Science Understanding, Math Mentoring Integrated with Technology (SUMMIT) Teaching New Standards Summative Report

06/30/2013

Report written and submitted to SUMMIT

By
Dr. Anna Lewis
University of South Florida St. Petersburg

USFSP UNIVERSITY OF SOUTH FLORIDA ST. PETERSBURG
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I. Introduction

Due to Florida's recent adoption of a New Generation of Sunshine State Standards (NGSSS) for Mathematics and Science and upcoming adoption of Common Core Standards a way is needed to assist teachers in making a smooth transition to implement these new standards. The SUMMIT project endeavors to meet this need. Year two of the Project worked to provide a cohesive, consistent, and rapid-roll-out training that would help elementary teachers across the state of Florida to: 1) Understand the concept of “Big Ideas”; 2) Obtain a deep conceptual understanding of the benchmarks; 3) Develop strategies that enable teachers to help students to achieve benchmark outcomes, specifically familiarity with inquiry methods. By providing this type of training the SUMMIT program hoped to help Florida elementary teachers to develop the skills that would enable them to:

1. Teach implementing the NGSSS science and Common Core standards.
2. Apply research based pedagogy in classroom instruction (Inquiry, Argumentation, Questioning, Misconceptions).
3. Apply research based instruction in their professional development (Intensive Training, Modeling, Follow Up, and Accountability).
4. Integrate technology into the science class.
5. Develop Lesson Study Teams (LST) in their respective schools that will enhance student learning outcomes.

The purpose of this report is to present and discuss the project’s success at meeting these goals. The report is derived from a variety of means, such as, observations and participant feedback from the institutes and follow-up workshops conducted in schools throughout Florida from November 2012 to May 2013. The information contained herein is intended to contribute to the 2013 Summative Project Report to the project managers and funders.
II. Background

The University of Central Florida formed a partnership with twenty-nine Florida school districts. Table 1 shows the number of participating teachers for each of these districts for each of the activities conducted during the grant period. Outcomes for these activities will be discussed in more length later in this document. However, as a brief overview; institutes that were 5-days in length were offered to help teachers to understand how to incorporate inquiry pedagogy into standards driven lessons; in addition, these institutes offered time to help teachers understand Lesson Study and develop Lesson Study teams. Lesson Study days were then utilized by teacher teams to practice Lesson Study methods in their own classrooms. Several districts were interested in only providing the inquiry portion and these 2-day workshops were called 2-Day Specials. Twenty-four 5th grade classroom teachers volunteered to conduct a SUMMIT developed inquiry lesson in their classrooms, and student data from these activities were collected.

In addition, to the above activities there were several 1-day events which entailed: 1) teachers from the Year 1 Summit cohorts met to debrief and discuss “lessons learned” 2) teachers from the Year 2 Summit cohorts met to debrief and discuss “lessons learned” or 3) teachers who did not participate in the 5-day or 2-day workshops but wanted some exposure to inquiry methods. No information, regarding the number of teachers participating was given to the evaluators regarding these one day events, so these events will not be included in this report.

Table 1 - Year 2 SUMMIT Participants

<table>
<thead>
<tr>
<th>District Name</th>
<th>5-Day Institute</th>
<th>Lesson Study</th>
<th>2-day Special</th>
<th>Classroom Lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Broward</td>
<td>75</td>
<td>80</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>2 Citrus</td>
<td>47</td>
<td>50</td>
<td>50</td>
<td>8</td>
</tr>
<tr>
<td>3 Clay</td>
<td>29</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Collier</td>
<td>39</td>
<td>35</td>
<td>35</td>
<td>19</td>
</tr>
<tr>
<td>5 DeSoto</td>
<td>7</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Duval</td>
<td>55</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Duval/Flagler</td>
<td>36</td>
<td>40</td>
<td>40</td>
<td>22</td>
</tr>
<tr>
<td>8 Escambia</td>
<td>63</td>
<td></td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>9 Hardee</td>
<td>21</td>
<td></td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>10 Highlands</td>
<td>8</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Hillsborough</td>
<td>76</td>
<td></td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>12 Indian River</td>
<td>12</td>
<td>25</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>13 Lake</td>
<td>50</td>
<td></td>
<td>50</td>
<td>28</td>
</tr>
<tr>
<td>14 Lee</td>
<td>20</td>
<td>30</td>
<td>30</td>
<td>29</td>
</tr>
<tr>
<td>15 Manatee</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Totals</strong> 625</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>District Name</th>
<th>5-Day Institute</th>
<th>Lesson Study</th>
<th>2-day Special</th>
<th>Classroom Lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Marion</td>
<td>89</td>
<td>120</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>2 Martin</td>
<td>27</td>
<td>36</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>3 Miami-Dade</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Monroe</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Okaloosa</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Orange</td>
<td>18</td>
<td>28</td>
<td>64</td>
<td>1</td>
</tr>
<tr>
<td>7 Osceola</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Palm Beach</td>
<td>40</td>
<td>50</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>9 Pinellas</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>6</td>
</tr>
<tr>
<td>10 Polk</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Santa Rosa</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Seminole</td>
<td>75</td>
<td>80</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>13 St. Lucie</td>
<td>56</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 TCC</td>
<td>67</td>
<td>50</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>15 TCC</td>
<td>67</td>
<td>50</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

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As Table-1 shows, over 2,000 individual teachers were involved in some form of Professional Development through the SUMMIT project. (Many of the teachers involved in the Lesson Study activity also participated in the 5-day workshop so the total number of teachers cannot be attained by adding across totals for each activity.)

