Summary Report of the Evaluation of the Illinois Mathematics and Science Academy's Fusion Program

2014-2015 Program Year

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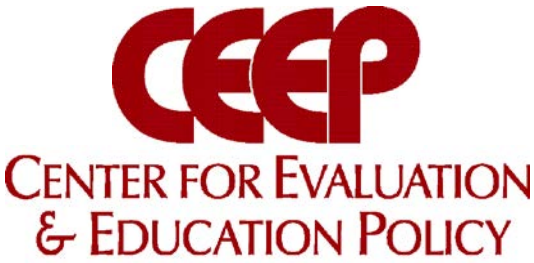

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Introduction

This document summarizes data collected by the Center for Evaluation and Education Policy (CEEP) at Indiana University during the 2014-2015 program year for the evaluation of the IMSA Fusion program. CEEP currently serves as the external evaluator for the IMSA Fusion program through annually renewable contracts beginning in July 2013 through June 2018.

In collaboration with the IMSA Fusion staff members, the evaluation team at CEEP designed and implemented four surveys to collect data from (1) the students participating in Fusion programs, (2) the parents/guardians of those students, (3) the teachers serving as Fusion instructors, and (4) the principals at schools with Fusion programs. Data to inform the IMSA Fusion evaluation were also collected through an observation tool administered by Fusion site observers during site visits conducted during the 2014-2015 academic school year.

This comprehensive report serves as the required deliverable for the evaluation contract from July 1, 2014-June 30, 2015. The report provides data summaries and findings for each of the four surveys and the observation tool. A copy of each of the four survey instruments, two parent/guardian consent forms, and the site observation tool are provided in the appendices.

Key Findings

Perceived Impact on Students' Interest in and Understanding of Mathematics and Science

Overall students, parents, teachers, and principals have high praise for the IMSA Fusion program, especially in terms of impact on students' interest and understanding in mathematics and science. Of the teacher respondents, the majority (no fewer than 88%) agrees or strongly agrees that students in their schools who participated in IMSA Fusion developed deeper interest and understanding in mathematics and science. Similarly, most principal respondents (93%) agree or strongly agree that students in their schools who participated in IMSA Fusion developed deeper interest and understanding in mathematics and science.

The majority of parent/guardian respondents (no fewer than 84%) also agrees or strongly agrees that their children who participated in IMSA Fusion developed deeper interest and understanding in both mathematics and science. Similarly, the majority of student respondents (no fewer than 77%) also agrees or strongly agrees that they are more interested in and better understand both mathematics and science because of their participation in Fusion.

Teacher respondents identify a variety of areas in which IMSA Fusion improves students' learning, including being able to integrate mathematics and science content; collect, organize, and analyze data; communicate orally; work productively in groups; and connect new information with prior knowledge.

Eighty-four percent of teachers and 88% of principals agree or strongly agree that IMSA Fusion has offered students who typically do not participate in mathematics and science activities access to STEM programming. Ninety-five percent of parent/guardian respondents agree or strongly agree that IMSA Fusion is a valuable part of their children's learning experiences and would recommend the program to other parents and students. Ninety-five percent of student respondents agree or strong agree that Fusion is a good learning experience, and 90% of students would recommend IMSA Fusion to their friends.

Perceived Impact on Schools and Parental Interest

Eighty-three percent of principal respondents agree or strongly agree that their schools place more emphasis on science instruction, and 78% of principals agree or strongly agree that their schools place more emphasis on mathematics instruction because of IMSA Fusion. Seventy-six percent of principal respondents agree or strongly agree that parents of students in IMSA Fusion are more interested in their children's achievement in mathematics, and 76% of principals agree or strongly agree that parents are more interested in their children's achievement in science because of IMSA Fusion.

