35	35	100%
Science Camp Surveys 2008	90	88	97%
Science Camp Surveys 2009	100	98	98%
Student Surveys at Science and Local Wisdom Camp 2008	113	101	89%

Major Evaluation Activities in 2008-09. During the past year, the evaluation team conducted classroom observations, interviewed teachers, and conducted surveys of workshop participants. The various data collection activities along with the numbers of potential participants and response rates are listed in Table 1. While the response rates are generally high, they are somewhat misleading as it proved quite difficult to schedule observations and interviews.

In the coming year, the evaluation team will focus on developing good measures of the level of use of IN-STEP materials in the classes serving the 9th graders who graduated in April 2009 and the 9th graders who will graduate in April 2010. This data will be used in combination with student performance results on the 9th grade Ordinary National Educational Test (O-NET) science assessments to examine the impact of IN-STEP on science learning. The first analysis will use the 2009 data and be conducted in the Winter of 2009-10. Since the exposure of these 9th-grade students to IN-STEP has been somewhat limited, this analysis may not show any effects. As a consequence, the analysis will be repeated in the Fall of 2010.

III. The Context of Science Reform in Thailand

The rapidly growing demand for highly skilled workers has led to global competition for talent (OECD, 2008). While basic competencies are generally considered important for the adoption and spread of new technologies, high-level competencies—21st century skills—are critical for the creation of new knowledge, technologies, and innovations. This implies that the share of highly educated workers in a nation's labor force is an important determinant of its economic growth and social development. Investing in excellence may benefit everyone because individuals possessing higher level skills contribute more to the development of new knowledge (Minne *et al.,* 2007). This happens because highly skilled individuals create innovations in various areas (for example, technology, production methods, work organization, marketing, design) that benefit all or that boost technological progress. Research has also shown that the effect on economic growth of a population with skill levels one standard deviation above the mean in the International Adult Literacy Study is about six times larger than the effect of having skill levels one standard deviation below the mean.[3]

Thus it is noteworthy that the share of 15-year-olds who are top performers in science is distributed unevenly across countries. Of the 57 countries that participated in the science portion of the Programme for International Student Assessment (PISA) in 2006, nearly one-half (25) had 5% or fewer of their 15-year-olds scoring at Level 5 or Level 6, whereas four countries had at least 15% of their students demonstrating high levels of science proficiency.[4] The variability in the percentages of students with high science proficiency across nations suggests differences in their future capacity to staff knowledge-driven industries with home-grown talent.

Thailand's Performance. Very few Thai students performed at high levels on the PISA assessment. Thailand's mean score placed it 47th out of the 57 nations, but only 0.04 % of Thai students performed at Level 5 and the number performing at Level 6 was less than 0.01%. The OECD average was 7.4% and 1.4% respectfully. The highest percentages were found in Finland (17% and 3.9%) and New Zealand (13.6% and 4%). More pertinent comparisons for Thai policymakers to consider were the performances of students in the other Asian countries that are displayed in Table 2.

[3] Hanushek, E. & Woessmann, L.(2007). The role of education quality for economic growth, *Policy Research Working Paper Series* 4122, The World Bank.
[4] See Table 2.1a and Table 2.1c, *PISA 2006: Science Competencies For Tomorrow's World* (OECD, 2007)

What accounts for the relatively poor performance of Thai students on PISA? An analysis of the school experiences and backgrounds of top performers on PISA reveals one of the important factors. [5] On average, OECD found that the top performing 15-year-olds spent an average of four hours a week studying science in school but in Thailand lower secondary schools, only 120 minutes are allocated for science. Thai lower secondary schools are required to teach eight subjects to all students and also offer extra-curricular and social development activities during the school day. The result is time pressure on academic subjects and science instruction suffers accordingly. Given that the amount of instructional time allocated to a subject is a strong predictor of student performance, the results on PISA are a predictable result of the time allocation policies. [6]

Table 2
Performance of Students from Asian Nations
On the 2006 PISA Science Assessment

Country	Percent of Students Scoring a 5	Percent of Students Scoring a 6	Mean Score
Hong Kong China	13.9	2.1	542
Indonesia	0.0	0.0	393
Japan	12.4	2.6	531
Korea	9.2	1.1	522
Chinese Taipei	12.9	1.7	532
Thailand	0.4	0.0	421
OECD Average	7.4	1.4	491

Note. Source: OECD, 2007. PISA 2006: Science Competencies for Tomorrow's World. Paris: author.

Another important factor in the performance of the Thai students is their literacy in Thai. It is difficult to succeed in science unless one can read well. Science texts are often difficult to read and science introduces a large amount of new vocabulary. It is notable that Thai students performed relatively poorly on the 2006 PISA reading test—ranking 42nd among the 57 nations. And it is notable that IN-STEP teachers have reported to the evaluation team that they have many students who are unable to read the material provided in the IN-STEP modules. Literacy skills appear to be a major barrier to achievement in science, especially in small rural schools.

Motivation may be yet another factor affecting the test scores. Since Thai students are accustomed to taking high-stakes assessments, and the PISA test holds no stakes for them, they may simply be not taking the test as seriously as they should. As a result, their scores may be depressed and not reflect their actual skill level. However, this situation also applies to the students in the nations that are out-performing Thailand. However, there is some evidence from IN-STEP that motivation to study science may be a factor. Feedback from IN-STEP teachers suggests that some Thai students, especially boys see

5 OECD (2009). *Top of the Class: High Performers in Science in PISA 2006*. Paris: author.
6 Berliner, D. (1990). *The nature of time in schools theoretical concepts, practitioner perceptions.* New York: Teachers College Press.

science as a difficult subject and one not related to their futures, and therefore, they make less effort than is required to master it.

Whatever the causes of the nation's low performance, it is clear that Thailand needs to improve science education, and not only improve the average performance of its students but also increase dramatically the numbers of students performing at high levels. Sustained economic growth in an increasingly competitive region will require an increased supply of students prepared to enter science, engineering, medicine, and related fields.

IV. IN-STEP Professional Development in 2008

The IN-STEP professional development workshops are designed and delivered by experienced science teachers. Initially led by members of the MISE staff, these teams are now led by local educators. The intent has been to build Thailand's capacity to provide curriculum-based, hands on professional development, and the strategy has been to combine formal training (the Professional Development Design Workshop) with an apprenticeship (the mixed instructional teams) to provide Thai instructors with experience and feedback.

Table 3 displays the professional roles held by the Thai members of the IN-STEP instructional teams assembled over the past three years. A total of 84 Thai's have served as members of instructional teams. Prepared through training and apprenticeship, they all have helped deliver at least one professional development workshop. They have played active roles in the instructional teams and have received feedback on their performance. As experienced professional development leaders, they represent an important new asset for their schools, their province, and their nation. They are capable of replicating the IN-STEP program or similar initiatives with little or no assistance.

Table 3
Position/Background of Instructional Team Members

Position	Year One	Year Two	Year Three
MISE	3	5	4
Active Teachers	15	27	34
University Faculty	3	0	0
National Gov't Agency (IPST + OBEC)	6	5	3
ESAO Phang-nga	3	2	2
Other			1
Total	30	39	44

Note. Source: Kenan Institute database

Table 4 shows the overall ratings of the professional development design retreats conducted in 2007 and 2008 by instructional team. Note the Likert scale ratings are generally quite high. However, while the variation is not statistically significant, two modules—Light and Human Body Systems—received somewhat lower ratings. These data have been provided to the MISE external consultants and to the team leaders. Table 5 displays the level of participation of teachers in IN-STEP professional development by curriculum module and by year. Clearly the most popular module is Energy, Machines, and Motion I, followed by Earth in Space, and Human Body Systems.

Table 4
Team Members Ratings of the Design Workshops (Scale 1-4)

Module	Year Two – Fall, 07	Year Three – Fall, 08
Earth in Space (EIS)	3.65	3.61
Energy, Machines, & Motion I (EMM I)	3.92	3.73
Light (L)	3.94	3.36
Properties of Matter I (POM I)	4.00	3.85
Energy, Machines, & Motion II (EMM II)	3.64	3.58
Human Body Systems I (HBS I)	3.87	3.46
Human Body Systems II (HBS II)		3.63
Catastrophic Events (CE)		3.66
Overall Average	3.84	3.64

Table 5
Number of Teachers Prepared to Teach Each Module by Cohort

Module	Cohort 1	Cohort 2	Cohort 3	Total Number of Workshops Completed
EIS	18	12	0	30
L	20	7	0	27
EMM I	26	18	7	51
EMM II	6	0	0	6
POM I	11	13	2	26
POM II	0	0	0	0
HBS I and II	16	9	7	32
CE	1	5	6	12
Total	98	64	22	184

Note. This data set base on total number of active teachers including IN-STEP teachers, IN-STEP master teachers, and IN-STEP master teachers outside Phang-nga.

