Because we are early in Phase II of our project, the major findings resulting from our activities are related to baseline data collected from teacher participants in Cohort 1 and their students. Quantitative findings are informed by our project teacher surveys, teacher classroom observations, and student surveys. Qualitative findings are informed by observations, interviews, and collected artifacts.

Because no post-data has been collected to date the research questions are not specifically addressed in this report of the major findings of Year 2 of the project, but they are shared here to offer a reminder of the research questions that will be answered in the future (i.e., starting with the Year 3 report):

*Note: [Instrumentation finalized in Phase I of the project intended to quantitatively measure research questions are bracketed in each question. Reliability and validity data was reported after piloting in the Year 1 report]:

1. To what extent does professional development (PD) focused on cyber-enabled cognitive tools and scientific inquiry as a central pedagogical approach support teachers' practice and development [Reformed Teaching Observation Protocol, Technology Use in Science Instruction, Technology Integration Checklist-Classroom Observation Protocols & Teaching Science as Inquiry, ICT Capabilities-Teacher, Formal/Informal Technology Usage-Teacher, Teacher New Literacies Scenarios-Self Reporting Surveys] and close the gap between formal and informal student cyber-enabled learning [Formal/Informal Technology Usage-Student]?

2. To what degree does closer alignment between informal and formal use of cyber-enabled technologies [Formal/Informal Technology Usage-Teacher & Student-Self Reporting Surveys] influence student attitudes about science [Students' Motivation Toward Learning Science (SMTLS)- Self Reporting Surveys]?

3. To what degree does closer alignment between informal and formal use of cyber-enabled technologies [Formal/Informal Technology Usage-Teacher & Student-Self Reporting Surveys] influence student science achievement [UT & NY State Standardized Assessments]?

4. How does the use of cyber-enabled technologies [Technology Integration Checklist-Classroom Observation Protocol & ICT Capabilities-Teacher & Student, Formal/Informal Technology Usage-Teacher, Teacher & Student New Literacies Scenarios-Self Reporting Surveys] influence student access to significant and relevant science process skills and content knowledge [Reformed Teaching Observation Protocol, Technology Use in Science Instruction-Classroom Observation Protocols & Teaching Science as Inquiry-Self Reporting Survey & UT & NY State Standardized Assessments]?

5. How does the use of cyber-enabled technologies [Technology Integration Checklist-Classroom Observation Protocol & ICT Capabilities-Teacher & Student, Formal/Informal Technology Usage-Teacher, Teacher & Student New Literacies

Scenarios-Self Reporting Surveys] influence students' new literacy skills [Student New Literacies Scenarios-Self Reporting Survey]?

The following is more about each of the instruments included in brackets to answer the research questions:

Teacher Instruments

- ICT Capabilities-Teacher (developed by selecting items from pre-existing surveys created by Markauskaite, 2007)
- Formal/Informal Technology Usage-Teacher (designed based on several surveys developed by the Pew Research Center: (a) Teens and Mobile Phone, (b) Social Media & Mobile Internet Use Among Teens and Young Adults, (c) Generations Online in 2009)
- Teacher New Literacies Scenarios (designed based on the instrument developed by ETS (Educational Testing Service): ICT Literacy Assessment, and British National ICT assessment tasks)
- Teaching Science as Inquiry (Smolleck & Yoder, 2008)

Student Instruments

- ICT Capabilities-Student (developed by selecting items from pre-existing surveys created by Markauskaite, 2007)
- Formal/Informal Technology Usage-Student (designed based on several surveys developed by the Pew Research Center: (a) Teens and Mobile Phone, (b) Social Media & Mobile Internet Use Among Teens and Young Adults, (c) Generations Online in 2009)
- Student New Literacies Scenarios (designed based on the instrument developed by ETS (Educational Testing Service): ICT Literacy Assessment, and British National ICT assessment tasks)
- Students' Motivation Toward Learning Science (Tuana, Chin, & Shieh, 2005)

Classroom Observation Protocols & Checklist

- Reformed Teaching Observation Protocol (Piburn et al., 2000)
- Technology Use in Science Instruction (Campbell & Abd-Hamid, in review)
- Technology Integration Checklist (designed by Wang & Hsu (NYIT PI & CoPI) based on New Literacies Scenarios framework/constructs, ICT Capabilities instrument, and Formal/Informal Technology Usage surveys as a triangulating inventory)

In addition to the overall measures targeted with each teacher and student instrument, each of the piloted instruments has 4-5 sub-constructs to ensure that a deeper understanding of each measure emerges throughout the research.