Perceived Impact on Teachers' Pedagogy and Professional Practice

Eighty-eight percent of principal respondents agree or strongly agree that teachers in their schools have enhanced their regular classroom instruction because of IMSA Fusion. Teacher respondents identified a variety of their classroom teaching duties and instruction that are directly influenced by their experiences as instructors in the IMSA Fusion program, including using real-world examples in their teaching of

content; having students work in pairs/teams to collect and analyze information; having students identify problems/issues; using open-inquiry strategies in questioning students about their knowledge; and having students engage in group discussions to reflect on their learning.

Teachers who serve as instructors in IMSA Fusion actively participate in STEM professional development opportunities locally, regionally, and nationally; and serve as instructional mentors and curriculum leaders in their schools and districts.

Implementation Fidelity and Quality of STEM Learning Opportunities

Overall the implementation of the IMSA Fusion curriculum by instructors during the 2014-2015 program year demonstrated high fidelity and consistent quality. Out of 140 observations conducted by IMSA Fusion site observers, 25% (35) demonstrated moderate fidelity and 73% (102) demonstrated high fidelity. Across all eight areas of STEM programming, as identified in the observation tool, the majority of observations met or exceeded expectations of quality ranging from 77% to 97% of ratings across the eight areas receiving a rating of reasonable evidence [3] or exceptional evidence [4] on the scale.

Teachers serving as IMSA Fusion instructors are demonstrating high quality preparation, organization, and implementation of the curricular units; and appropriate use of facilities, space, and equipment. Fusion instructors are also fostering student participation and team work; creating purposeful activities; supporting student engagement with STEM and STEM content learning; promoting inquiry and problem solving; and facilitating reflection, relevance, and making connections by students.

Challenges and Areas of Support for Teachers and Principals

Challenges identified by teachers included setting up and completing the IMSA Fusion units/lessons in the time allotted for the program; recruiting and retaining students; providing students with adequate background knowledge on mathematics and science concepts; working with mixed-age and mixed-ability groups of students; and encouraging students to work in groups and think critically. Teacher respondents also mentioned as challenges using the Moodle website and not receiving timely feedback from Fusion staff. Other challenges included finding time to attend IMSA Fusion professional development sessions during the summer and school year; overlapping schedules with other afterschool programs and sports teams; and malfunctioning of equipment/materials and/or inadequate supplies of equipment/materials for the number of participating Fusion students.

Challenges identified by the principal respondents included securing funding for the program including for field trips and transportation, and selecting students when more students are interested in participating than the program is able to enroll.

When asked how IMSA might support the teachers in their roles as Fusion instructors, respondents mentioned video-taping the professional development workshops so that instructors could review them just prior to implementing a unit/lesson and supplemental video-taped lessons of the activities not covered in the professional development workshops. Teacher respondents also suggested providing materials lists for each unit's activities and an inventory list of those materials items to return to IMSA. Teachers would

also like to have an increase in student-led and hands-on activities in the curriculum to encourage student engagement.

Another support noted by teacher respondents included having IMSA Fusion staff members communicate more frequently and consistently on the Moodle website, especially to provide commentary on the feedback provided by the teachers for each unit; and to help teachers navigate how and where to access materials on the Moodle during the POP workshops and professional development sessions throughout the school year.

Examples of how IMSA Fusion could further support principals included helping them identify strategies for integrating more STEM content and pedagogy into the regular day curriculum; allowing additional teachers in the schools to attend Fusion professional development held during the school year on STEM teaching strategies; bringing together teachers and principals from Fusion programs around the state at meetings of professional associations to discuss how each site selects students (i.e., criteria) and implements its Fusion program; and helping school promote the program to students, parents, and the community.

Overall Recommendation

The IMSA Fusion program continues to receive high praise from students, parents, teachers, and principals. No critical areas of concern were identified for the 2014-15 program year. The IMSA Fusion program staff members should continue to be creative in facilitating and promoting high fidelity and high quality implementation of the IMSA Fusion curriculum through its ongoing, multi-faceted professional development and formative feedback processes.