Table 6 displays the progression of the project over time. Teachers have received training in one module a year, and typically they have been offered a choice of one module from three options. In Cohort 1, there are some teachers who have received training in only one module because they were recruited to serve as members of training teams for the second and third rounds of workshops and therefore were not able to be workshop participants in Years Two and Three. However, the dramatic drop-off between the numbers of Cohort 1 teachers who received training in two modules and those receiving training in three, and the similar drop-off in Cohort 2 between those trained in one or two modules, reflects the unexpected low attendance at the March 2009 workshop. The causes of this drop-off are being investigated in 2010 as they may offer important lessons for the future design of the program.

Table 6
Amount of Training Completed by Cohort

Cohort	Number of Teachers with Training in:			Total Workshop Participation
	One Module	Two Modules	Three Modules	
One	23	33	3	98
Two	28	18	0	64
Three	22	0	0	22
Total	73	51	3	184

Note: This data includes the total number of active teachers trained including master teachers in and outside of Phang-Nga.

School Size and Participation. Tables 7 and 8 display the enrollments in the lower secondary schools in Phang-nga. The participating schools vary in their grade spans, some covering K-9, some 7-9, and some 7-12. Nearly half of the schools have less then 120 students which means they probably have only one class at each grade level and may have only one science teacher teaching all three grades. These teachers do not have colleagues with whom to share the experience of teaching the new curriculum modules which makes implementation much more problematic. Moreover, most of these schools are extended schools; that is, they were originally founded as primary schools and have added Grades 7-9 in recent years. Typically, these schools have less qualified teachers, larger class sizes, and less science equipment and facilities.

It is clear from Table 7 that IN-STEP has reached almost all of the lower secondary schools in the province. And Table 8 shows that over two-thirds of the schools have sent half or more of their science teachers for training.

Table 7
Number of Schools by Size of Enrollment in Grades 7-9

	Schools Participating	Schools in Province
Small (<120)	25	27
Medium (121-300)	15	19
Large (301-600)	5	6
Very Large (>601)	4	4
Totals	49	56

Table 8
School Size and Penetration of IN-STEP

Level of Participation	Small	Medium	Large	Very Large	Total
All science teachers	19	7	1	0	27
Half or More	4	4	4	0	12
Less than Half	1	1	0	4	6
N/A	0	3	0	0	4
Totals	21	15	5	4	49

Note. Source: Kenan Institute database
N= 49

Teachers Expectations. Table 9 shows that most teachers volunteered for the program because they either wanted to learn new teaching strategies or obtain new instructional materials or both. Our interviews reveal that the teachers wanted to learn how to motivate and engage their students. Motivation as we shall see is one of the major challenges confronting teachers, especially those working in the extended schools.

Table 9
Teachers' Expectation of IN-STEP

Expectation	Number of Mentions
New Instructional Materials	14
Increased Science knowledge	6
New teaching strategies	19
Better student outcomes	8

Note. Source: Workshop Survey (WS) Questionnaire, 2008
N= 47

Of the 47 teachers who attended the March 2009 professional development session, forty responded to a question about their overall satisfaction with the program and as Table 10 shows, the results were highly positive.

Table 10
Teachers' Satisfaction with IN-STEP

Satisfaction	Number of Teachers
Yes	37
No	1
N/A	2
Total	40

Note. Observation Interviews
N= 40

V. The Implementation of IN-STEP

In spite of the high ratings given to IN-STEP professional development and the enthusiasm of participants about the quality of the instructional materials, use of the modules remains uneven and problematic. Tables 11, 12, and 13 below show the incidence of actual and planned use of the IN-STEP modules by cohort. It is clear that many of the participating teachers are not teaching all of the modules for which they have received training.

It was believed that one of the major reasons that some teachers were not using the modules was that they perceived some of the content to be poorly aligned with the Thai science standards. K.I.Asia organized a review of all of the modules by experienced teachers who found that alignment was not a serious problem. While some of the content of some modules, such as Energy, Machines, and Motion II, and Properties of Matter II, goes beyond the standards, alignment is not a major problem.

However, several other factors are producing implementation problems. First, the MOE only requires lower secondary schools to allocate 120 minutes per week for science. Given this minimum time allocation, the modules even when used efficiently take up a large chunk of the available instructional time for science during a school year. The annual required time allocation is approximately 76 hours of instruction whereas the use of three modules in a year would require 50 or more hours of instructional time. This would make it hard for a teacher to cover all of the content required by the curriculum since the modules cover less than half of the standards teachers are expected to address. Even a teacher familiar with the investigations would have difficulty dealing with these time constraints, and teachers who are inexperienced at managing investigations and classroom discussions require even more time to teach the modules. And if one takes into account the large number of school holidays in Thailand, not to mention the large amounts of instructional time lost as students are pulled out of science class for school and club activities, the time problem becomes more severe. Fortunately, some schools have increased the time allotted to science by using some of the time normally given to student activities, but in most schools IN-STEP teachers face severe time constraints, and, as a consequence, some have given up.

A second factor affecting implementation of the modules is that teachers have found that the work is simply too difficult for many students. One source of this difficulty lies in the students' weak reading and writing skills. The IN-STEP student manuals are based on the assumption that students are reading on grade level, but many are not. Moreover, the vocabulary is demanding and requires explicit instruction which is not always being provided because it has not been stressed in the training and because of the time problems described above.

Another likely reason for failure to use the modules is that many of the IN-STEP teachers are not used to the demands of inquiry-based teaching in terms of classroom management and lesson preparation. Both are more demanding than lessons relying on textbooks and teacher-centered instruction. Many of the participating teachers have requested additional training on questioning skills, classroom management, and student discipline which give an indication of some of the problems they are encountering with the activity-based learning required by the IN-STEP modules. In visits to IN-STEP teachers in December, 2008 and January 2010, members of the evaluation team observed serious discipline problems in more than a third of the classrooms visited.

Table 11
Plans to Use IN-STEP Modules in School Year 2009-10
Cohort 1 Teachers

	Number of Teachers Reporting They:				
Module	Numbers Trained by Module	Do not plan to use the modules at all	Plan to use some lessons of activities	Plan to use the entire module with some modification	Plan to use the module with few changes
EIS	18	3	1	1	1
L	21	6	1	1	2
EMM I	26	6	1	2	4
EMM II	6	1	1	2	2
POM I	11	1	2	0	2
POM II	0	0	0	0	0
HBS I and II	16	3	3	2	2
Total	98	20	10	8	13

Note. Source: Telephone Interviews with 35, WS Questionnaire from 5 (Missing 19).
N = 40 (out of 59 in the original cohort)

Tables 11, 12, and 13 show how many modules the participating teachers have used or plan to use in the 2009-10 school year. This information comes from telephone interviews conducted in July and August 2009. Of the 113 teachers who have attended IN-STEP workshops, 76 were reached by phone—a response rate of 67%. However, the rate of response differed across the cohorts; 74% of Cohort 1 were reached, 54% of Cohort 2, and 79% of Cohort 3. Additional information was obtained by checking which teachers had checked out modules from the Resource Center. As of August 2009, 32 of the 59 teachers in Cohort 1 had not checked out any modules, and as Kenan invited teachers to reserve modules for the first or second semester, the best guess is that these teachers do not plan to use any modules this year.

Looking at the number of workshops attended by the 59 Cohort 1 teachers, we find they have been prepared to implement a total of 98 modules, so full implementation would mean they would be teaching that number of modules during the year.[7] Removing the 14 teachers who are no longer in the province, the total expected use would be 72 modules.

[7] If we were to consider the teachers who did not attend the second or third workshop opportunity offered to them as non-implementers for these modules that they chose not to be trained to use, then the actual implementation rates would be even lower.

Instead, Table 11 shows that the Cohort 1 teachers who were reached are making use of only 21 modules (including 8 with some modifications). If we assume that the five active teachers who were not reached are using the modules at the same rate as the others, then the active Cohort 1 teachers would have an estimated implementation rate of 33% (24 divided by 72).

The estimated implementation rate for Cohort 2 teachers is higher—about 53% (see table 12). This is based on interviews with 24 of the 46 teachers in Cohort 2 and their rate of module use has been projected for the entire sample. However, the implementation rate for Cohort 3 teachers who have attended only one workshop so far is actually 116%. How can that be? It could be correct as some of them are reporting they are using modules that they have not yet been trained to use, but may have learned how to use from their colleagues.