The evaluation team for Florida SUMMIT is comprised of personnel from the University Of South Florida St. Petersburg College Of Education (USFSP COE). The formative evaluation plan calls for gathering data on the quality and effectiveness of the project’s summer institutes and follow-up sessions. Data were collected through several triangulated means: structured observations of institute sessions; participant and facilitator feedback; content assessment of participants; and a feedback survey completed by participants.

Observations

The observations conducted all followed the same procedure, summarized as follows:

1. The observer read through the Facilitator’s Manual materials for the day(s) of the observation.
2. Just prior to the observation (the evening before or the morning of), the observer conducted a brief interview with the facilitators to get information on the participants, how the institute had gone so far, any adjustments that had been made from the institute plan, and the learning objectives for the time of the observation.
3. During the session(s), the observer took extensive field notes on the activities and interactions. The observer did not participate in institute activities.
4. At a convenient time during the visit, the observer conducted a focus group interview of volunteer participants to gather their perceptions of the institute.
5. At the end of the observation period, the observer again spoke with the facilitators to get their thoughts about the session(s), progress made toward the learning objectives, and what would happen next in the institute.
6. The observer completed the Professional Development Observation Protocol using the field notes.

USFSP COE personnel compiled data from the individual Observation Reports and generated the summary results and analysis reported in this document.

Participant and facilitator feedback

In order to provide formative data to help inform subsequent PD revisions, as well as summary information for project reports, the evaluator gathered feedback for the 5-day institute and Lesson Study activities from participants via personal interviews with workshop facilitators and participants. These interviews and focus groups were conducted verbally by the workshop observer.
Survey instruments

In addition to observing portions of the SUMMIT professional development (PD) and conducting interviews, a survey was used to capture additional participant information. The survey was developed to gather data regarding teacher efficacy (Q1-Q15), teacher content knowledge regarding the topics covered (C1-C15), facilitator and environmental ratings (F1-F13) and a variety of open-ended questions where participants could provide unstructured feedback. The self-efficacy portion was taken from the Science Teaching Efficacy Beliefs Instrument Form B (STEBI-B) developed by Enochs & Riggs, 1990; a validated and reliable instrument. The content questions were provided by the workshop facilitators to ensure alignment between the intended content to be delivered and tested. The facilitator and environment questions were developed to capture information regarding how the PD was conducted and overall perceptions during the workshops. The open-ended questions allowed participants an opportunity to share their thoughts and ideas in an unstructured and personal manner regarding their experiences during the PD.

USFSP COE staff distributed pre & post survey instruments in postage-paid return envelopes to each district partner so that at the end of the final follow-up session participants were able respond to the survey and the information could be returned in a timely manner.

Cautions and limitations regarding observations and data collection

The evaluation team made great efforts to ensure that the observations, survey instruments, and focus groups gathered credible data about the PD offered, and we feel confident that this is the case. However, we also acknowledge the following limitations on the data collected:

- The observations are a “snapshot” of events occurring. The data collected refer only to the particular sessions observed. Those sessions may or may not be typical of other institutes or workshops, which were not observed. Observation at each workshop would have helped address this concern, but resources and scheduling constraints precluded this.

- Scheduling of the observation dates and sites was done to meet the availability of the observers to undertake the travel. Therefore, the particular session(s) observed represent a sample of convenience, not a random sample. Again, caution is needed in generalizing to the entire institute time.

- Pre/post-survey results could only be calculated with surveys that could be identified, 74% of the 5-day workshop content data could be analyzed in this manner. Other questions such as the facilitator and environmental questions were only asked in the post test so this restriction did not apply to all areas investigated.
• The institute developers did not see the observation protocol during the design phase or prior to the observation visit. There is a possibility that the framework for effective professional development used in the protocol and the framework from which developers operated were not in complete alignment. This might result in deficiencies being noted in the sessions that were not part of the developers’ intent. We are confident in the validity of the observation protocol and its indicators, and view any differences as “food for thought” as the project considers revisions to the institutes.

The results presented in the remainder of this report should be read with these limitations in mind, with caution against interpreting them more broadly or strongly than the data justify. That said, we believe the results provide valuable information to include in discussions about the project among the SUMMIT leadership.