Quantitative Findings

Because the baseline data was seen as important for informing our future work, analyses for this report are focused on comparisons between teacher and student participants. This focus this year, before focusing more on research questions next year, allow us to further consider and modify our approaches to the teacher group, their needs, abilities, and practices in the context of considering these same student characteristics. Based on the baseline data collected, the following are quantitative findings from Year 2 of the project:

Tables are presented for each first before this is followed by discussion.

Teacher/Student Survey Data

Overall Results Across All Participants for Parallel Tests Given to Teachers/Students

	Teacher (*N*=24)		Student (*N*=1654)				
Test Type	***M***	***SD***	***M***	***SD***	***t***	***p***	**Cohen's *d***
ICT Total	4.14	0.41	3.83	0.61	2.39	0.0168	0.49
NLS Total	3.39	0.64	3.12	0.92	1.45	0.1477	0.30

*ICT=ICT Capabilities and NLS=New Literacy Testing Scenarios; Note FITS=Formal/Informal Technology Use was administered across teacher and student participants, but analyzed and presented separately due to the nature of analyzing the instrument.

With respect to overall measures of teacher and student ICT capabilities and New Literacy Scenarios, no statistical differences were found when comparing teachers and students. These measures look at the extent to which respondents report abilities to use technologies to complete meaningful problem-based tasks. According to these findings, teachers and students are reporting similar abilities with technologies such as the use of word processing, search engines, the use of Google docs, and Google sites as just a few examples.

ICT Capabilities

	Teacher (*N* =24)		Student (*N* =1654)				
Construct	***M***	***SD***	***M***	***SD***	***t***	***p***	**Cohen's *d***
Problem Solving	4.24	0.51	3.93	0.64	2.39	0.0167	0.48
Comm & MetaCog	4.04	0.54	3.86	0.72	1.21	0.2251	0.25
Basic Capabilities	4.71	0.41	4.18	0.70	3.69	0.0002	0.76
Analysis & Prod	3.68	0.70	3.71	0.77	0.14	0.8900	0.04
Info and Internet Cap.	4.01	0.50	3.63	0.77	2.48	0.0133	0.49

When the individual constructs of ICT capabilities are examined, significant differences were found with respect to teacher and student comparisons of reported a) problem solving, b) basic capabilities, and c) information and internet-related capabilities. On each of these measures, teachers reported higher capabilities. The following provides more details about each of these constructs:

- Problem Solving- problem solving capabilities, including planning to production of solution.
- Basic Capabilities- core ICT competences (e.g., word processing/formatting, managing computer software, communicating via email with attachments or skype).
- Information and Internet-related Capabilities- Capabilities to find, produce, and manipulate visual and textual information.

Upon considering these outcomes, it makes sense that one possible explanation for these differences might come from teachers' use of these technologies in performing their duties of instruction. While students do not have similar duties, use of ICTs is pervasive in society and is one area where increases in reported capabilities from students seems desirable as preparation for future needs as citizens and members of a workforce. These differences offer some area for future growth for students as we connect these competencies and capabilities to experiences learning inquiry-based science, so that the capabilities are drawn on in authentic contexts more mirroring the complex contexts where ICT capabilities are leveraged throughout society.

New Literacy Testing Scenarios

	Teacher (*N* =24)		Student (*N* =1654)				
Construct	***M***	***SD***	***M***	***SD***	***t***	***p***	**Cohen's *d***
Identify/Recog. Info	3.63	0.57	3.16	0.93	2.50	0.0127	0.51
Locate/Manage Info	3.32	0.59	3.15	0.93	0.95	0.3442	0.18
Evaluate Info	3.26	0.63	3.07	0.93	1.01	0.3129	0.21
Synthesize/Answer	2.93	0.75	2.94	1.00	0.04	0.9655	0.01
Communicate Answers	3.50	0.85	3.23	0.99	1.33	0.1844	0.27

