

Evaluation Report: Science Kits

July 2013



Key Findings

The differences in the use of the Battle Creek Area Mathematics and Science Center (BCAMSC) science kits and implementation of science instruction varies dramatically between schools with improving and declining 5th grade science MEAP scores. The key findings from this qualitative study are below:

Factors Contributing to Student Success

- ✓ Supporting literacy materials in the hands of students may lead to more success.
- ✓ Ongoing training for teachers using the science kits may be important to successful implementation and impact on students.
- ✓ There is an increase in inquiry-based instruction for teachers using the science kits.
- ✓ Students are talking about science at a deeper level than before.

Instructional Time & Implementation

- ✓ Science instructional time is not a priority in many elementary buildings, especially in K-3rd grades.
- ✓ Science instructional time has decreased over the past few years.
- ✓ Delivering the majority of the science content during a dedicated science instructional time may lead to more success.
- ✓ There is limited ongoing monitoring of the implementation of the science kits.
- ✓ Time constraints for science instruction is the biggest barrier.

Methodology

iEval, an external evaluation firm, was hired to evaluate the impact of the use of the Battle Creek Area Mathematics and Science Center (BCAMSC) science kits on students, teachers, and schools. A qualitative approach using the success case method and a quantitative approach using a stratified random sample of schools were both recommended. Due to time constraints and access to data, the qualitative portion of the evaluation was selected for implementation and planning for future implementation of the quantitative analyses would occur.

In using the success case method, specific criteria were identified from which schools were selected for interviews about their training, implementation, and impact of the science kits. The criteria included were:

- Fully implemented since kits in at least grades 3-5 (“fully implemented” means they have had the kits for those grades for at least two years)
- Have used revised science kits at least since fall 2010
- Have fall 2009, fall 2010, fall 2011, and fall 2012 5th grade science MEAP scores available

The 5th grade science MEAP trends over the four years of data were analyzed and adjusted for current cut scores. Schools were separated into two groups: 1) those who scored below state average in 2009 and improved to above state average in 2012 and 2) those who scored above state average in 2009 and declined to below state average in 2012. Schools were then selected at both ends of the spectrum for interviews to help identify what barriers have precluded success and what bridges have facilitated success. Ten schools were identified, five with positive trends and five with negative trends, and interviews were conducted with one or more representatives from nine of the schools. The schools will remain anonymous, as the purpose of this is to understand the characteristics that make up schools with improving or declining science MEAP scores in 5th grade. The descriptives for the nine participating schools are below:

Table 1. School descriptives.

School	Grades use literacy trade books	Trend in MEAP scores	Statewide percentile rank fall 2012	Free & reduced lunch fall 2012	Number of people interviewed
1	K-5 th	declining	33	66%	2
2	K-5 th	declining	60	45%	2
3	K-2 nd	declining	55	63%	1
4	2 nd -5 th	improving	77	51%	1
5	3 rd -5 th	declining	38	43%	1
6	3 rd -5 th	improving	29	58%	1
7	5 th	improving	56	58%	3
8	None	improving	58 – focus	65%	2
9	None	declining	70	61%	1

The questions were developed specifically to evaluate the training, implementation, and impact of the science kits. The interviews were conducted over the phone and lasted 20-30 minutes each. Follow-up phone interviews were conducted when more clarification was needed on a specific discussion point from the first interview. The data in this section are reported in the aggregate, not by individual school or interview. The basic questions asked (additional probing questions were asking, when appropriate) were:

1. Do your teachers have a specific amount of time allotted to teach science each day?
2. Has science instructional time decreased over the past few years? If a specific science time has been eliminated, has it been integrated into language arts or math classes?
3. In your planning for implementation for use of the science kits, what was your training approach for your teachers? (e.g., all teachers participate in training with a representative from the BCAMSC, few teachers trained then train others)
4. Do you provide refresher training each year? Do you provide training for those changing grade levels and new teachers?
5. Do you have anyone monitor the implementation of the kits to ensure the consistency of delivery based on training?
6. Do you have the literacy trade books that go along with the science kits? If so, do you have enough trade books for paired/shared reading? How are your teachers incorporating the literacy elements?
7. Are science elements integrated into writing and reading classes during the day?
8. How has the use of the science kits impacted your teachers? Your students?
9. Successful: Your school's MEAP scores in science have improved over the past few years. What supports/facilitators do you think have helped impact that change? What barriers did you encounter in the past few years? How did you overcome them?
10. Failing: Your school's MEAP scores in science have declined over the past few years. What barriers do you think have impeded progress? What supports/facilitators do you feel you need to make positive change?