Questions to be addressed by observations and feedback

This report provides an overview of the findings for of all the data collected and integrates the various results into general conclusions and observations. In particular, the observations, focus groups, and surveys were designed to collect data that contribute to addressing the following questions:

<table>
<thead>
<tr>
<th>Evaluation Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To what extent does the SUMMIT professional development exhibit a primary focus on the targeted pedagogical content?</td>
</tr>
<tr>
<td>2. To what extent do the design and implementation of SUMMIT workshops reflect attention to conditions for adult learning and characteristics of effective teacher professional development?</td>
</tr>
<tr>
<td>3. To what extent were participants satisfied with this professional development experience?</td>
</tr>
</tbody>
</table>
III. SUMMIT Activities - Participant Information

The 5-day institutes were designed to provide intensive pedagogy-focused experiences that would enhance the depth and breadth of participants’ pedagogical knowledge in their teaching discipline, in addition to exposing teachers to inquiry and Lesson Study strategies. The institutes were developed to model appropriate instructional strategies.

The Lesson Study sessions were intended to further integrate science content and pedagogical skills, learned in the 5-day workshops, into the classroom. Twenty-four 5th grade teacher volunteers then taught a lesson, designed by SUMMIT management, in their own classrooms to better understand how this teacher training might translate into student achievement. This lesson was an activity regarding friction, which was aligned with Florida science standards and the district curriculum maps.

Pre/post-content questions were distributed to all 5-day institute participants. Teachers were asked to use a number they would remember to identify their surveys or simply use their first initial/birthday/last initial as an identifier to connect pre/post surveys. In many cases the pre-/post tests could not be compared due to inaccuracies in the identifier requested on each pre/post form. Of the 569 pre/post-tests returned from the 5-day institute 74% could be used for identifying individual changes.

In addition, information regarding participant demographics was obtained through pre/post-tests and surveys. Table 2 displays the number of instruments returned from participants. Table 2 indicates a total of 569 returns from the 5-day, 566 from the 2-day specials, 285 from the Lesson Studies, and 577 from Student tests. No demographic information was ascertained on the student tests, due to IRB restrictions.

Table 2 - Breakdown of Returned Surveys

<table>
<thead>
<tr>
<th>5-day Institute</th>
<th>2-day Specials</th>
<th>Lesson Study</th>
<th>Class Lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td># Pre/Post-tests</td>
<td># surveys</td>
<td># surveys</td>
<td># of student Pre/Post-tests</td>
</tr>
<tr>
<td>Matched</td>
<td>Unmatched</td>
<td>Matched</td>
<td>Unmatched</td>
</tr>
<tr>
<td>420</td>
<td>149</td>
<td>566</td>
<td>285</td>
</tr>
</tbody>
</table>

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From the 1,420 returned surveys it was determined that most participants described themselves as Elementary (90%) educators and were teachers (over 85%) as opposed to coaches or other roles in non-elementary grades. Approximately 10% of the participants were not affiliated with elementary education. Those who did not indicate their primary role as teachers indicated that they worked in a variety of roles, such as ESE teachers, behavior specialists, STEM lab instructors, coaches, science specialists, held administrative positions, or choose not to answer this question. Tables 3 & 4 show the breakdown of roles and grades taught by those who returned surveys for evaluation.

Table 3 – Grades Taught

<table>
<thead>
<tr>
<th></th>
<th>5-day Institute</th>
<th>2-day Specials</th>
<th>Lesson Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-5</td>
<td>92%</td>
<td>89%</td>
<td>92%</td>
</tr>
<tr>
<td>6-8</td>
<td>5%</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>Other</td>
<td>3%</td>
<td>5%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Table 4 – Educational Roles of SUMMIT Participants

<table>
<thead>
<tr>
<th></th>
<th>5-day Institute</th>
<th>2-day Specials</th>
<th>Lesson Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>83%</td>
<td>88%</td>
<td>85%</td>
</tr>
<tr>
<td>Coach</td>
<td>10%</td>
<td>6%</td>
<td>11%</td>
</tr>
<tr>
<td>Other</td>
<td>7%</td>
<td>5%</td>
<td>5%</td>
</tr>
</tbody>
</table>
IV. Findings from the SUMMIT Professional Development Project

This section summarizes general findings stemming from analysis of the observation data, interviews, pre/post tests and surveys distributed and returned by participants. The findings are organized around the evaluation questions as noted on page 6.

Evaluation Question: To what extent does the SUMMIT professional development (PD) exhibit a primary focus on the targeted pedagogical content?

**Finding:** The PD observed exhibited an appropriate focus on teachers’ disciplinary pedagogical knowledge, as intended by the SUMMIT project.

Through pre-PD interviews with facilitators it was established that science content was not being addressed specifically during the PD, but rather pedagogical knowledge was to be learned through modeling appropriate inquiry lessons. This was evident in the modules observed. For instance, participants were given the opportunity to engage in a procedural lab where they determined the density of given materials and an inquiry activity that required no prior knowledge to sort images of dots and rings. These lessons lead to a discussion regarding the fundamental differences between these two types of activities. Participants experienced these labs from the student perspective and then reflected upon them as educators to come to a deeper understanding of the when and how these types of labs may be appropriate, which labs encourage students to think critically, and which activity is simply more engaging.

PD Facilitators consistently assisted participants in identifying what NGSSS benchmarks were being addressed and how to integrate Common Core Standards in each module and illustrated how to meet and go beyond the standards by using appropriate inquiry pedagogy. The PD was structured as to help teachers apply content learned to the daily lives of elementary students and connect with other subjects beyond science. In addition, participants were given appropriate content information to understand the requirements and function of Lesson Study groups.