Table 12
Plans to Use IN-STEP Module this School Year - Cohort 2

Module	Number of Teachers Reporting They:				
	Numbers Trained by Module	Do not plan to use the modules at all	Plan to use some lessons of activities	Plan to use the entire module with some modification	Plan to use the module with few changes
EIS	12	0	2	1	0
L	7	1	1	1	0
EMM I	18	1	2	2	2
EMM II	0	0	0	0	0
POM I	13	3	1	1	4
POM II	0	0	0	0	0
HBS I and II	9	0	0	2	2
CE	5	1	1	2	0
	64	6	7	9	8

Note. Source: Telephone Interviews, 9; WS Questionnaire 15, (Missing 22)
N=24 (out of 46 in cohort)

The data in Tables 11, 12, and 13 also reveal that some of the modules are more popular than others. In Table 14 we have calculated these differential rates of implementation. The data show several patterns consistent with the hypotheses presented earlier:

- The modules that require high amounts of preparation time such as EIS or take more class time (EMM I) or must be used at special times of the year (EIS) have low implementation rates.
- Modules that teachers tell us have proved particularly difficult for students to understand (EMM, Light, and POM) have lower implementation rates. Interestingly all of these modules are in the physical sciences.

- The most recently introduced modules (HBS I and II and CE) tend to have higher implementation rates.

Table 13
Plans to Use IN-STEP Module this School Year - Cohort 3

Module	Number of Teachers				
	Numbers Trained by Module	Do not plan to use at all	Plan to use some lessons of activities	Plan to use the entire module with some modification	Plan to use the module with few changes
EMM I	7	0	0	3	3
POM I	2	1	0	1	0
HBS I and II	7	0	1	3	1
CE	6	0	0	5	1
Total	22	1	1	12	5

Note. Source: WS Questionnaire 21 (Missing 3)
N = 19 (out of 22)

The data in the three tables also reveal differential rates of implementation across the three cohorts. We offer four hypotheses to explain this variation:

Hypothesis One: As teachers use the modules, they begin to realize that some parts of the modules do not align well with the Thai standards. So they decide to focus only on what is required by the standards. This leads to dropping some lessons and eventually entire modules. We call this the “lack of alignment hypothesis.”

Hypothesis Two: Teachers discover when they first use the modules that they take a longer time to teach than they had been told to expect. This may be due to their inexperience, the need for more scaffolding for students, student reading problems, or disruptions of class time. As a consequence, they can find time to fit one IN-STEP module into their curriculum but fitting in two is much harder, and using three is virtually impossible. We call this the “too little time to teach hypothesis.”

Hypothesis Three: Teachers find some of the modules quite difficult to teach. They report that many of their students do not understand the concepts or principles, and it may be that they also do not understand the content well enough to provide alternative explanations or representations. The literacy problems discussed earlier obviously contribute to the difficulties experienced by the teachers, and the easiest solution is not to ask the students to do this work so the lessons or entire modules are dropped. We call this “the lack of preparation hypothesis.”

Hypothesis Four: IN-STEP also introduces a new teaching approach that teachers need to adjust to and which requires more work on their part. The prep required for investigations, the management of classes during investigations, and the grading of student work all create more work for teachers. The large class sizes and problems with discipline compound this problem. The existing textbook and worksheets are much easier to use in comparison. So teachers return to their old methods. We might call this the "too much work hypothesis."

These four hypotheses identify factors that separately or in combination provide an explanation for why so many teachers are deciding not to use materials which almost all agree are excellent. The reasons for low implementation probably vary across school contexts. A caveat to these four hypotheses is that teachers are most likely to use the IN-STEP modules in the year following their first training. Initially, they are excited by the quality of the training and they are less aware of the problems of teaching time and difficulty of the content for both the students and themselves. So a pattern of declining use or selective use begins to appear in the second year of their participation.

While our data do not give us sufficient evidence to choose among these four competing hypotheses, we can test them to some degree.

Alignment of the Modules. Hypothesis One is one of two hypotheses that has been examined closely. K.I.Asia convened a group of experienced teachers in October 2009 to review the alignment of the modules. They re-examined the alignment of the modules and concluded that in general, they were well-aligned with the Thai science standards. Only a few lessons across the nine modules were judged to be unaligned. However, that is not quite the entire story. They also looked at how the content of the modules aligned with the standards in each of the three grade levels. Table 14 shows how this panel judged the modules fit across the grade levels.

A quick glance at Table 14 reveals one reason why the use of the EMM module may have declined. It is aligned in general but its content spreads across all three grade levels. This means that to use it in an aligned manner the teacher would have to check it out for relatively short periods at each grade level. All of the other modules are more closely aligned with a single grade level.

Table 14
Alignment of the IN-STEP Modules
With Thailand's Grade Level Standards
Based on Professional Judgment

Module	Grade 7	Grade 8	Grade 9
CE			
EIS	5 units		2 units
EMM I	8 units	8 units	9 units
EMM II	4 units	2 units	8 units
HBS	1 unit	22 units	
Light	All		
POM I	13 units	1 unit	1 unit
POM II	No data		

Time. If Hypothesis Two was true, we imagine that many teachers would use only a single module or even abandon the use of IN-STEP modules altogether during the second year. In fact, we find that most Cohort 1 and 2 teachers are using only one module in 2009-10, and the fall off in attendance at the 2009 workshop provides some additional support for this hypothesis. The data presented in Tables 11 through 13 generally show this pattern.

Close examination of the time expectations associated with the modules sheds some additional light on the observed patterns of use. Table 15 displays the time requirements set for the U.S. and Thai versions of the modules. The Thai versions were shortened by dropping some units that were not aligned with the Thai standards. However, no adjustment was made for the extra time required for the activities in larger classes—up to 45 in many of the IN-STEP schools—or by students and teachers who were not familiar with investigations.

Table 15
Time Requirements for the U.S. and Thai Versions of STC Modules

	U.S. Version		Thai Version		Percent of Annual Science Time in Thailand
Module	Units	Maximum Periods	Units	Maximum Periods	
CE	25	65	17	44	41%
EIS	22	68	7	29	27%
EMM I	22	41	10	23	21%
EMM II	Incl. above		9	15	14%
HBS	22	46	23	48	44%
L	26	50	7	20	18%
POM I	26	55	13	27	25%
POM II	Incl. above		12	26	24%

The percentage of annual time was calculated by dividing the number of 40-minute periods required for a module by the total minimum hours allocated for science in lower secondary schools which is 72 hours (36 weeks times 120 minutes per week). This does not take into account the many holidays taken in Thailand which reduces the time available. Nor does it take into account the many hours of instructional time lost because of special events or activities which teachers told us is common, but of course varies across schools. Nor do these calculations take into account the extra time required for teachers who are inexperienced in managing investigations or the extra time required for students with weak literacy skills. In short, the percentages of the total time available for science shown in Table 15 should be regarded as quite conservative estimates of the time required for the IN-STEP modules.

It is clear from Table 15 that the modules vary widely in their estimated time requirements—from 14% of the time for EMM II and 18% for Light to 41% for Catastrophic Events and 44% for Human Body Systems. Since these modules cover only a portion of the science standards teachers are required to cover each year, it is obvious that teachers could not be expected to use two of the large modules such as Catastrophic Events, EMM, or Human Body Systems in the same year. At best, they might use one of the large modules and one smaller one.

If the EMM module were re-packaged into three pieces reflecting its alignment with the grade-level standards (see Table 14), then it might be used along with Property of Matter in Grade 7, Human Body Systems in Grade 8, and Catastrophic Events in Grade 9 to form an investigation-rich spine for the lower secondary curriculum. It is not clear how Light and Earth in Space would fit in time-wise. And it is necessary to remind oneself that the actual time required to teach the modules may be larger than the official estimates contained in the materials, and therefore, one module per year may be a more realistic expectation.

Level of Difficulty. The time required is also a function of how difficult the students find the work. If the third hypothesis concerning the challenges the modules pose to students with weak literacy skills were true to some degree, we would expect to see lower use of the modules which have content that is more difficult for the students and teachers. These would be the modules in physical science and chemistry because the vast majority of the teachers report they have weaker backgrounds in these domains and, based on the O-NET and PISA results, Thai students also tend to find these topics difficult. In fact, the data in Table 16 below show lower use of these modules than Human Body Systems or Catastrophic events.

In retrospect, it may have been an error to try to introduce more investigations and more student-centered pedagogy in the domains that teachers and students find the most difficult. It might have been easier to introduce the new methods with topics in biology and earth science than in physics and chemistry. Teachers were asked to master new content, new methods, and the management of investigations in large classes at one time. It may have been too much to ask.