Overall Themes

While the training, implementation, and impact of the science kits varied dramatically across the schools and within the schools that participated in the interviews, there were some general themes across most schools.

- ✓ **Science instructional time is not a priority in the elementary buildings, especially in K-3rd grades.**
All of the elementary schools are focusing on English language arts and mathematics, while still trying to carve out some time for science and social studies. Science instructional options shared included blocking off special science days to try to cover what is in a science kit, alternating science and social studies during a 45 minute block each day, no district or building requirements – instructional time in science varies by teacher, devoting 45 minutes per day for 6-8 weeks until the science kit is done, and a set block of time every day for science (only in 4th grades on up).
- ✓ **Science instructional time has decreased over the past few years.**
Only two buildings have maintained a consistent allotment of time for science over the past few years. Many schools indicated they don't have enough time to get through all four

science kits at a grade level, often only getting through two or three. Other schools indicated they've had to condense days allotted to cover each kit, ensuring that the GLCEs are covered but sacrificing writing and activity time. Two schools did mention they plan to take an intentional look at science instructional time next year, especially with the requirements coming from the Common Core.

✓ **Delivering the majority of the science content during a dedicated science instructional time may lead to more success.**

Teachers, on their own, sometimes integrate the science literacy trade books or other science-related reading materials into their language arts classes. Less frequent is the integration of science content into writing assignments or math work. Principals indicated they want that integration to happen but that it's difficult for the teachers to figure out how to integrate it. Interestingly, those schools that have a positive trend in 5th grade science MEAP scores do not typically integrate science into other content areas, instead delivering most of the science content within a dedicated science time. Those same schools do encourage students to pick science related stories to use during independent reading time.

✓ **Supporting literacy materials in the hands of students may lead to more success.**

The schools with positive 5th grade science MEAP trends put literacy materials (e.g., trade books purchased through the BCAMSC, science supplement to the Weekly Reader, miscellaneous compiled science texts) into the hands of the students for individual or paired reading. The schools with declining MEAP trends either do not use any supplemental literacy materials or typically have limited sets for a classroom to use for read alouds, document camera projection, or small group work.

✓ **Ongoing training for teachers using the science kits may be important to successful implementation and impact on students.**

The initial training on the BCAMSC science kits varies from sending teachers to the BCAMSC for training and then those teachers train the rest of the school (i.e., train the trainer model) to whole school training by the BCAMSC to whole school training by the local intermediate school district. Of the four successful schools, three of them offer training each year for new staff or as a refresher for current staff. Of the five declining schools, only one school indicated some ongoing guidance offered through their local intermediate school district.

✓ **There is limited ongoing monitoring of the implementation of the science kits.**

The majority of the schools do not have any process for ongoing monitoring of the implementation of the science kits by a curriculum director, science consultant, or principal. Several schools have an informal process including grade level teachers meeting together during the year to discuss implementation strategies and building principal observing a science lesson as part of the annual teacher evaluation process (but not monitoring for

science implementation, more focused on instructional strategies and classroom management).

✓ **There is an increase in inquiry-based instruction for teachers using the science kits.**

The principals and teachers interviewed feel the training for the science kits was very good, and the curriculum is organized with appropriate investigative activities including questioning, predicting, etc. Teachers who aren't as comfortable with the content of science have the information and tools necessary to become facilitators of the learning process.

✓ **Students are talking about science at a deeper level than before.**

Students love exploring science through engagement in hands-on, content-rich activities that give them experience with the scientific method. Students are more comfortable with not getting the right answer the first time, rediscovering, and collaborating.