**Finding:** Fundamental deficiencies were noticed in participants’ science content backgrounds that were beyond the scope of this PD to address.

As noted in Year 1 of the SUMMIT grant, participants were expected to create lesson plans based on science benchmarks that utilized inquiry procedures and methods. To scaffold learning in this area, teachers were asked to create a lesson plan so that facilitators and peers could provide feedback and assistance. The observer reviewed many of these lessons as they were being created and the finished products. In many cases the science and science skills in the lessons were faulty and inaccurate. For example one lesson that the observer saw indicated that radiation from the electromagnetic spectrum traveled at different speeds depending on the wavelength of the specific radiation. Misconceptions regarding animal adaptations were noted at least four times over the course of all 5-day PD observations. Due to
time constraints the facilitator could not review each teacher’s content statements or lessons for accuracy, and teacher peers were unwilling or unable to provide appropriate feedback regarding the science content or level of inquiry.

**Finding:** No Significant differences were found in Pre/Post Pedagogical Content test items from the 5-day workshops.

The pre/post-tests contained 15 pedagogical content questions; these questions were created by the PD developers as focal points for the PD. Although there was a positive increase in overall scores from pre to post-testing, there was no significant difference in this change. In several of the items regarding Lesson Study many students scored higher on the pre-test than the post-test. For instance, a true/false question was given: “Lesson study is not about the teacher and methods of presentation; it is about the lesson” (ANS: TRUE). On the pre-test 58% answered this correctly, on the post-test only 9% answered correctly. This was also true for the question: “Developing a research theme for lessons is not necessary since there are unit goals and lesson goals around which the lesson is built” (ANS: FALSE). Initially, 81% answered correctly, but on the post-test 61% answered this question correctly. Though these questions came directly from the Lesson Study manual they did not translate into the teachers’ repertoire of understanding. Each district handled the Lesson Study portion differently, which may explain this discrepancy.

Observers noted that during the PD that the facilitators consistently promoted critical thinking skills as a fundamental component of inquiry lessons and labs. It is surprising then to note the response to the true/false question: “Any lab that encourages critical thinking can be considered an inquiry lab” (ANS: TRUE). On the pre-test 60% answered correctly, but on the post-test only 61% responded correctly.

In other questions regarding inquiry pedagogy teachers showed greater increases between pre and post-test scores, such as characteristics of an inquiry lab, approaches to build thinking skills, selecting appropriate methods of instruction, how to engender respect in the classroom, and way to help students to clarify their thinking.

**Finding:** Positive significant differences were found in pre and post-tests regarding teachers’ attitudes and beliefs about their ability to teach science in the classroom.

The pre and post-test asked 15 questions regarding attitudes towards teaching science. Each question offered a 5-point scale from “Strongly Agree to Strongly Disagree”. **ALL 15 questions showed significantly positive gains.** The following 5 questions showed the greatest positive increases:

- I do not know what to do to turn students on to science.
• Even if I try very hard, I do not teach science as well as I do teach most subjects.
• I am not very effective in monitoring science experiments.
• I continually find better ways to teach science.
• I understand how to ask questions so my students can think more deeply about science.

These findings indicate that after experiencing the SUMMIT 5-day PD teachers felt more confident regarding teaching science more effectively.

**Finding:** Overall participants indicated that they gained pedagogical knowledge and were now more knowledgeable about the content addressed and NGSSS benchmarks.

Participants in focus groups held during observations periods indicated that they felt they had obtained new knowledge by participating in the PD. In addition, post-survey results from all activities (5-day, 2-day specials, and Lesson Study) reveal that participants felt the PD will help them support student achievement of the NGSSS. Figure 1 shows the response to this question from all returned surveys. Out of 1,267 responses 94% felt that it was “Very True or True” that their learning from the SUMMIT PD supported student achievement of NGSSS.

![My learning in this institute will help me to support student achievement of the NGSSS](image)

**Figure 1 - Survey Results from ALL SUMMIT Activities**

As shown in Figure 2, very similar results were found to the item: “My teaching will be more effective as a result of this training”. Ninety-three percent responded that this statement was “Very True or True”.

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Finding: Positive significant differences were found in ALL Pre/Post self-efficacy test items.

Survey results indicated that positive gains were also made in the area of self-efficacy measures. Items on the pre/post survey assessed participant growth in self-efficacy and understanding of inquiry pedagogical practices. In ALL items positive significant changes were observed. After completing the PD, teachers felt more prepared to answer student questions, had additional resources to motivate and excite students, felt more inclined to welcome student questions, and allow principal visits to their classroom. Those teachers who initially believed they would not be effective science teachers considered themselves more able and better prepared to teach science after completing the PD.

Finding: The PD observed exhibited an exemplary focus on teachers’ PCK as intended by the SUMMIT project.

Observers noted that facilitators provided exemplary models of inquiry methods in the facilitation of workshops. They asked clarifying, probing, rhetorical, and thought-provoking questions that challenged participants to think deeply about procedures, underlying processes, and assumptions that assisted participants in articulating and understanding the science skills and the nature of scientific endeavors.