Like the overall comparisons between teachers and students, the constructs within the New Literacy Testing Scenarios scale were also similar, for the most part. The New Literacy Testing Scenarios were designed to measure teachers' and students' abilities to use ICT skills within the context of solving authentic problems. What is noticeable here is that most averages for each construct for both teachers and students were around 3 when measured on a 5-point Likert scale. A 3 was represented on the scale as "I can do it if I follow step-by-step directions" for tasks like "I can create a chart using Google spreadsheet data". The ICTs included in the New Literacies Scenarios are those that are included in the projects (e.g., Google Docs, Google Spreadsheets, Google Earth) and are situated in problems that are similar to the ones that are being shaped for engaging students in the project. These reported averages leave room for growth for both teacher and student groups, especially as they are strategically planned as part of the learning experiences in the project.

The only statistically significant differences found with comparing teachers and students within New Literacy Testing Scenarios emerged when considering the identification of questions and recognizing relevant information. This construct focuses on using ICTs to identify research questions and recognize information relevant to the problems. Within this construct, teachers reported a higher level of abilities. As part of developing New Literacies, this project is focused in enhancing these abilities both within teachers and students, so attention will be focused on these measures moving forward to check the impact of module enactments as part of the project and to continually consider additional ways to enhance these capacities moving forward.

FITS=Formal/Informal Technology Use Overall Results (Note these are presented by item pools that allow for comparisons between formal and informal technology usage)

This is a unique instrument, which does not lend itself to presenting overall cumulative averages in tables like the other instruments used in the project. This instrument is intended to measure the use of technologies in formal and informal settings. With this aim in mind, the instrument surveys teachers' and students' use of technologies in informal settings using a specific set of questions. These same questions are then used to check the usage of technologies in formal settings. Comparisons between how teachers and students use technologies in informal settings are then compared, followed by a comparison of how teachers and students use technologies in formal settings. The following are the results of each of these comparisons followed by discussion of these findings:

Informal Use of Technology
The following question was used to detect the frequency of Internet usage:

- Overall, how often do you use the Internet at home in your leisure time?

This was rated on a 6-point Likert scale treated as interval scaled. Because of an insufficient n-size for teachers at this stage of the project ,with just Cohort 1 teachers included to date, a goodness of fit test was not possible; therefore a t-test was used at this stage to compare scale means. A HIGHER mean indicates LESS use of the Internet.

	Students			**Teachers**				
	n	**Mean**	**SD**	**n**	**Mean**	**SD**	**t-Test**	**P-Value**
Overall	1363	2.63	1.60	23	1.61	0.99	4.83	< 0.0001

As can be seen in these results, teachers reported significantly more Internet usage in their leisure time.

Teachers and students were also asked to select from a list of technologies to report, which they used and did not use. From these lists, the 3 most prevalently reported technologies for all participants (teachers and students combined) were watching Video (83.5% of participants), Playing Games (80.7% of participants), and Email (75.6% of participants). Closely behind these technologies was social networking (73.8% of participants).

When students and teachers were compared on their use of top 3 technologies used in leisure time, the following was found:

Watching Video: Percentages of Students and Teachers

	Students			Teachers				
	n	Mean	SE	n	Mean	SE	t-Test	P-Value
All	1363	73.6	1.19	23	87.0	7.18	1.45	0.1476

Playing Games: Percentages of Students and Teachers

	Students			Teachers				
	n	Mean	SE	n	Mean	SE	t-Test	P-Value
All	1363	81.1	1.06	23	56.5	10.57	2.97	0.0031

Email: Percentages of Students and Teachers

	Students			Teachers				
	n	Mean	SE	n	Mean	SE	t-Test	P-Value
All	1363	75.2	1.17	23	100.0	0.00	2.75	0.0060

From these comparisons, it can be seen that teachers and students use the Internet in leisure time to watch videos comparably. Significant differences were found as students used the Internet in leisure time more for playing games, while teachers used it more for communicating via email. Understanding this is important as we consider how to leverage skills students and teachers already possess for inclusion into classroom experience shaped by project modules.

As we investigated which technologies are most used at home (e.g., cellphones, desktops, laptops), we found the following top three technologies: Desktop Computer, Cellphone, and Laptop. We believe this ordering is somewhat reflective of the saturation in the marketplace and households of these general devices.