Teacher Workload. If Hypothesis Four were the primary explanation, we might expect to see an across-board systematic decline in the use of the modules if they were all are equally demanding in terms of workload. But as we have seen from the above discussion, they are not equally demanding. Some require much more time than others, and some pose greater teaching challenges because the content is more demanding. While we do observe a general trend of declining use, there do appear to be some differences in the rates of use of different modules. Teachers report that the use of the modules requires more time on their part, and this problem is quite serious in small schools where teachers teach multiple grades and therefore have to deal with multiple preparations. More investigation is required to determine if the burdens associated with any particular module would justify making modifications or dropping it all together.

Table 16
Plans to Use IN-STEP Module this School Year - Cohort 1

Module	Number of Teachers Prepared to Use	Number of interviewed teachers using the entire module or the module with some modification	Adjusted Number Based on Response Rate of .67	Rate of Use (Percent)
EIS	30	2	3	10
Light	27	2	3	11
EMM I	51	7	9	17
EMM II	6	2	3	50
POM I	26	2	3	12
HBS I-II	32	7	9	28
CE	12	7	9	75
Total	184	29	39	21

Note. Source: Telephone Interview and WS Questionnaire

Summary. Our analysis suggests that at least three of the hypotheses deserve further investigation as they might help explain the lower than expected implementation rates and the declining participation in IN-STEP professional development. While we can rule out lack of alignment as a major factor, the other three factors—time, difficulty, and workload—seem to be important, perhaps in combination.

Modifying the Modules. In interviews conducted with IN-STEP teachers who were observed, we asked if they made modifications to the materials, what they modified and why they made them. Their responses are summarized in Tables 17, 18 and 19 below. About half of them made modifications including dropping lessons and using the modules as supplemental material. The reasons for these changes varied; some were intended to reduce the amount of time required to complete the module, some were responses to fit students' reading levels, and others reflected concerns that the material was too challenging.

Table 17
Modifications Made to Observed Lessons

Modify	Number of Teachers
Yes	16
No	19
Total	35

Note. Source: Observation Interviews
N = 35

Table 18
Nature of Adaptations

Adaptation	Number of Mentions
Use IN-STEP as supplemental material	6
Cut some activities/units	5
Change teaching strategies	1
Re-order the lessons/changing steps in activities	4
Expand class time	2
Provide extra explanations	3
Create special assignments	1

Note. Source: Observation Interviews
N = 16

Table 19
Reasons for Making Adaptations

Reason for Adaptations	Number of Mentions
IN-STEP does not align well with the O-NET test	1
Improve student understanding	2
Make the lesson fit the available time	7
Problem with Guides: Confusing, Hard Reading, Did not deliver	1
Students lack essential skills (reading, inquiry, presentation, using materials) or prior science knowledge	4
Materials Problem: Did not deliver, Delay, Lack some Items	3
Teacher was assigned to teach another subject or grade.	3

Note. Source: Observation Interviews
N = 16

Table 20
Use IN-STEP in all classes

Use IN-STEP all class	Number of Teachers
Yes	13
No	11
Maybe	3
N/A	8
Total	35

Note. N = 35

We asked the teachers if they used IN-STEP materials with all of the classes they taught, and slightly over half indicated that they did. Based on the implementation data collected recently, this may be an exaggeration. Since many of the teachers come from small schools and teach multiple grades, they may not have been prepared to use a module for all of the grades they are teaching. Therefore, this data may be somewhat misleading.

Summary. What can we conclude about the implementation of the IN-STEP modules? First, the use of the modules declines over time as teachers encounter a variety of problems. Second, the rate is uneven across the modules so variations in their level of difficulty, time requirements, and workload must be affecting their level of use. Third, school factors such as the proportion of the staff using the modules, the support from the principal, the time allocated to science, student and community interest in science, and access to science labs probably also influence the level of use. We will examine their influence in the next report.

VI. Science Instruction in Phang-nga

During late 2008 and early 2009, the IN-STEP evaluation team conducted 35 classroom observations and extended interviews with the observed teachers all of whom had participated in IN-STEP training. Only sixteen of the 35 teachers were teaching IN-STEP lessons at the time of the observations. The schools varied in how they scheduled science classes, some using 40-50 minute periods and some using 100-minute periods. Since all of the teachers have been trained in IN-STEP workshops, they might be expected to be using similar pedagogy regardless of the instructional materials in use on the given day or the length of the class. So these data do not provide a comparison between standard instructional practice and the inquiry mode advocated by IN-STEP, but merely a description of what instruction looks like among this population of teachers.

Scheduling times when the evaluation team could journey to the south and when the teachers were using the IN-STEP proved challenging. In addition, there were many last minute schedule changes due to school events, teacher absences, and other schedule disruptions.[8] The observations were conducted using a structured protocol (see Appendix A). Both the observations and the interviews were coded for analysis using Atlas Ti. In this section, we report on what we observed in this set of lower secondary science classrooms.

A few comments are in order before looking at the data. First, our presence in the classrooms obviously affected student and teacher behavior; it always does. But these effects may have been stronger than normal in some of the small schools where visitors are unusual. Students may have been better behaved in some cases and distracted in others. Second, we were relying on inexperienced classroom observers; this is why we used a highly focused and structured observation instrument. We provided training to the observers and de-briefed each day, but there may still be some reliability problems so we should not over-interpret these findings. Third, we were somewhat surprised at the poor discipline in some classrooms and in the numbers of students pulled out of class for various activities in others. In the latter instances, we cannot be sure we observed a typical lesson as the classes were smaller than normal. Interview data show these were

[8] The expense of taking a team of researchers to Phang-nga combined with the scheduling problems encountered in a narrow (two-week) window have led us to make a change in our data collection for 2009. We are asking two Kenyan consultants stationed in the province to do the bulk of the observations and interviews over a longer period of time. In this way, we are more likely to “see” teachers using the In-STEP modules and we will be able to reach a larger sample of the project participants.

not isolated events. Classroom management is a serious problem for a number of teachers, especially new teachers teaching in extended primary schools where a large number of students may be unmotivated because they believe their prospects of entering upper secondary school are poor or because they have withdrawn from academic work in order to reduce the stigma of poor performance. In addition, these new teachers receive little support from other teachers or their principals. Attendance is a problem in a number of schools, but this loss of instructional time is exacerbated by a pattern of pulling students out of academic classes for various school, local, or provincial activities.

In Table 21, we present the observers' assessments of the general conditions observed in the classrooms. The table is divided between 50-minute and 100-minute periods, and within these categories, between teachers using IN-STEP materials and those who were not. It is clear from Table 21, that IN-STEP materials were more likely to be found in use in the 100-minute periods. Second, overall, the IN-STEP teachers working in the 50-minute classrooms appear to have the highest ratings, but this was a sample of only three, so sample bias undoubtedly explains these results. We may have been observing more experienced and accomplished teachers. Overall, in Table 21, the mean ratings of the four groups are quite similar with two notable exceptions: IN-STEP teachers' classrooms are characterized by better organization and more frequent use of questions to monitor student progress. These are important differences. In Table 22, data on student behavior in the observed classrooms are presented, and we see no differences between the classrooms in which IN-STEP materials were being used and those in which they were not.

Table 21
Observed Classroom Conditions and Practices: IN-STEP and Non-IN-STEP

Question	50-minute classroom		100-minute classroom		Ave. All
	Using IN-STEP N = 3	Not Using IN-STEP N = 11	Using IN-STEP N = 13	Not Using IN-STEP N = 8	
1. The classroom was well-organized and equipment was distributed efficiently.	4.33	3.09	4.09	3.50	3.80
2. The classroom climate was warm and supportive.	4.00	3.72	3.72	3.75	3.80
3. The teacher linked the lesson to students' prior knowledge.	4.00	3.81	3.81	2.50	3.53
4. The teacher encouraged student questions by responding thoughtfully.	3.66	2.90	2.90	2.75	3.05
5. The teacher encouraged student discussion.	3.00	3.45	3.45	3.75	3.41
6. Students were encouraged to consider alternative solutions or inquiry strategies.	3.33	2.81	2.81	2.87	2.96

7. The teacher acted as a resource person, working to support student investigations.	3.66	3.54	3.54	3.50	3.56
8. The core concepts of the lesson were clearly explained.	3.66	3.54	3.54	3.25	3.50
9. The teacher demonstrated a solid grasp of the subject matter content.	3.66	3.54	3.54	3.12	3.47
10. The teacher used questions to monitor student progress and understanding.	4.66	3.72	3.92	3.50	3.90
Ave. All	3.79	3.41	3.41	3.24	