These facilitators modeled how to create a safe and respectful environment in which to explore scientific concepts. The ability to provide empirical evidence to support claims was emphasized over simply obtaining right and wrong answers. An example of this modeling occurred through the use of small white boards that were used to note observations of test tubes filled with a variety of substances. Participants were asked to explain what was happening based upon their observations. Some provided correct explanations based upon their prior knowledge and not what was observed in their test-tube. When this occurred the
facilitator would challenge these responses asking if their observations supported their claims, if not how can they be sure, what test could they conduct to prove their explanations were accurate, and then asked them to conduct those procedures and report their results back to the group.

Figures 3 and 4 show the overall rating on four characteristics that participants rated from very true to not true at all. Responses for the inquiry methods were taken from 5-day workshop post-tests and 2-day specials. Responses for the Lesson Study strategies were taken only from the 5-day workshops. The reason for this is due to the fact that the 2-day specials only dealt with inquiry and did not include Lesson Study information. Below is breakdown of these four characteristics for learning inquiry methods and Lesson Study strategies:

**Inquiry Methods**
- 94% of the participants felt it was *very true or mostly true* that the *facilitators were knowledgeable regarding Inquiry methods*;
- 88% felt that it was *very true or mostly true* that facilitators *made the Inquiry topics interesting and understandable*;
- 91% felt that it was *very true or mostly true* that facilitators *answered questions in ways that were relevant to using Inquiry in classroom situations*;
- 92% felt that it was *very true or mostly true* that facilitators *modeled effective Inquiry strategies*.

**Lesson Study Strategies**
- 92% of the participants felt it was *very true or mostly true* that the *facilitators were knowledgeable regarding Lesson Study*;
- 88% felt that it was *very true or mostly true* that facilitators *made the Lesson Study topics interesting and understandable*;
- 89% felt that it was *very true or mostly true* that facilitators *answered questions in ways that were relevant to using Lesson Study in classroom situations*;
- 89% felt that it was *very true or mostly true* that facilitators *modeled effective Lesson Study strategies*.

The overall rating of the PD facilitation as shown in Figures 3 and 4 indicate the *average rating of the above 4 characteristics* for each topic. As Figure 3 shows in regards to *Inquiry learning* overall 92% of the participants felt it was true that the facilitators were knowledgeable, the topics were interesting, that the training was relevant to their teaching, and that these strategies were modeled effectively.
As Figure 4 shows in regards to Lesson Study learning, overall 89% of the participants felt it was true that the facilitators were knowledgeable, the topics were interesting, that the training was relevant to their teaching, and that these strategies were modeled effectively.
Finding: Overall participants indicated that they gained new PCK and were now more comfortable using inquiry methods in their classrooms and participating in or facilitating lesson study groups.

Participants were asked, ‘what will you tell teachers about inquiry teaching methods to encourage them to use inquiry lessons in their classrooms’? The following responses are examples of the types of responses participants gave in both the focus groups and on the post-survey. They reveal participants’ enthusiasm for these types of pedagogy and an understanding of why it is of value in the classroom.

- I will tell them to-do inquiry... Students need to own the concepts by coming to their own conclusions. I will encourage them to use inquiry in their classes.
- I will go over it at the weekly team meetings. When I use it I will see if it works and if it does encourage other teachers to try it.
- Yes, I will encourage the use of inquiry teaching. I believe that it is a method that can truly help students learn.
- I will inform other teachers that we need to encourage the students to think. I will teach them strategies from the workshop.
- Inquiry is fabulous! It teaches kids to think rather than regurgitate facts/info.
- This is a creative way of teaching while ensuring students to think on their own.
- I will continue to use lesson study to improve my skills as a teacher.
- Lesson study is what teachers naturally do. The format and structure provided by a formal lesson study help ensure the best results.
- I think by doing more lesson studies you can build teacher confidence and have better continuity in teaching.
- These strategies promote student problem solving and higher order thinking among students.
- Although this requires time to implement it is a wonderful way for teachers to be reflective of lessons and fix what might be the problem. Loved the time to do this.
- Offer this again. Everyone needs to take this class.

Participants were also asked what they would do to ensure collaboration among teachers in Lesson Study groups; the following are sample responses that were given during focus group discussions and on the surveys. These responses suggest that PD participants were able to assimilate the basics of lesson study groups and the means of creating and maintaining positive collaborative teams.

- Focus on the lesson not the teacher’s ideas. You don't have to agree or disagree because lesson is the focus and what you are comfortable working with.
- To ensure collaboration among teachers it is important to allow everyone time to talk and express ideas.
• Establish norms and guidelines; obtain consensus when making decisions; divide tasks equally; invite all ideas - agree to disagree; be productive yet patient; learn each other’s style, strength
• Stick to the norms. Take turns in order. All have a role or task to play. I think inquiry teaching using the Dr. Chew methods helps students to think which a necessary life skill in today’s world is.
• Have a common goal and focus on the student learning for long term retention.
• Allow specific time throughout the year to meet as a team. Not only as a grade level, but with other grade levels as well.
• Use same lesson; be a mirror for the presenter; provide constructive feedback

All comments and survey responses were positive and upbeat, only a small percentage of survey takers declined to respond to these questions (7%) regarding Inquiry and Lesson Study. No response given expressed negativity or disinterest in using either activity in the classroom and with their teaching peers.