✓ **Time constraints for science instruction is the biggest barrier.**

With the elementary emphasis on reading, writing, and mathematics, attention to the other core areas has been less. That is not something the BCAMSC can change, but there are some time constraints that can be impacted through the science kits. Several suggestions included: creating a guide for integrating science content into ELA and math, more training so teachers have more confidence in setting up experiments and teaching the content, updating lessons so they can be accomplished in the recommended time allotted (e.g., removing redundancies), providing guidance on how to effectively use journaling as part of the scientific process, ensure the science kits are teaching the knowledge and skills needed to success on the state science assessment, and advocating that the Michigan Department of Education put more emphasis on the importance of science instruction (particularly with the desperate need for expertise in STEM careers).

Individual Cases

The following summaries are a composite for the schools that have had declining or improving MEAP scores over the past three years. The details are taken from the interviews but combined into one school representing the most common ideas shared.

Declining School

At this school, teachers do not dedicate a specific amount of time each day to teaching science, instead they are encouraged to teach science and fit it in whenever they have time. Because of the additional emphasis on instructional time in mathematics and language arts, teachers typically only get through 2-3 science kits per year instead of four. The science kits typically have to be shared at a grade level so resources are often missing and not restocked. Teachers have tried to

integrate some science content into reading and writing, but they lack the resources necessary to do that. The school does not have the literacy trade books that go along with the science kits.

Teachers were trained by a BCAMSC or a local ISD representative when they first began using the science kits years ago. There have not been any refresher training or training for new staff members in the last five years. There is no monitoring of the implementation of the science kits from lead teachers, curriculum directors, or principals. Teachers try to share implementation strategies with other teachers at their grade level, but there is no consistent process for that.

The principal feels there is a disconnect between what the MEAP tests and what the teachers are teaching in science. The principal said, “It can’t be that all of the teaching and learning is bad.” The principal recognizes that there are inconsistencies in time spent fully doing the investigations and that teachers have less time they can spend teaching science. One teacher concurred saying, “I’m not sure we always set the task at hand with the fun experiments to ensure that the learning is occurring.” Teachers are beginning to get frustrated with the science kits because they feel like they’re doing the best job they can, yet MEAP scores continue to decline. The teachers do love the organization, ease of use, and investigative portion of the science kits. They feel the lessons introduce the scientific process well and allow students to go through that process. They feel more organized and able to teach science, especially those teachers who are more uncomfortable with the science content. One teacher said, “It allows me to be what I’m supposed to be – a science facilitator.” Another teacher said, “We have less prep time, plus there is a guide and script so we are more confident in teaching science.” Overall, the students enjoy the activities and are gaining good experiences in asking questions, making predictions, etc. One teacher said, “{Students are} more comfortable with not getting the right answer the first time and working to rediscover and collaborate.” Teachers would like to see a review sheet or some component that can be used to reinforce concepts or share with students who were absent.

Improving School

At this school, teachers have a dedicated amount of time for teaching science, typically alternating that block of time each day with social studies. The amount of time dedicated to science has stayed fairly consistent over the past several years, typically around 45-50 minutes each time (2-3 times/week). The school has the literacy trade books recommended to accompany the science kits, as well as other supplementary science reading materials, and they are often used during silent independent reading time and guided reading time as well.

Teachers were trained by a BCAMSC representative when they first began using the science kits years ago. There is a refresher training offered every year, and the school sends new teachers to the BCAMSC to receive training. Monitoring of the implementation of the science kits is not consistent, but the principal and/or lead teacher does try to observe at least one science lesson

per teacher each year. Teachers share strategies as needed with fellow teachers to ensure some consistency in implementation.