Table 22
Observed Student Behavior: IN-STEP and Non-IN-STEP

Question	50-minute classroom		100-minute classroom		Ave. All
	Using IN-STEP	Not Using IN-STEP	Using IN-STEP	Not Using IN-STEP	
1. Students were enthusiastic about the work they were doing.	3.00	3.00	3.00	2.50	2.88
2. There was a climate of respect for what others had to say.	3.66	3.54	3.54	3.37	3.53
3. There was a lot of student-initiated discussion and a significant amount of it occurred among students.	3.00	2.54	2.54	3.37	2.86
4. Students were respectful of the teacher	4.00	3.72	3.72	3.75	3.80
5. The rules of the classroom seemed to be understood and respected.	3.33	3.09	3.09	3.25	3.19
6. Students sought support from each other when they needed help.	3.66	3.40	3.40	3.50	3.49
Ave. All	3.43	3.10	3.10	3.08	

Note. Average the point from observers, N = 35

The observers took three counts of student engagement during the observations. They noted how many students were engaged, how many were not engaged (socializing, sleeping, day-dreaming, etc.), and how many were involved in transitional activities (sharpening pencils, getting materials, etc.). Table 23 presents the results. Typically student engagement is viewed as being adequate or acceptable when at least 80% of the students are on task at all points in the lesson. Engagement in the observed classes was acceptable in about half of the cases, but fell somewhat below acceptable levels in 9 classes and was simply horrible in 8 of the classes. It also is clear that engagement levels were on average slightly higher in the non-IN-STEP classes. Teachers have expressed concerns at other times that student motivation and engagement were challenges to the use of the IN-STEP materials and that students frequently do not complete classroom assignments (see Tables 24 and 25 below).

Table 23
Observed Student Engagement

Level	IN-STEP	Non-IN-STEP
Acceptable (>81%)	6	12
Below Standard (61%-80%)	7	2
Low (<60%)	3	5
Total	16	19

Note. Source: Observations
N = 35

Table 24
Teacher's Perception of Student Motivation

Level of Students' Motivation	Number of Teachers
High	11
Low	20
Mix	12
N/A	2
Total	45

Note. Source: *WS Questionnaire, 2008*
N = 45

Table 25
Teacher Perceptions of Assignment Completion

Students Accomplish Assignment	Number of Teachers
Yes	8
No	15
Mix	12
N/A	10
Total	45

Note. Source: WS Questionnaire, 2008
N = 45

The structure of lessons is strongly related to student learning.[9] In particular lessons that open with reviews of previous work and solicit the entering knowledge of students about the topic to be studied, and which close with reviews of what was learned and reflections on explanations of the phenomena that were observed are likely to be more effective.

[9] Corcoran T., & Silander, M.(2008). Instruction in High Schools: What do we know? In C. Rouse and J. Kemple (eds.), *America's High Schools*. Princeton, NJ: The Future of Children.

Tables 26 and 27 show that the teachers using the IN-STEP materials were somewhat more likely to engage in these practices, but it should be kept in mind that both sets of teachers had had IN-STEP training. Even so, the teachers who were not using the IN-STEP materials were twice as likely to open a lesson with a lecture, whereas the IN-STEP teachers were twice as likely to open with some kind of group activity. Moreover, it is important to note that nearly half of the observed lessons lacked a coherent opening and about the same number lacked a coherent closing.

Table 26
Nature of the Opening Activities

Activities in the First 12 minutes	IN-STEP Classes	Non IN-STEP Classes
Review of previous work	11	14
Input of content by the teacher	8	13
Describing procedures/administration	12	13
Modeling by the teacher	5	7
Checking for understanding	8	8
Group work	11	7
Individual work	3	3
Discussion	10	14
Discipline	3	6
Interruption	9	8

Note. N = 35, IN-STEP Class = 16, Non IN-STEP Class = 19

Table 27
Nature of the Closing Activities

Activities in the Last 12 minutes	IN-STEP Classes	Non IN-STEP Classes
Presentation of content by the teacher	8	7
Describing procedures/administration	1	3
Checking for understanding	12	8
Group work	7	9
Individual work	4	8
Discussion	9	11
Discipline	5	6
Clean-up/equipment	9	9
Interruption	3	6
No close at all	0	3

Note. N = 35, IN-STEP Class = 16, Non IN-STEP Class = 19

During the interviews the teachers commented on the challenges that they faced teaching science. About a third noted that some students lacked prerequisite skills—particularly in reading, but also in mathematics. A few felt that the IN-STEP materials were too difficult for their students. About a fifth commented on frequent problems with discipline, attendance, and low motivation.

Table 28
Cognitive Demand of Lessons
IN-STEP and Non-IN-STEP Lessons

Task	Use IN-STEP	Not Use IN-STEP	Total
1. Students are asked to memorize material or present from memory	3	1	4
2. Students learn procedures or perform procedures previously learned	5	11	16
3. Students are asked to communicate understanding of content	5	6	11
4. Students are asked to make connections, apply concepts to solve a problem and justify strategies or answers	3	1	4
5. Students are asked to generalize, analyze, make conjectures, offer alternative explanations, solve unfamiliar problems, or create new questions	0	0	0
Total	16	19	35

Note. N = 35

Table 29
Challenges Posed by Students

IN-STEP affect students	Number of Mentions
Students lacking skills (reading, calculation)	11
Student behavior (discipline, laziness, miss class)	6
Student lack of collaboration	2
Time	3
Difficulty of the IN-STEP Materials	4
Student failure to complete assigned tasks	9

Note. Source: Observation Interviews
N = 35

Table 30
IN-STEP Effects on Teaching

	Number of Teachers
Yes	31
No	4
Total	35

Note. Source: Observation Interviews
N = 35

In spite of these problems, the teachers overwhelmingly felt that they and their students were benefiting from IN-STEP. Thirty-one of the 35 teachers observed felt that IN-STEP had had positive effects on their teaching (Table 30); most frequently reported improvements were in student engagement, student understanding of the concepts, and the use of investigations (Table 31). Twenty-five of the 35 indicated that they planned to continue to use the materials and another nine indicated they probably would (Table 32).

Table 31
IN-STEP Effects on Instruction

	Number of Mentions
Use of investigations	8
Lesson plans	3
Student engagement	16
Use of Formative assessment	1
Use of question and answer	3
Student level of conceptual understanding	9

Note. Source: Observation Interviews
N = 40

Table 32
Continued Use of IN-STEP Materials

	Number of Teachers
Yes	25
No	1
Probably will	9
Total	35

Note. Source: Observation Interviews
N = 35

VII. Building Professional Communities in the Schools

The development of professional learning communities in schools is seen by many researchers as a powerful approach to improving teaching and a potent strategy for school change and improvement. Researchers have identified what successful professional learning communities look like and act like. The requirements necessary for such organizational arrangements include:

- the full participation of the principal who helps the staff set priorities and shares leadership-and thus, power and authority—through inviting staff input in decision making;
- a shared vision of good instruction based on evidence is used as the template to assess practice and guide improvement;

- time to meet and discuss instruction on a regular basis;
- collective learning among staff and application of that learning to solutions that address students' needs;
- open classrooms that encourage visitation by peers and the provision of feedback; and,
- physical conditions and human capacities that support such an operation.

In the surveys distributed at the IN-STEP workshops, we asked teachers about conditions in their schools and they were ambiguous about the amount of support they were receiving from their principals. Slightly over half affirmed that they received adequate support, but the other half gave mixed responses.

Table 33
Principals Support by Cohort

	Cohort			
Level of Support	One	Two	Three	Total
Yes	19	25	20	64
No	1	5	9	15
Maybe	23	15	2	40
Total	43	45	31	119

When we interviewed a sample of IN-STEP teachers at the end of 2008, they were generally positive about collaboration with other teachers. More than half indicated that they were able to collaborate at least on a weekly basis.

Table 34
Frequency of Collaboration with Other Teachers

Frequency of Collaboration	Number of Teachers
Daily	15
Weekly	10
Monthly	7
Rarely	5
NR	8
Total	45

Note. N = 45

When asked what they collaborated on, they generated a long list that included science fairs and student projects, but also included lesson planning and development of instructional materials. Table 35 displays the range of responses. Not surprisingly most indicated that teachers in their schools shared materials. More surprisingly, and encouragingly, over half of those interviewed indicated that they visited other teachers' classrooms and welcomed their colleagues into their classrooms.