Finding: Positive significant differences were found in Pre/Post Content test items from student tests

An inquiry lesson was developed by the SUMMIT management team on the topic of friction. This was an opportunity to offer additional scaffolding to apply the ideas discussed in the 5-day PD. Twenty-four 5th grade teachers volunteered to try out the lesson in the classroom. Over six hundred students participated in these lessons. Pre and Post-tests were given to the students (due to errors in identifying conventions used to protect the identity of the students only 522 of these tests could be identified as matching). Results showed a significantly positive increase in test scores for the students engaged in the lesson.

Though these results cannot be considered conclusive, as they were not compared to teachers using other teaching pedagogies, it does show increased achievement in classrooms where teachers practiced inquiry methods and is a positive indicator of the usefulness of the PD offered. Teachers were asked to review the experience and return a brief survey regarding their experience teaching this lesson to their students. On a scale of 1-5 where 1: Strongly Agree and 5: Strongly Disagree, on average all teachers Agreed (mean score 1.7) that during the experience they:

• Asked more questions than telling students what to do
• Students were able to understand the science concepts
• Students were engaged throughout the activity
• Students enjoyed the activity
• They would like another lesson like this one to practice inquiry.
Teachers comments overall showed their delight that students were collaborating and thinking more critically. Below are a few examples of the comments returned when asked “what was the best moment during the lesson”:

- Students working cooperatively to test each material. When they were surprised the socks did not allow the chair to move.
- Seeing the students figure out which objects allowed for the least amount of friction - when it was different from their prediction
- When the groups went back and thought about their material and tweaked them. By the end of the activity students found ways to reduce the amount of friction.
- The best moment was when the students began to try 2 different materials at the same time to see if that would make the chair slide more easily.

When asked what the worst moment was, teachers reported:

- Several groups traded out students in chairs and different "pushes". We had to go over only making changes to the variable
- Clean-up and getting the students back to the post test. Loved the lab.
- More direction for the teacher would have been helpful. Question 4 was not there - confused some students. Overall it was a good activity.

Finding: A small study that compared inquiry and non-inquiry teaching pedagogy showed no significant differences in outcomes from different pedagogies.

A small study (7 classrooms, 131 students) was conducted with teachers who attended the SUMMIT PD and use inquiry methods and teachers who did not attend the SUMMIT PD and use direct instruction. Three lessons using direct instruction and four lessons using inquiry instruction were conducted. All classes were reviews on the topic of complete and incomplete metamorphosis. When results were compared between instructional methods, no significant differences in student outcomes were observed. All students showed positive increases between pre- and post-test scores.

More in-depth analysis is required to further explore the differences in pedagogy. It is possible that inquiry pedagogy was not explicitly followed. To determine this, characteristics of each methodology will be documented more accurately by viewing videos of the teacher lessons to determine any differences in outcomes beyond student achievement.
Evaluation Question: To what extent do the design and implementation of SUMMIT reflect attention to conditions for adult learning and characteristics of effective teacher professional development?

Finding: Participants indicated high satisfaction with the facilitation of the PD.

Facilitator ratings were averaged over all post-tests and surveys distributed in the 5-day and 2-day Special workshops ratings are shown in Table 5. On each of the criteria indicated in Table 5, facilitators were rated on a 1-5 scale, 1 being Poor: 5 being Excellent. On average all facilitation for both the 5-day and 2–day Specials were rated “Very Good to Excellent” by over 2,500 PD participants.

<table>
<thead>
<tr>
<th>Table 5 - Facilitator ratings for the 5-day and 2-day special workshops</th>
</tr>
</thead>
<tbody>
<tr>
<td>This trainer kept me engaged the whole time.</td>
</tr>
<tr>
<td>ALL 5-day average score</td>
</tr>
<tr>
<td>ALL 2-day specials average score</td>
</tr>
</tbody>
</table>

Finding: Though overall facilitators were rated highly, observers noted there was little uniformity between the lesson study portion of the workshops or lesson study groups overall.

Workshop and Lesson Study observations revealed a broad spectrum of experiences. It was obvious that teachers across districts did not receive the same training in regards to lesson study development and implementation. In the case of at least one district (that was observed) SUMMIT trainers were not involved in the training offered on days 4 and 5 of the 5-day workshop. This type of design precluded the ability to interweave inquiry strategies into Lesson Study methods. Many of the teachers observed in the Lesson Study teams did not have a strong enough grasp of inquiry and did not take the opportunity to learn or practice this pedagogy in the lesson study activities. If the two pedagogies were held together and taught as a seamless whole as intended by the 5-day workshop teachers might have a better grasp of how to use Lesson Study opportunities to strengthen their inquiry practices.
Finding: Facilitators and participants expressed frustration in regards to logistics and planning of workshops and Lesson Study meetings.