In 2014-15 the IMSA Fusion program created and implemented new 6th -8th grade curricular units; expanded the number of Fusion programs to 133 (which include both the afterschool and embedded *INFusion* models); and refined the design of its professional development programming. The IMSA Fusion program also hired new staff members to provide curricular development, professional development, and site support; and introduced the use of a Moodle online site for communication and access to curricular resources. Throughout these multiple changes, the staff members of IMSA Fusion have demonstrated the ongoing commitment to adapting the professional development and support services to teachers, principals, and schools – while maintaining curricular fidelity and supporting high quality STEM learning experiences for students across the participating sites.

Data Summaries and Findings

Aggregate Summary IMSA Fusion Teacher Surveys

This section of the report summarizes the IMSA Fusion teacher surveys collected in spring 2015. Teachers (who serve as instructors for the Fusion program) across the 133 program sites (operating in academic year 2014-2015) were asked to complete a brief survey through an online software program. Teachers were given approximately 12-16 weeks to complete the survey (early January through April 30, 2015). CEEP researchers analyzed the survey responses using SPSS software.

One-hundred-thirty-eight (138) teachers completed the survey, across 70 program sites. Forty-four percent (61) of respondents teach in the 4th-5th grade program, 55% (76) teach in the 6th-8th grade program, and one percent (1) teaches in both programs.

Teachers were asked to rate their level of agreement with a set of statements about the impact of the IMSA Fusion program (see Table 1). Ninety-two percent of respondents **agree** or **strongly agree** that *Students in my school have developed deeper interest in science because of IMSA Fusion* (mean = 3.63).

Teachers were also asked to rate their level of agreement with statements about student learning in the IMSA Fusion program (See Table 2). No fewer than ninety-one percent of **agree** or **strongly agree** with the statements. The statements with the highest mean were *IMSA Fusion improves students' abilities to work productively in groups* and *IMSA Fusion improves students' abilities to work with their peers to achieve common goals* (both with means of 3.72).

Teachers were also asked to identify areas of their regular teaching duties/classroom instruction that have been directly influenced by their experiences as instructors in the IMSA Fusion program. Respondents could choose as many instructional areas as appropriate (See Table 3). Eighty percent (96 out of 120) of respondents noted their use of real-world examples in teaching of content was directly influenced by their Fusion experiences.

Classroom successes in using IMSA Fusion pedagogy or curriculum included using a variety of IMSA Fusion pedagogical approaches, hands-on activities, strategies, and resources in the regular classroom. Illustrative examples are provided.

> *I have been letting students come together and teach each other what they have learned. I am working on changing my role from teacher to more of a facilitator.*
>
> *I want students to be more in control of their learning. I try to take a hands-off approach when it comes to science. I want THEM to do the science to figure it out on their own. That is where true learning comes into play.*
>
> *Recently, I had students solve a complex, multi-step word problem that required them to think about the strategies they used to solve the problem. There were multiple ways to solve the problem, so students had different entry points into the mathematical thinking. The kids grew in their problem solving skills, and I'm looking forward to seeing how they tackle the next one.*

Since I teach science IMSA FUSION is a great compliment to preparing the students for applying the scientific method, inquiry and building critical thinking skills for problem solving.

I tried to create my own science lessons that reflected the inquiry format that is similar to fusion lessons. The kids were very engaged and enjoyed participating in lessons that were taught in this format.

I have more confidence as a teacher allowing the kids to work in groups. Also, I have learned to let the students explore and investigate more and if they come up with the incorrect answer, that is ok as long as they can explain their reasoning and see where they made an error.

I have learned that students are just as good of teachers (sometimes better) than I am! Encouraging a more collaborative learning environment is a direct result of the IMSA program. I have also used more real world videos, articles, etc. to teach content so that students can see the connection. Finally, I approach my classroom as a place to discover knowledge. I want to empower my students to be learners and seek new information rather than wait for it to be handed to them!

I like to ask open ended questions in all subject areas. I encourage students to come up with multiple ways to solve problems or give me an answer. I like for them to be able to give any answer they would like as long as they can give the support as to how they found their answer or why they are answering the question the way that they are. I also have my students work in groups and have discussions about what we are learning.