Table 35
Type of Collaboration with Other Teachers

Type of Collaboration	Number of Mentions
Science Fair/Special Event	16
Student learning activities/projects	7
Meet/Discuss	15
Share/Join to produce lesson plan	14
Share learning material/lab	13
Develop testing	3
Co-teaching	3

Table 36
Sharing Materials with Other Teachers

Sharing with Other Teachers	Number of Teachers
Yes	29
No	5
N/A	1
Total	35

Note. N = 35

Table 37
Regular Visits to Other Classrooms

Visitations	Number of Teachers
Yes	24
No	12
N/A	9
Total	45

Note. N = 45

The primary barrier to collaboration, not surprisingly is time. Personality issues were also mentioned. However, another barrier is shown in Table 39; of the 35 teachers observed this year, about a third of them had no colleagues in their schools who were also engaged in IN-STEP. This meant that they had no one who was sharing the experience of using more challenging instructional materials that they could talk to about the problems they were confronting.

Table 38
Teachers' Perception on Barrier of Collaboration with Other Teachers

Barriers	Number of Mentions
Time	12
Personality/Attitude	5
No barriers	11
Age	2
Budget	2

Note. N=32

Table 39
Other Teachers Using IN-STEP

	Number of Teachers
Yes	17
No	9
N/A	9
Total	35

*Note***.** N = 35

Mentoring.

Kenan conducted a special mentoring project with five schools, assigning an experienced mentor to work intensively with one teacher in each one. The mentor visited each of these schools three or four times during a two-month period at the end of 2008. All of the schools are extended primary schools. Here is the mentor's account of what happened:

School One: The school is remote and receives little support from the ESAO. The teacher faces high student turnover as they move frequently. Many of the students have reading problems and their motivation is poor. Student discipline is poor and they come and go during the class time. Initially the teacher did little preparation. The mentor provided advice to re-structure the groups in the class. She also used observation and gave feedback to the teacher, and then she co-planned and co-taught a lesson. Teacher responded well to the assistance, and the mentor saw improvement.

School Two: This was an Islamic school with large co-ed classes. The mentor observed that the teacher did little preparation and had no lesson plans. She also observed that the teacher focused on the girls during the class. Feedback was not well-received. Follow-up was unsuccessful because the teacher was out ill or refused to schedule meetings.

School Three: The teacher was senior and experienced but viewed the students as incapable of complex learning, and focused on simple lessons. After meetings with the teacher, the mentor concluded that it would be hard to change the mindset of a senior teacher.

School Four: The principal was quite supportive and the teacher wanted to improve, and was willing to try new strategies. The classes were large, but the teacher followed the mentor's advice and re-arranged the groups and students were responsive. The teacher saw higher levels of engagement and participation and was eager to continue work with the mentor.

School Five: The teacher was using IN-STEP to complement the materials but was willing to change her practice. The students were well-behaved and cooperative. Teacher also taught primary classes and used some In-STEP there. The mentor visited the teacher before and after class. The results were positive and the teacher seems willing to continue to improve her practice.

These five cases illustrate the complexity and uncertainty of reforming classroom practice. In three cases, the results were positive and the work will continue. In two cases, teachers held beliefs that obstructed the work and were not likely to be changed without intensive work and perhaps interventions by supervisors. This experiment in intensive mentoring did demonstrate its value and suggests that a strategy of concentrating mentoring on high-need, but willing subjects might be more effective than providing a little mentoring to everyone.

VIII. ESAO and The Principals: Their Role and Needs

The general perception is that school principals are overloaded with routine administrative duties and as a result, devote little time to instruction. This might be particularly true in small schools where principals have little, if any, administrative support and must play many roles. If teachers have little time to work with each other, and professional communities are relatively weak (See Section VI above), and principals devote little time to instructional supervision and improvement, then there is likely to be little pressure to improve classroom practices and little support if teachers did decide to change their practices.

Twenty-eight principals from the 52 schools participating in the IN-STEP program attended a workshop on instructional leadership in December 2008. A brief survey was distributed at the end of the workshop to find out the extent to which they were involved in instruction and what they perceived to be the priorities for improvement. Among the questions asked in the survey were:

1. Please describe your current activities related to school management.
2. In which area do you want to improve teaching and learning quality in your school?
3. How do you want to improve instructional quality?
4. Do you want to join an activity related to instructional leadership for principals to be organized in Feb. 09?
5. What topics do you want to suggest for the activity in #4?

The answers to the first two questions were grouped into eight categories of activity defined by Goldring and her colleagues (2008)[10]. The categories are:

a. Building operations: schedules, space operations, building maintenance, vendors.
b. Finances and financial support for the school: budgets, budget reports, seeking grants, managing contracts.
c. Community or parent relations: formal meetings and information interactions.
d. Relations with system officials.
e. Student affairs: attendance, discipline, counseling, hall/cafeteria monitoring.

[10] Goldring, E., Huff, J., May, H., Camburn, E. (2006). *School context and individual characteristics: what influences principal practice*? Madison, Wisconsin: CPRE.

f. Personnel issues: recruiting, hiring, supervising, evaluating, problem solving.
g. Planning/setting goals: school improvement planning, developing goals.
h. Instructional leadership: monitoring/observing instruction, school restructuring or reform, supporting teachers' professional development, analyzing student data or work, modeling instructional practices, teaching a class.
i. Personal professional growth

Table 40 displays the results of this analysis. When asked about their current priorities, 31 out of the 75 management activities mentioned were related to instructional improvement. Almost all of the principals identified it as a high priority. Among the 31 responses listed under instructional improvement category, nine addressed the general need for improving academic achievement, eight focused on teacher development and five of them were about teacher monitoring and curriculum development.

Table 40
Priority Activities Related to School Management

Current Activities Done by Principals	Number of Mentions	Percentage
Building Operations	13	17%
Finance and financial support for School	0	0%
Community or parent relations	11	15%
School district functions	NA	
Student affairs	12	16%
Personnel Issues	6	8%
Planning/setting goals	0	0%
Instructional Improvement	31	41%
Professional Growth	2	3%
Total	75	100%

Table 41
Instructional Improvement Activities

Areas of Improvement	Number of Mentions
Instructional Improvement	8
Curriculum Development	2
Teaching Plan	3
Teacher Professional Development	16
Classroom Management	1
Time allocation for teaching	1
Teacher monitoring	3
Student Achievement	2
Student evaluation	1
Focus on Student literacy	4

When asked about how they would like to improve instruction, more than half of them gave a response related to teacher professional development.

The principals were asked if they would like to participate in an instructional leadership workshop. Twenty-seven out of the 28 indicated that they would. They were asked what topics should be covered. Their suggestions are presented in Table 42 below. The topics on the list are quite varied and there is no clear focus. However, it is significant that nearly a third felt that teacher monitoring and evaluation or professional development should be the priority.

Table 42

Topics for Leadership Training

Suggested Topics	Number of Mentions
Teacher Monitoring & Evaluation	5
Teacher Professional Development	4
Subjects integration	1
Time Management	2
Student Behavior	1
Building motivation for teachers	2
Leadership for change	2
Visiting high achieving IN-STEP schools (Thailand & overseas)	1
Organization Management	1
School Culture	1
Research for Principal	1

Table 43
Strengthening IN-STEP

Suggested Topics	Number of Mentions
Stress teacher monitoring and follow up	8
Continue to develop teachers	8
Expand to more science teachers in lower grades	6

While many ideas were offered by the principals, the three most frequently mentioned were provision of more direct follow-up, continuing to provide professional development for the teachers, and expanding the project into the lower grades.

Summary. In conclusion, principals mostly placed high importance on instructional improvement. Teacher professional development and teacher monitoring are what they want to focus on for an improvement. They are enthusiastic to learn more on how to improve their schools.

IX. Effects on Student Learning

At present we have only anecdotal evidence that IN-STEP is having positive effects on student learning. The majority of the IN-STEP teachers report that students are more engaged in their science lessons and are acquiring deeper understanding of science. Toward the beginning of 2010, we will issue a report on the first analysis of the impact the program is having on learning. We will look at the relationship between a student's exposure to IN-STEP as measured by the number of modules used in the student's science classes, and the student's performance on the O-NET science assessment.

If we find that teachers who are using the IN-STEP modules have students who earn higher scores, we can offer at least three hypotheses to explain the finding. These are:

1. Teachers assigned to teach students with a history of high performance are more likely to have implemented more of the science modules. In other words, these students always had higher performance, and the modules added little or no value.
2. Teachers who implemented more science modules are also more likely to be concerned about the quality of their teaching and to have implemented other aspects of good science instruction (teaming, good lesson design, formative assessment, and so on). Thus, good science instruction (not necessarily the modules) led to higher student performance.
3. Exposure to more science modules caused students to earn higher scores on the O-NET. Simply put, the program had a positive impact on performance.