The following are comparisons between students and teacher on these top three technologies:

Desktop Computer: Percentages of Students and Teachers

	Students			Teachers				
	n	Mean	SE	n	Mean	SE	t-Test	P-Value

All	1363	80.8	1.07	23	87.0	7.18	0.75	0.4560

Cellphone: Percentages of Students and Teachers

	Students			Teachers				
	n	**Mean**	**SE**	**n**	**Mean**	**SE**	**t-Test**	**P-Value**
All	1363	76.8	1.14	23	95.6	4.35	2.14	0.0326

Laptop: Percentages of Students and Teachers

	Students			Teachers				
	n	**Mean**	**SE**	**n**	**Mean**	**SE**	**t-Test**	**P-Value**
All	1363	70.9	1.27	23	87.0	7.18	1.63	0.1038

From these analyses, it can be seen, that the only differences between how students and teachers use these three technologies is that teachers use cellphone more than students in our sample. While this is different, it is important to recognize that even as students used cellphones less in comparison, 76.8% of students reported using cellphones. This is also informative for our project as we consider what technologies students and teachers are already familiar with and using for considering how these abilities and preferences can inform experiences in learning science with cyber-enabled technologies in our project.

The following question was also asked of students and teachers:

Overall, how often do you use the following technology OUTSIDE of SCHOOL (e.g. at home, library, bus, friend's house)? (Never, once a year, once or twice a month, once or twice a week, almost every day)

1. Computer installed Word processing tool (e.g. Word, Pages)
2. Computer installed Spreadsheet tool (e.g. Excel)
3. Computer installed presentation tool (e.g. Power Point, Keynote)
4. Google docs
5. Maps (e.g. Google Map, MapQuest)
6. Google Earth
7. Social networking tool (Facebook, MySpace)
8. Blog
9. Youtube
10. Second Life/OpenSim
11. Web editing tool (Google Site)
12. Movie production tool (iMovie, MovieMaker)
13. Instant messengers or video conferencing tools (e.g. Skpye, Facetime, MSN)
14. Text messages (cellphone text, text messaging apps)
15. Web search engines (e.g. Google, Yahoo, Bing)

For each of these items, a larger item mean indicates more frequent outside of school use of a technology. As before, the scale was treated as interval and means compared on each individual item between students and teachers.

	Students (n = 1369)		**Teachers (n = 23)**			
FITS ITEM	**Mean**	**SD**	**Mean**	**SD**	**t-Test**	**P-Value**
Computer installed Word processing	3.01	1.28	4.43	0.79	5.29	<0.0001
Computer installed Spreadsheet	2.16	1.20	3.30	0.82	4.56	<0.0001
Computer installed presentation	2.54	1.23	3.35	1.27	3.13	0.0018
Google docs	2.34	1.36	2.17	1.37	0.61	0.5412
Maps	2.66	1.27	3.04	0.93	1.44	0.1492
Google Earth	2.74	1.28	2.43	0.90	1.14	0.2541
Social Networking	3.65	1.61	4.30	1.06	1.95	0.0512
Blog	2.07	1.40	2.22	1.31	0.51	0.6088
Youtube	3.87	1.25	3.69	0.97	1.65	0.5111
Second Life	1.77	1.27	1.04	0.21	2.72	0.0065
Web Editing	2.14	1.37	1.70	1.22	1.53	0.1275
Movie Production	2.13	1.37	1.52	0.79	2.11	0.0351
Instant Messenger	2.77	1.59	2.78	1.44	0.05	0.9626
Text Message	3.84	1.57	4.43	1.31	1.80	0.0718
Search Engines	3.85	1.34	4.74	0.86	3.16	0.0016

What is obvious above is that, for longer-established and more mainstream technologies (Word, spreadsheet, texting, search engines), teachers generally have a higher mean (often significantly higher), but for more recent technologies (web editing, movie making), students have the higher mean than teachers. This is important to note for our project as we consider which technologies teachers might need more experience with before incorporating at least the facets of the most prevalent student used technologies into learning experiences.

Formal Use of Technology

The following question was used to detect the frequency of Internet usage:

- Overall, how often do you use the Internet at home to complete school work?