Focus group interactions and facilitator interviews revealed an underlying frustration with scheduling, planning, and overall logistics of the PD. One teacher commented, “It would be nice to have some district people involved”. Some districts had a representative attend all sessions, while other district administrators were noticeably absent. In these instances communication between SUMMIT management and teachers to plan Lesson Study team meetings and communicate information was noticeably inadequate. Facilitators indicated they would have greatly benefited from more district interaction – they felt if they had the opportunity to speak with district personnel they could have tailored the workshops to more closely meet the needs of the teachers. Because, each district has unique goals and policies, had better communication existed facilitators felt that they could have modified the teacher interactions to better suit requirements specific to those teachers.

In addition, scheduling of 5-day workshops, 2-day specials, and lesson study meetings were difficult to ascertain since often last minute changes precluded posting meeting dates on the SUMMIT calendar. Due to time constraints, many districts planned meetings during the same week which made it difficult of SUMMIT management to organize enough trainers to meet the need.

Evaluation Question: To what extent were participants satisfied with this professional development experience?

Finding: Participants indicated overall satisfaction with the SUMMIT PD.

Participants highly rated the overall SUMMIT PD. Figure 5 shows the average overall rating of the PD on three characteristics. Below shows breakdown of these characteristics:

- 90% of the participants felt it was very true or mostly true that they received valuable resources;
- 90% felt that it was very true or mostly true that the PD was time well spent;
- 91% felt that it was very true or mostly true that they would recommend the SUMMIT PD to other teachers.

The overall rating of the PD facilitation as shown in Figure 5 indicates the average rating of the above 3 characteristics from all participants from all activities who responded very true, mostly true, somewhat true, and not true at all – regarding their perception of their overall satisfaction with this PD.
In addition to the likert response survey questions focus group responses and open-ended questions on the survey also indicated what participant’s learned and gained from the SUMMIT PD. Below are examples of these types of participant comments:

- I learned it is ok to be lost in a lesson. I learned how important it is to ask important clarifying questions.
- I loved Dr. Chew. He kept me engaged and interested. I loved the inquiry lessons.
- I learned to try to let go and let my students try to find their own answers rather than supplying all of the answers to them. I learned that being lost is not always a bad thing, but in fact can be a good thing; 5E process works.
- How to ask probing questions to encourage teaching students to think. I liked the handbook and learning more about the standards and test specs. I am excited to review the inquiry materials.
- Emphasis is on the lesson rather than the teacher or students. Students are forced to think and problem solve. Teachers serve more as facilitators than the server of instruction or the majority of information.
- Learned components to a lesson study and how to implement it.
- I will now use a different sequence of events when teaching a lesson. Leaving the students "lost" and guiding them to the answers. I learned why it is important and how to implement this strategy.
- I was very excited to learn how to implement inquiry based learning. I want to implement inquiry based learning in all subject areas.
- It was wonderful! I learned so much and so excited to use it in my classroom and share with others.
- Enjoyed the collaboration and working with people from other schools.
- I have thoroughly enjoyed this experience and feel that it is very helpful to my professional development and student improvement.
- Overall great experience - good training!
When participants were asked to offer suggestions or recommendations for improving the PD the comment most often provided revolved around the pacing of the PD. Unlike last year the greatest number of suggestions requested less downtime between activities. Below are samples of participant comments that are exemplars of the major themes for suggestions for PD improvement.

- There were quite a few times on both Saturdays and Monday/Tuesday that had downtime or time where we were stopped and made to do something else. Pacing needs to be addressed.
- The two Saturdays could have been combined into one. There was too much down time.
- Either offer only inquiry or lesson study. Each is a significant practice to implement and I felt overwhelmed with both at once. I didn't feel ready to try to implement an inquiry lesson for the lesson study because I thought my team wouldn't understand.
- One suggestion is to have a review of the lesson study process before having teachers practice it. Don't assume they all know the process.
- More time with Dr. Chew!
- I would rather meet in the afternoons or on Saturdays rather than school days. It takes a lot of time/resources to create sub plans that might not actually be completed correctly. My reading scores have been negatively affected by my numerous absences these past few weeks.
- Training during summer or beginning of the school year.
- Present a slideshow of videos of actual lesson study so we can observe the effectiveness of our lessons. Involve administrators so that they can understand the inquiry task process.
VI. General Conclusions and Recommendations

In considering the trends and patterns recorded in the SUMMIT PD the following thoughts are submitted for consideration to the project leaders in planning next steps:

- As in the first year, teachers were especially positive when activities were varied and changed throughout the day; hands-on activities were well-received and felt to be the most engaging. Though many of the issues were addressed from last years’ review due to the variation between workshops, some of these comments are still relevant. The most often cited causes for teacher frustration during the PD was the length of time spent on some activities (pacing), and the desire to have more time with a facilitator of Dr. Chew’s caliber. In addition, the lack of uniformity noticed by the observers may need to be addressed to ensure the goals of the project are met.

- Overall, the facilitators were effective in creating an appropriate climate for learning and the treatment of the science pedagogy was rated as Very Good. Unfortunately, as seen in Year 1, the actual instructional experiences often fell short of the depth of science needed due to the inadequate science background of many of the participants. This deficit may be attended to by having participants complete online science courses (NSTA science learning packs for instance) that review basic science skills and content before attending these workshops. In this way, the educational tools offered by the PD will become more relevant to the participants as well as offering yet another avenue of increasing teacher basic science content knowledge.