In the Fall of 2010, we will repeat this analysis, and also examine the relationship between school level gains on O-NET and the use of IN-STEP modules with the students in the graduating 9th grade.

X. The Lessons Being Learned from IN-STEP

The IN-STEP pilot in Phang-nga has surfaced a number of issues that should be addressed by national, provincial, and local leaders if Thailand hopes to improve its performance in science education. Some of these are issues of policy, and some are issues of practice. Here we provide an overview of some the lessons emerging from IN-STEP.

Curriculum-based Professional Development. Providing intensive professional development around specific curriculum materials has been shown to be an effective way of deepening teachers' content knowledge as well as their pedagogical content knowledge and stimulating changes in classroom practice. This strategy works in Thailand as well as in other countries. IN-STEP teachers not only rate the professional development highly, but they are using what they are learning even when they are not using the modules themselves. They are using more investigations than they did prior to the IN-STEP training, their lessons are better structured, they make better use of questions to monitor student understanding, and they focus more attention on helping students explain what they observe.

Developing Professional Developers. The IN-STEP experience also has demonstrated the efficacy of the apprenticeship model of building capacity to design and deliver professional development. The Thai science educators who have participated on the instructional teams have become proficient at the delivery of high-quality professional development and many have shown they are capable of leading this kind of work. There are now more than 80 experienced individuals who can conduct professional development in science.

Time. The most important issue confronting those interested in improving science learning is the amount of instructional time devoted to science in the lower secondary schools. Researchers around the world have found a consistent and strong relationship between the time devoted to a subject and student performance in that subject. As discussed earlier, the top performers in science on the PISA spend an average of two hours more per week studying science at school than the poor performers. On average, top performers receive four hours of instruction per week in science at school, half an hour more than the strong performers and two hours more than lowest performers. In fact, all of the countries whose average PISA scores are above the international mean require at least 240 minutes or more of instruction in science per week in Grades 7, 8, and 9. If Thailand wants to improve the performance of its students, the lowest cost way to do that would be to increase the amount of time devoted to science not only in the lower secondary grades, but also in the intermediate grades—4, 5, and 6.

School Leadership. We have also noted in this report that many school principals do not have a lot of time to devote to monitoring and improving instruction. Principals have many duties especially in small schools where they have to take care of the facilities and grounds, maintain good relations with the community, raise funds and take care of the school accounts, counsel students, and deal with personnel issues. Yet the IN-STEP principals recognize the importance of improving instruction and want to do more in this domain. Many of them have not been well-trained to do classroom observation or to provide teachers with feedback. They would like to know more about good instructional practice. It is clear that principals need to be encouraged to take a more active role in improving instruction and be prepared to do that. It is also clear that science teachers, especially those in small schools, need more professional support and more interaction with other science teachers than they now receive. Developing science networks or associations at the provincial level or science teacher networks around clusters of schools could contribute to development of a climate supportive of instructional improvement.

Class Size. The IN-STEP modules and the investigations that they contain were designed for the typical class in the United States where class sizes in Grades 7, 8, and 9 run between 25 and 30. However, some IN-STEP teachers have 40-45 students in their classes. While it is still possible to do the investigations, assuming students are well-behaved and on-task (see below), it is harder to manage the classroom and it takes longer. The latter exacerbates the time problem. The former could be addressed by more effective use of student groups. Many Thai teachers organize students into groups, but some have not been trained on how groups should be formed and managed and therefore do not realize the benefits that can be associated with this strategy. Good training in student teaming would help Thai teachers cope with the large class sizes.

School Discipline. In about a quarter of the classrooms we visited discipline was a serious problem. Students, usually boys, were off-task, acting out, and disrupting others who wanted to work, and the teachers seemed unable to control their behavior. When asked about it, the teachers said this was a common problem and that they had little leverage over the students. They said if they sent unruly students to the principal, it would do no good as the principal did not wish to offend parents and would send the students back. Clearly there needs to be a discussion about discipline (and work effort) in these schools and perhaps with their communities, and clear expectations and disciplinary policies need to be established. The MOE or the ESAO could make a valuable contribution to these schools, and to improving instruction, if they would lead a process to develop a disciplinary code.

Workload in Small Schools. Teachers working in small schools often teach multiple grades and therefore have multiple preparations. This makes it more difficult for them to adopt new materials that require more lesson preparation or generate more student products to assess. There is no easy solution to this problem. Options include the development of smaller modules that require less preparation, the use of community members with science backgrounds as adjuncts to help with labs and grading student papers, and perhaps the sharing of assignments with teachers in nearby schools so that one could teach only Grade 8 and another only Grade 9 and so on. The latter idea may only be practical in a few places.

National Testing. The new O-NET science assessment administered for the first time in the Spring of 2009 is important to students and teachers as it influenced the former’s prospects for upper secondary school. As a consequence, the content of the assessment is likely to influence what is taught and how it is taught in the future. The 2009 test contained 40 multiple-choice items and a number of them asked students to interpret data or to think about the scientific process. Encouragingly, about half of the items appeared to assess content that was covered in the IN-STEP modules.

Costs and Replication. The cost of the IN-STEP materials remains a huge barrier to their extensive use. The goal should be to cut the costs by more than half.

XI. Recommendations

Based on our analysis of the data from the past 18 months, we offer the following recommendations to the program managers of IN-STEP:

A. Design and Management of the Program

1. **Require the Participating Schools to Increase Time Allocations for Science to 250 minutes.** The international standard for instructional time for science in grades 7 and 8 is approximately 250 minutes. This is the amount allocated in all of the high-achieving countries. While time is not the only factor affecting achievement, it is an important one and increasing it will give a dramatic boost to science. Therefore, we urge the IN-STEP program to consider making such an

allocation of time a requirement for all schools participating in IN-STEP in the future. This would make it possible to use the curriculum modules and it would demonstrate the importance of the time allocation to the Ministry of Education. Schools are able to make such an allocation by reducing the discretionary time they allocate to student development and other activities.

2. **Strengthen the Requirements in the Memorandum of Understanding Signed by the Schools.** The schools now sign an MOU with the ESAO, but the requirements should be more specific and more binding. Schools participating in IN-STEP are receiving free access to valuable instructional materials and intensive professional development. It seems reasonable to ask them to make some commitments in turn. In addition to the increased time allocation, the schools should commit to sending all of their science teachers to the workshops, having each teacher implement a minimum set of modules (see Recommendation #4 below), having the principal attend the leadership workshops, providing mentors access to science classrooms, and providing the data required for the evaluation. The ESAO should put pressure on the schools to comply with the requirements.
3. **Define Minimum Implementation Expectations.** In schools where teachers have 2 or more preparations in different grade levels, it is difficult to find time to prepare to teach two, let alone three of the large IN-STEP modules each year. It also takes up too much of the current time allocation. As a consequence, we recommend that IN-STEP alter its objectives and treat the modules as an enrichment of the science program rather than a replacement for the current curriculum. The modules could provide students with rich opportunities for inquiry and provide a pedagogical model that might be replicated in other parts of the curriculum. Given this perspective, the minimum expectation might be that teachers use at least one large and one small IN-STEP module each year. This will ease the implementation problem and as teachers find the modules effective, they might be motivated to expand their use.
4. **Pilot Alternative Delivery Models.** One of the possible explanations of the decline in teacher participation in the IN-STEP workshops is the annual loss of vacation time for the teachers. Giving up one week of vacation annually for three years is a high cost. Now that the instructional teams are more experienced, it may be possible to reduce the professional development to three days by using the time more efficiently. It also may be worth considering the possibility of delivering the professional development on three or four consectutive Saturdays during the school year. As the IN-STEP program is expanded in collaboration with IPST, it might be worth testing the efficacy of alternative delivery models.

B. The IN-STEP Curriculum

5. **Re-structure the EMM module.** Since this module is one that teachers and students find difficult and because the Thai standards it aligns with cover the entire three years, it is strongly recommended that it be broken into three discrete parts aligned with the standards in grades 7, 8, and 9. This would increase the likelihood that it would be used and would contribute to improved performance in the physical sciences.