The principal does not want to take away any science instruction time. The principal said, “There are so many careers that will be science and math related – we need to focus on these areas.” The principal and teachers think that one of the primary reasons they have been successful in improving science MEAP scores is because of their integration of science into language arts, particularly “focus on reading and writing and authenticity in instruction using infographics, content texts...” The teachers believe the science kits help provide cross-curricular connections that are meaningful and build on the work the prior grade has done. One teacher said, “We haven’t found another kit or curriculum that has given us this type of student growth!” The teachers acknowledge that science is not a content area they are comfortable with, but they believe the science kits are designed to fill those gaps. The teachers are seeing growth in student inquiry, but they acknowledge that teachers and students struggle with one area, “Kids already love the labs and sharing data, but we’re not getting the most out of learning from the journals. We’re thinking about trying group journaling to try different methods.”

Suggestions from Schools

The teachers and principals interviewed had many suggestions on what kind of help they needed to be (or to continue to be) successful with science instruction. Below is the list of those recommendations:

- We need more time to devote to science!
- With significant time constraints on teaching science, a guide that prioritizes what are the most critical elements of a kit to teach and what could be removed if time runs out would be very helpful. Teachers feel there are some redundancies that could also be removed.
- Teachers are still confused by the content and lack confidence in teaching it, so additional training specifically in the science kits and training at the college level in general science content really is needed.
- The journals need to be more integrated and meaningful to the work, and teachers aren’t sure if the journaling provides any usefulness to students in preparing for the MEAP. Guidance on how to more effectively use the journals is needed.
- Nonfiction texts need to be a mandatory part of the science kits.
- Schools need support in understanding the NextGen expectations, like making inferences beyond the data, and how the science kits will address those.
- Administrators should have to go to the science kit training so they understand the importance of using the science kits.

- High school and middle school teachers could help the elementary teachers better understand the science content and applicability so teacher confidence in science improves.
- We need more interactive, technology-based supplemental materials to go along with the science kits – the current workbooks are just coloring pages, word searches, and articles.
- Teachers could use training on how to blend science activities, concepts, and lessons into language arts and mathematics.
- “I need to make sure the BCAMSC is right on top of the changes coming out of the state so we’re receiving the most current curriculum based on the standards.”

Next Steps

The teachers and principals interviewed were very eager to hear the results of this study, not as much the summary of the findings but how the BCAMSC is going to respond to the findings. A follow-up email should be sent to the participating schools, sharing some of the key findings from this report and what actions the BCAMSC will be taking moving forward.

Additionally, planning for a quantitative study of the implementation of the science kits is necessary to accurately determine what impact the science kits have on student academic achievement. Below is one suggestion for how that quantitative study could be implemented. The estimated costs for an evaluation study of this nature is \$35,000.

Primary Evaluation Activities	BCAMSC	Evaluator
Select a stratified, random sample of schools from whom to collect data	Identify schools in 2012 Spr Count Data who are fully implementing the science kits in 3 rd -5 th grades	Using 2012 Spr Count Data, identify a stratified random sample based on ED, gender, & ethnicity
Develop data collection instruments	Review tools	Develop teacher survey about implementation and impact of science kits
Administer teacher survey to teachers in 40 classrooms ¹	Invite, encourage, and follow-up with teachers to participate in online survey (survey must be completed for 2011-12, 2012-13, and 2013-14 school years)	Implement and analyze online survey

¹ This number is based on 140 schools fully implementing the science kits with an average of 6 classrooms and 25 students per classroom. In order to have a confidence interval of 95%, we should need teachers representing 400 students to reply. That means 16 classrooms. Assuming some classes will be invited and not participate, we need to oversample. It is recommended to invite 40 teachers/classrooms to participate.

Primary Evaluation Activities	BCAMSC	Evaluator
Gain access to fall 2011, fall 2012, fall 2013, and fall 2014 MEAP science scores	Explain to schools the importance of this study and encourage cooperation	Access and house MEAP data at the individual student level (must be able to connect students with the teachers who completed the survey)
Analyze implementation and impact data	Provide list of expected use of science kits in selected classrooms	Analyze MEAP data, teacher survey data, and science kit data
Reporting	Review report	<p>Preliminary analyses/reporting will happen with 2011-12 and 2012-13 data</p> <p>Final reporting will occur once fall 2014 MEAP data are available</p>