This was rated on a 6-point Likert scale treated as interval scaled. Because of an insufficient n-size for teachers at this stage of the project with just Cohort 1 teachers included to date, a goodness of fit test was not possible; therefore a t-test was used at this stage to compare scale means. A HIGHER mean indicates LESS use of the Internet.

	Students			Teachers				
	n	**Mean**	**SD**	**n**	**Mean**	**SD**	**t-Test**	**P-Value**
Overall	1363	3.48	1.59	23	2.35	1.15	3.40	0.0007

As can be seen in these results, teachers reported significantly more Internet for schoolwork at home.

Teachers and students were also asked to select from a list to report, for students- the kinds of activities they do with computer technologies in science class and for teachers-whether they use it in school for curriculum related activity. From these lists, the 3 most prevalently reported kinds of activities with computer technologies were, for all participants (teachers and students combined), Researching Information (84.1% for all participants), Learning Materials (77.2% for all participants), and Creating Text Information (56.0% for all participants). What is noticeable from the response, is a big drop-off in percentages between the top 2 and the 3rd category. Overall, there appear to be 2 dominant technology uses in the classroom and the rest are at or well below 50% usage levels.

When students and teachers were compared on their use of top 3 technologies for science class, the following was found:

Researching Information: Percentages of Students and Teachers

	Students			Teachers				
	n	**Mean**	**SE**	**n**	**Mean**	**SE**	**t-Test**	**P-Value**
All	1363	83.9	0.99	23	95.7	4.35	1.53	0.1273

Learning Materials: Percentages of Students and Teachers

	Students			Teachers				
	n	**Mean**	**SE**	**n**	**Mean**	**SE**	**t-Test**	**P-Value**
All	1363	76.8	1.14	23	100.0	0.00	2.64	0.0085

Creating Text Information: Percentages of Students and Teachers

	Students			Teachers				
	n	**Mean**	**SE**	**n**	**Mean**	**SE**	**t-Test**	**P-Value**
All	1363	55.3	1.34	23	95.7	4.35	3.88	0.0001

From these comparisons, it can be seen that teachers and students report researching information similarly as activities in school. While there were significant differences found with learning materials in science class, these were both reported at high levels (i.e., 76.8% and 100% for student and teachers respectively). The biggest difference found appears to be the extent to which teacher create text information in comparison to students. Only a little over one-half of the students reported using computer technologies for this purpose in science class. This is an area where our project can focus to enhance students' ability to communicate scientific understandings with platforms that may be more amenable for this than traditional paper-pencil methods.

The following question was also asked of students and teachers:

Overall, how often do you use the following technology AT SCHOOL (Never, once a year, once or twice a month, once or twice a week, almost every day)

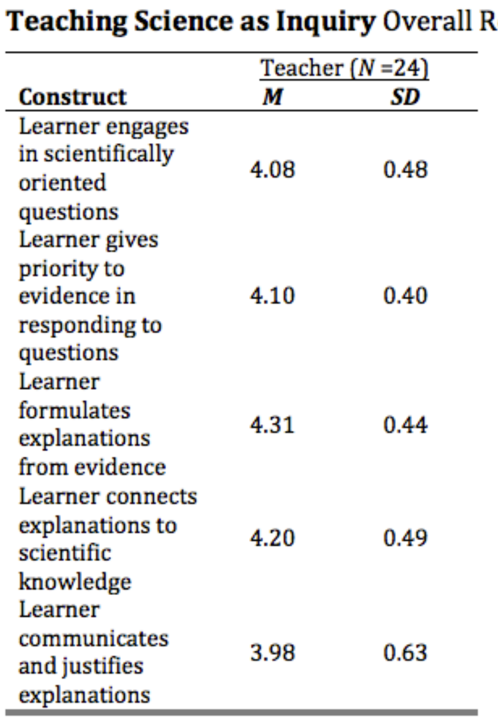
1. Computer installed Word processing tool (e.g. Word, Pages)
2. Computer installed Spreadsheet tool (e.g. Excel)
3. Computer installed presentation tool (e.g. Power Point, Keynote)
4. Google docs
5. Maps (e.g. Google Map, MapQuest)
6. Google Earth
7. Social networking tool (Facebook, MySpace)
8. Blog
9. Youtube
10. Second Life/OpenSim
11. Web editing tool (Google Site)
12. Movie production tool (iMovie, MovieMaker)
13. Instant messengers or video conferencing tools (e.g. Skpye, Facetime, MSN)
14. Text messages (cellphone text, text messaging apps)
15. Web search engines (e.g. Google, Yahoo, Bing)

For each of these items, a larger item mean indicates more frequent outside of school use of a technology. As before, the scale was treated as interval and means compared on each individual item between students and teachers.