6. **Check the Reading Level of the Student Materials.** Given the constant feedback from teachers that some of their students cannot read the student materials and the documented literacy problems in schools in Thailand, it seems important to check the reading levels of the materials and where possible modify them to use simpler language that would reduce the barriers to student learning. The materials were written for students reading on grade level and were translated by Thai university faculty who may have used more challenging language than is required.
7. **Add Inquiry Projects.** Given the possibility of increasing the time available for science instruction, and the recommendation that IN-STEP be viewed as an enrichment curriculum rather replacement, it would seem appropriate to add more extensive student projects to each of the modules. Teachers could choose which ones to use, but could be encouraged to use at least one each year. These projects could help build motivation for science and connect science to students' lives and the needs of their communities. The kind of projects being undertaken in the Science and Local Wisdom project provide models for what could be done in every school. This would students with opportunities to apply and transfer knowledge and contribute to their communities.
8. **Embed Classroom Management Skills in the Workshops.** Many of the participating teachers appear to have trouble with classroom management. Discipline was a serious problem in a third of the observed classrooms. Teachers need help in this area, not just to manage inquiry, but more generally to keep students on task.

C. Implementation Support

9. **Continue the Intensive Mentoring Program.** The experiment undertaken by Kenan with intensive mentoring seems to have been successful and ought to be continued and studied. It might be a more efficient strategy for implementation support than providing mentoring to all teachers.
10. **Work with the ESAO and the Science Society of Thailand to Set Up a Science Association and/or Teacher Networks.** Many teachers, especially those in remote rural schools work in relative isolation and have no one to turn to when they do not understand the science or experience difficulties in the classroom. They also have no regular mechanisms to support their professional growth. The teacher networks advocated by Kenan could provide a solution to these problems, but they will not be sustained unless the ESAO takes responsibility for sustaining them and unless the Ministry provides some incentives for teachers to participate in them. A provincial science society sponsored by the ESAO and the Science Society might be a more workable alternative to local networks and could sponsor semi-annual meetings that highlight good practices being used in the schools and connections to other public and private organizations with interests in science education. Activities of this type are occasionally sponsored by various agencies but they are often disconnected from the professional development needs of teachers.
11. **Provide Teachers with Stronger Incentives to Participate.** Many teachers have told us that they would like to receive some direct benefit for participating in

IN-STEP. They would like to see the professional development or perhaps research projects linked to the program connected to the requirements for professional advancement. We recommend that Kenan work with the Ministry to review these requirements and consider how the activities of the IN-STEP program might be contribute to a teacher's advancement.

12. **Lobby the Ministry of Education to Reduce Disruptions of Instruction.** In our observations and interviews, we saw how poor discipline can disrupt well-designed lessons and we learned that students frequently are pulled from class for social development events, sports, and clubs. The discipline problems need to be addressed systematically as well as through training. Schools should have discipline policies and principals should support teachers who enforce them. The extent of the pull-out problem undoubtedly varies across schools, but it seems ubiquitous and should be strongly discouraged. Thailand already has a short school year given the high number of holidays and a relatively short school day given the time given to non-academic activities, so missing more class time contributes to Thailand's performance problems. We recommend that this issue be brought to the attention of the Ministry with a recommendation that a school's funding be linked to satisfying a minimum set of academic time requirements for all students.

Appendix A

IN-STEP Classroom Observation Protocol

IN-STEP Observer ____________________Date of Observation_____________

A. Background Information

School ____________Teacher Observed _____________Grade Level ________

Number of adults in the classroom _______Number of students ________________
Time Lesson Began ______ Ended ________

IN-STEP Module ____________ Lesson Number _________

B. CONTEXTUAL BACKGROUND AND ACTIVITIES (Notes as class begins)

In the space provided below please give a brief description of the classroom setting in which the lesson took place (space, seating arrangements, crowding, access to equipment, etc.), and any other relevant details about the situation, students (number, gender, ethnicity) and teacher that you think are important. Use diagrams if they seem appropriate.

C. Monitoring Teacher Behaviors

At each three minute time interval, check the box(es) that best describes what is going on in the classroom at that time.

Action	Time in the Lesson (Minutes)														
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
Review of previous work															
Input of content by the teacher															
Describing procedures/ Administration															
Modeling by the teacher															
Checking for understanding															
Group work															
Individual student work															
Discussion															
Discipline															
Clean-up/ equipment															

D. Checks for Student Engagement

About 5 minutes after the class begins, once during the middle of the lesson, and 5 minutes before the class ends, visually survey the classroom and count how many students are engaged in behaviors that fit the three categories listed below. Transitional activity refers to getting materials, sharpening materials, waiting for assistance, etc. If there is significant off-task behavior (more than 25% of the class), please make a note about the behavior and its apparent cause.

1. Five minutes after class begins

On Task- engaged in the task	Transitional activities	Off-Task

Description: ____

____

____

____

2. During the middle of the class [student work period]

On Task- engaged	Transitional activities	Off-Task

Description: ____

____

____

____

3. Five minutes before class ends

On Task- engaged	Transitional activities	Off-Task

Description: ____

____

____

____

E. Use of the Module Materials

Major Lesson Activities from Teacher’s Guide	Used as Designed (Y/N)	Omitted (Y/N)	Adapted (Y/N)	Nature of the Adaptation

F. Perceptions of Teacher Behavior (answer when appropriate)

Question	Not at all				To a great Extent	
1. The classroom was well-organized and equipment was distributed efficiently.	**1**	**2**	**3**	**4**	**5**	**NA**
2. The classroom climate was warm and supportive.	**1**	**2**	**3**	**4**	**5**	**NA**
3. The teacher linked the lesson to students' prior knowledge.	**1**	**2**	**3**	**4**	**5**	**NA**
4. The teacher encouraged student questions by responding thoughtfully.	**1**	**2**	**3**	**4**	**5**	**NA**
5. The teacher encouraged student discussion.	**1**	**2**	**3**	**4**	**5**	**NA**
6. Students were encouraged to consider alternative solutions or inquiry strategies.	**1**	**2**	**3**	**4**	**5**	**NA**
7. The teacher acted as a resource person, working to support student investigations.	**1**	**2**	**3**	**4**	**5**	**NA**
8. The core concepts of the lesson were clearly explained.	**1**	**2**	**3**	**4**	**5**	**NA**
9. The teacher demonstrated a solid grasp of the subject matter content.	**1**	**2**	**3**	**4**	**5**	**NA**
10. The teacher asked questions to monitor student progress and understanding.	**1**	**2**	**3**	**4**	**5**	**NA**

G. Perceptions of Student Behavior

Student Activity	Not at all				To a great Extent	
1. The students seemed to be able to do the work that was assigned.	**1**	**2**	**3**	**4**	**5**	**NA**
2. The work was too challenging for many (estimate of a quarter) of the students.	**1**	**2**	**3**	**4**	**5**	**NA**
3. The work was too easy for many (estimate of a quarter) of the students.	**1**	**2**	**3**	**4**	**5**	**NA**
4. Students were enthusiastic about the work they were doing.	**1**	**2**	**3**	**4**	**5**	**NA**
5. There was a climate of respect for what others had to say.	**1**	**2**	**3**	**4**	**5**	**NA**
6. There was a lot of student initiated discussion and a significant amount of it occurred among students.	**1**	**2**	**3**	**4**	**5**	**NA**
7. Students used the Student Manual.	**1**	**2**	**3**	**4**	**5**	**NA**
8. Students were respectful of the teacher	**1**	**2**	**3**	**4**	**5**	**NA**
9. The rules of the classroom seemed to be understood and respected.	**1**	**2**	**3**	**4**	**5**	**NA**
10. Students sought support from each other when they needed help.	**1**	**2**	**3**	**4**	**5**	**NA**

H. The Lesson Overview (Complete after the observation)

In the space provided below list the key elements of the lesson you observed, describing the major activities of the students, note the nature of the interactions occurring between the teacher and students (lecture, teacher-led discussion, student-initiated discussion, group work, student presentation, teacher-led question and answer, etc.) and rate the level of cognitive demand using the following scale:

1. Students are asked to memorize material or present from memory

2. Students learn procedures or perform procedures previously learned.

3. Students are asked to communicate understanding of content.

4. Students are asked to make connections, apply concepts to solve a problem and justify strategies or answers.

5. Students are asked to generalize, analyze, make conjectures, offer alternative explanations, solve unfamiliar problems, or create new questions.

Activity	Interactions	Level of Cognitive Demand

1.____

2.____

3.____

4.____

5.____

6.____

7.____

I. Any Additional Comments about the Lesson (complete after the interview)

Please provide any additional information you consider necessary to capture the activities, tone or context of this lesson. Include comments on any feature of the class that is so salient that you need to get it “on the table” right away to help your ratings; for example, the class lacked the skills needed to use equipment, the kids were excited about an upcoming school event, there were serious classroom management problems, a large proportion of the class was absent, there was a major interruption in the middle of the class, or the teacher’s tone was so warm (or so hostile) that it was an overwhelmingly important feature of the lesson.