- The project succeeded in its efforts to assist teachers in gaining a greater understanding of how to use inquiry to teach NGSSS benchmarks. The variability in Lesson Study implementation suggests that some attention may need to be paid to helping facilitators deliver the desired pedagogical approach so that all institutes and Lesson Study teams are more uniform and coherent throughout.

- For the most part, participants considered the facilities and logistical arrangements for the institutes to be appropriate and satisfactory. Participants appreciated the snacks made available and the ability to buy snacks during the break.

- Providing teachers with inquiry lessons aligned to the curriculum was very well received. Teachers enjoyed having this experience to practice what they learned and it is recommended that this be duplicated and offered to a larger audience of teachers. Perhaps this lesson could be distributed to all teachers at the 5-day workshop. This may even be used as the practice lesson as an appropriate means for ensuring the Lesson Study teams practice an inquiry lesson.
• Scheduling is still an issue, due to the time constraints imposed by the funding agency. If the project could begin earlier or extend beyond the June 30th deadline, it would allow for a greater fluidity and flexibility to meet the needs of more Florida schools and teachers.

• In both focus-groups and survey comments teachers expressed concerns regarding the willingness of administrators to allow them to use this type of teaching style in the classroom. To ameliorate these concerns, perhaps an administrator rubric could be given to participants to give to their own administrators that would assist teacher evaluators to understand the positive characteristics of these activities.
Appendix A – Horizon Observations Protocol

Description of the observation protocol

The observations utilized the “2009 Professional Development Observation Protocol,” (PDOP) developed by Horizon Research, Inc. An earlier version of the PDOP has been used widely on a national level for observing professional development sessions, but the evaluation team (and Horizon personnel) felt that the earlier PDOP was lacking in several respects and was in need of revision. Therefore, Horizon personnel redesigned the instrument for use in institute observations.

The 2009 PDOP is derived largely from learning theory described in recent National Research Council publications, such as How People Learn. It focuses on aspects of professional development that create opportunities for participants to develop “conceptual understanding”, as opposed to lower-level types of disciplinary knowledge. In particular, the PDOP examines five key components of a well-designed learning sequence: motivation, activating/eliciting prior knowledge, intellectual engagement, use of evidence to critique claims, and sense-making.

Use of the PDOP requires knowledge of the goals intended for the professional development session observed. The protocol has two separate sections, depending on whether the session has goals for deepening “Teacher Content Knowledge” (TCK) and/or goals for increasing “Pedagogical Content Knowledge” (PCK). Only the section(s) pertinent to the espoused goals are completed.

The TCK and PCK sections each contain the following parts:

- Indicator statements reflecting the five components above to rate on a 1-5 scale, grouped into four categories (see the protocol in Appendix B for specific indicator statements):

  *Mathematics/science content.* Indicators in this category examine the extent to which the content of the session was accurate, accessible to participants, and aligned with the purposes expressed.

  *Professional development design.* Indicators in this category examine the extent to which the design of the session adequately and appropriately contained the components of learning experiences that contribute to building conceptual understanding.

  *Implementation.* Indicators in this category examine the extent to which facilitators conducted the session in a manner that created opportunities for meaningful conceptual learning.
**Culture of the professional development.** Indicators in this category examine the extent to which the session fostered an intellectual and social climate to support the desired learning.

- A “synthesis rating” (1-5 scale) for each of the above four categories – content, design, implementation, and culture. The synthesis rating is not an average of the indicator rating, but a holistic rating of the contribution of this area to meeting the espoused goals.

- Ratings of overall statements regarding Opportunity to Learn the targeted ideas.

- A “Capsule Rating” (1-4) for the quality of the professional development for meeting its TCK or PCK goals. The Capsule Rating is a holistic summary of the factors that impact the likelihood that the participants would develop conceptual understanding of the targeted ideas.

The Horizon PDOP is a challenging instrument to use. Rather than documenting frequencies of particular behaviors or events, it uses a “knowledgeable observer” to synthesize ratings after the observation based on extensive field notes and knowledge of effective professional development. Because of this, in-depth training is required to develop common understanding of the indicator meanings, to establish what to look for during observations, and to calibrate ratings for reliability. All observers used for the SUMMIT PD participated in an intensive, two-day training on the protocol, led by the developers from Horizon Research.
Appendix B – List of Acronyms Used in this Document

English for Speakers of Other Languages (ESOL)
Exceptional Student Education (ESE)
Lesson Study Leadership (LSL)
Lesson Study Teams (LST)
Middle School (MS)
New Generation of Sunshine State Standards (NGSSS)
Pedagogical Content Knowledge (PCK)
Professional Development (PD)
Science Understanding, Math Mentoring Integrated with Technology (SUMMIT)
University of South Florida St. Petersburg (USFSP)
Appendix C – Pre/Post Survey

The Summit PD post-survey is attached on the following pages to this document. The pre-survey consisted of pages 1-4 of the post-survey.