	Students (n = 1369)		**Teachers (n = 23)**			
FITS ITEM	**Mean**	**SD**	**Mean**	**SD**	**t-Test**	**P-Value**
Computer installed Word processing	3.15	1.28	4.65	0.57	5.64	<0.0001
Computer installed Spreadsheet	2.62	1.28	3.78	1.00	4.34	<0.0001
Computer installed presentation	2.90	1.22	4.22	0.90	5.15	<0.0001
Google docs	2.53	1.36	2.43	1.44	0.35	0.7282
Maps	2.46	1.30	2.04	1.22	1.51	0.1311
Google Earth	2.53	1.30	2.17	0.98	1.30	0.1940
Social Networking	1.97	1.42	1.52	1.20	1.51	0.1314
Blog	1.67	1.17	1.52	0.95	0.60	0.5453

Youtube	1.96	1.40	2.69	1.36	2.50	0.0125
Second Life	1.53	1.11	1.04	0.21	2.12	0.0346
Web Editing	2.18	1.31	2.04	1.36	0.48	0.6298
Movie Production	1.90	1.26	1.61	0.94	1.12	0.2629
Instant Messenger	1.72	1.26	1.39	0.94	1.25	0.2107
Text Message	2.10	1.54	2.47	1.78	1.18	0.2389
Search Engines	3.22	1.44	4.52	0.79	4.33	<0.0001

What is obvious above is that teachers are using more technologies than students in science classrooms and they are using the longer-established and more mainstream technologies (Word, spreadsheet, texting, search engines). This is important to note for our project as we attempt to bring more technologies into the science classroom to support science literacy and new literacy development simultaneously.



Teaching Science as Inquiry Overall Results

	Teacher (*N* =24)	
Construct	***M***	***SD***
Learner engages in scientifically oriented questions	4.08	0.48
Learner gives priority to evidence in responding to questions	4.10	0.40
Learner formulates explanations from evidence	4.31	0.44
Learner connects explanations to scientific knowledge	4.20	0.49
Learner communicates and justifies explanations	3.98	0.63

Teaching Science as Inquiry is a self-reporting survey designed to measure the self-efficacy beliefs of in-service science teachers in regards to the teaching of science as inquiry. Based on these higher averages for each construct of the measure, out of a 5-point Likert scale, early report suggest that participants were very confident in their ability to teach science as inquiry. But, some of these early self-reports were brought into question as classroom observations (reported as RTOP measures below), teacher interviews completed by HRI, and project qualitative research revealed lower abilities and understandings regarding teaching science as inquiry.

Windshitl (2004) offers some possible insight into why the self-reported data is not consistently triangulating with other measures at this point:

> Despite the ubiquity of the term 'inquiry' in science education literature, little is known about how teachers conceptualize inquiry, how these conceptions are formed and reinforced … and if these ideas about inquiry are translated into classroom practice (p. 481, 2004).

In HRI's approach, they used retrospective pre-/post- questions for comparison stating

> This "retrospectivepre" approach is useful when respondents are likely to change their perceptions of initial knowledge/preparedness as they learn more about a topic (e.g., in cases where they did not realize how much/little they knew about a topic until after their participation in the program) (HRI Year 2 Report, p. 13).

Evidence that our baseline Teaching Science as Inquiry measure was likely influenced by uncertainty regarding science inquiry were found in participant learning journals:

> In college our methods instructor talked a lot about inquiry. At the end of the class not one student knew what she was talking about. When I started teaching I looked further into inquiry and decided to try it out. It didn't work out too well. This was partly because of my lack of understanding and partly from overestimating what the students could do without proper lead in. [UT Cohort 1 Participant]
>
> When I started teaching I looked further into inquiry and decided to try it out. It didn't work out too well. This was partly because of my lack of understanding. [UT Cohort 1 Participant]

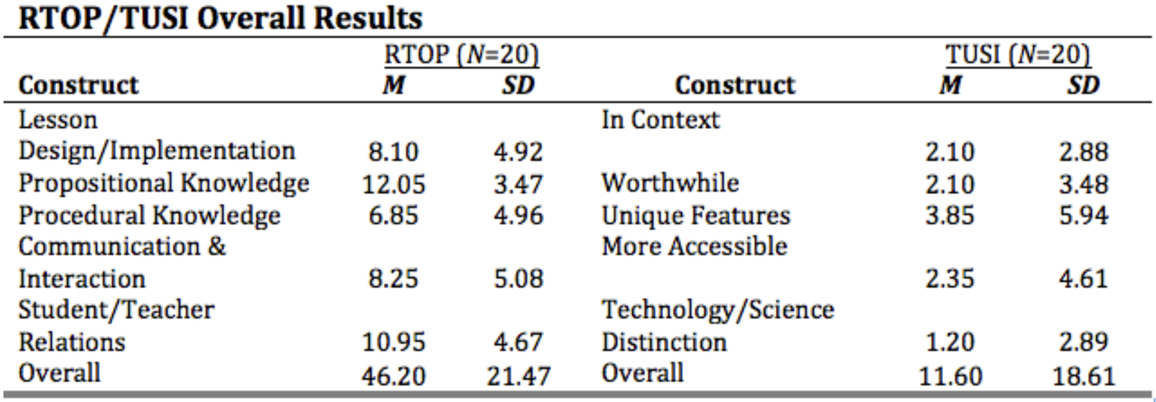
Based on what emerged in the baseline data and evidence found in our qualitative research suggesting that participants were gaining a better understanding of inquiry, we expect that there may even be a decrease in self-efficacy with respect to Teaching Science as Inquiry after the first year, just because this is likely to be founded on a better understanding of inquiry. But, we also expect that these measures will increase throughout the project as teachers are supported in teaching science as inquiry through the cyber-enabled technologies and project modules.

Students' Motivation Toward Science Learning Overall Results

Construct	Student (*N*=1654) *M*	*SD*
Self-efficacy	3.81	0.75
Active learning strategies	3.95	0.72
Science learning value	3.91	0.80
Performance goal	2.98	0.90
Achievement goal	4.01	0.75
Learning environment stimulation	3.55	0.79

The Students' Motivation Toward Science Learning is a questionnaire measures students' motivation toward science learning. Six scales are included: self-efficacy, active learning strategies, science learning value, performance goal, achievement goal, and learning environment stimulation. Based on the 5-point Likert scale, students agreed that they were most satisfied (***M*** = 4.01) when they increase their competence and achievement during science learning. And, they reported being least compelled by a performance goal (***M*** = 2.98), with performance goal defined as students' attempts to compete at high levels against peers to get attention from the teacher. Both of these findings sit well with our project as it focuses on scaffolding inquiry experiences so that students can reach their achievement goals in an environment not structured around competition, but instead structured around co-construction of knowledge through inquiry investigations supported by technologies.

Teacher Classroom Observations



RTOP/TUSI Overall Results

Construct	RTOP (*N*=20) *M*	*SD*	Construct	TUSI (*N*=20) *M*	*SD*
Lesson Design/Implementation	8.10	4.92	In Context	2.10	2.88
Propositional Knowledge	12.05	3.47	Worthwhile	2.10	3.48
Procedural Knowledge	6.85	4.96	Unique Features	3.85	5.94
Communication & Interaction	8.25	5.08	More Accessible	2.35	4.61
Student/Teacher Relations	10.95	4.67	Technology/Science Distinction	1.20	2.89
Overall	46.20	21.47	Overall	11.60	18.61

The Reformed Teaching Observation Protocol was used to assess the level of reformed teaching observed in the classrooms of teachers prior to starting participation in the project, with this reformed teaching framed by national standards documents grounded by constructivism and supportive of teaching science as inquiry as a central instructional strategy. The Technology Use in Science Instruction, like the RTOP, was used prior to participants starting in the project, but was focused on whether technology was being used in science instruction in ways supportive of science education reform outlined in standards documents.

With respect to the RTOP averages found in the baseline data collection, these findings suggest a degree of reformed teaching with an average RTOP found at 46.20. This level of reformed teaching is slightly above what MacIsaac and Falconer (2002) described as 'some levels of reform', but with much discourse still with the teacher. This is congruent with how Luft and Roehrig (2007) described the traditional, instructive, and transitional categories of teacher beliefs about science teaching and learning (i.e. most of the focus discourse remains with the teacher).

As each construct of reformed teaching is examined more closely, room exists for additional support and better alignment with principles of reformed teaching. An example of this 'room for improvement' is exemplified in the gap within the procedural knowledge construct where teachers averaged 6.85 out of 20.00 possible points. This scale is particularly focused on engaging students as active decision-makers in the learning process. One item in this category being: "Students made predictions, estimations and/or hypotheses and devised means for testing them".

The TUSI and each of the TUSI constructs from the classroom observations are represented as means (*M*) and standard deviations (*SD*). When considering that a maximum score for the TUSI is 104.00, it can be assumed that currently, technology plays only a small role in science instruction with the resulting average score being 11.60, with many of the participants observations rated as 0.00/104.00 because no technology was used at all during science instruction. Additionally, the TUSI is rated with a 0-4 Likert-scale with 0 described as 'never observed' and 4 described as 'very descriptive'. Given the means for each construct in relation to the total possible rating for each construct, it can be seen that for the most part technology use was restricted to the 'never observed' side of the Likert-scale (e.g. the 'In Context' *M* was 2.10/20.00). It is understood that certain technologies are not used daily, but if technology-enhanced tools are playing a significant role in science teaching and learning, some expectation of presence is warranted.

Several sources can be referenced to help explain the findings that have emerged here. As an example in our original funded proposal we explained, a high percentage of students are finding their way using technologies outside of school (Lenhart et al. 2008; Levin and Arafeh 2002; Pew Internet & American Lifereport 2002), but students have most recently report an absence of technologies inside of school in ways that they find meaningful and relevant to their lives (Dunleavy et al. 2009; Ito et al. 2008, 2009; Lenhart et al. 2008; Levin and Arafeh 2002). Further, when considering what is necessary for effective technology integration into subject matter, Koehler, Mishra, and Yahya (2007) suggest that this takes more than just knowledge of content, technology, and pedagogy, it also takes knowledge of the relationships of this tripartite of knowledge. Additionally, Levinz and Klieger (2010) found that time as it relates to the gaining of experiences that are connected to guidance or modeling of the integration of technological knowledge within teachers' pedagogical content knowledge are also important and needed. Given these findings with the TUSI there is little to no evidence that technologies are playing a role in learning science in science classrooms. While these findings seem dismal, especially recognizing the potential of technology-enhanced tools for transforming science learning, it should be noted that these participants are at the precipice of professional development aligned with what Levinz and Klieger (2010) suggest are needed.

The findings from the RTOP and TUSI collectively served to support the need for this project with the expectation that these ratings will increase as the project continues with the support of professional development and purposefully crafted curriculum materials supported by technologies.

Qualitative Findings

Based on initial qualitative analyses of the data collected, the following are qualitative findings from Year 2 of the project:

Overall Findings

- Teachers are challenged to implement science as inquiry in their classrooms, whether this is attributed to understandings of the nature of science (UT) or time constraints (NY).
- While adoption of modules is occurring to varying extents across teacher participants, the following are factors that limit the fidelity of adoption: teacher comfort and student familiarity with the intended tools as well as access and administrative controls (UT), and teachers have difficulties adopting modules due to time constraints (NY)

UT Specific Findings

- While teachers believe science is less about right and wrong answers and more about experimentation, a tension between curricular content requirements and ontological understandings of science exist.
- Teachers believe that student motivation is inherently tied to student learning, and while inquiry is motivating, misunderstandings about the nature of inquiry have led to variances in adoption.

NY Specific Findings

- Teachers formed learning community to share their tips and strategies of ICTs integration as an additional support connected to the professional development.

- The data shows that teachers have been applying the ICTs to topics other than the first two modules. Students do not have problems with the use of ICTs. They can easily adapt to the use of technology; however, their understanding of scientific content and scientific inquiry is relatively weak.

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