I extended STEM Enrichment offerings to the next top 23 fifth grade gifted students - students and parents were thrilled.

As we are moving to NGSS in our building, I have used some of the activities such as catapults in my classroom. Since I have IMSA Fusion students in my classroom, I made sure I made enough changes to provide them with a challenge that was seamless in presentation. I didn't want them to be singled out or others to feel like they had an "unfair" advantage. It worked really well for all of the students.

Using the Fusion format and activities allows all my students to be successful. Not only are they working with others to understand a topic they are getting hands on experience, they are using higher order thinking skills.

Give real world examples in math class. I plan on sharing some of the Middle Ages information I learned with my math classes when the Social Studies classes get to that topic. I encourage students to think back to past lessons and the information they learned to help aid current lessons.

I am bringing more real world problems to my students to have them solve in PBL type projects now.

I try to reinforce the need for clearly defined roles in groups in order to effectively and efficiently achieve a common goal.

I have taken the way we present information in IMSA and brought that into my classroom. I had my IMSA students explain and demonstrate how to do it to their classmates. We also make connections throughout the school day to things we have covered, studied, or experimented with in IMSA.

Guided Inquiry based instruction allows students to work at his/her own pace for learning a new concept. Keeping feedback loops with peers allows for classroom discussion about real world problems in math class.

My students with special needs had the opportunity to work through parts of some of the labs during a resource period. We were able to work on skills that they were working on in addition to learning additional concepts in science.

During centers for reading class students work every day within their group. They grew throughout the year as they learned to collaborate and collect data and analyze data when needed. Since I teach reading, this usually occurred with their reading articles or current events.

Teachers were also asked to identify professional development opportunities in STEM disciplines that they sought out because of their involvement in IMSA Fusion. Examples included taking graduate and extension courses in STEM areas at a variety of universities/colleges and museums; attending professional association conferences (e.g., ICTM); and participating in professional development training on *Next Generation Science Standards, Project Lead the Way, Lego STEM, Sci-Tech for Girls,* and *Common Core Standards.*.

Teachers were also asked to identify professional development opportunities in STEM disciplines that they participated in on the recommendation of their principals and/or district. Examples included attending professional association conferences (e.g., ICE, ICTM) and district sponsored professional development activities in engineering, mathematics, and *Next Generation Science Standards*.

Respondents also identified opportunities to serve as instructional mentors in STEM disciplines to peers in their schools because of their involvement in Fusion. These included serving on district and school-level mathematics and science curriculum and standards committees; leading district and school-level professional development activities in science; and providing informal and formal training to peers and student-teachers on IMSA curricular units and general STEM topics.

Areas of success of the IMSA Fusion program identified by respondents included the expansion of STEM activities available to students; enhanced student enthusiasm for learning mathematics and science; and student engagement with peers, working in groups, and collaborating to solve problems. Illustrative examples are provided.

That students of the different grade levels have formed friendship due to IMSA FUSION; kids making new friends and learning to work together.

We've really had several small successes starting with students from two different buildings integrating and learning how to work together. They have become friends and will have a leg up

on the other 6th graders as both groups transition to the middle school next year. They have also become much better at problem solving and being able to express their solutions verbally and in writing.

Students have learned so much it is hard to pick one thing out. The first thing that comes to mind is that we had one project where the entire group ended up having to work together to complete the project. These are students that often times will choose to work by themselves rather than with others. These students enjoy working together because they all want to work. They see what a group can accomplish when they are with a group of students where no one is a slacker.

It seems that every year our biggest success is how the students learn to work together to problem solve these big ideas in IMSA. Their reaction to finding success in class is fantastic. They work very hard and very well together, as well as learning important skills like public speaking when they present their findings to the group.

The greatest success was the students learning how to solve problems on their own and assess their own work in order to achieve their goals.

The students are starting to think for themselves instead of wanting us to guide them to the right answer. They are using strategies and accepting the fact that there is not always just one right way to find an answer.

The greatest success is watching students grow in their ability to think, process, and confidently work to solve the problem(s).

The engineering curriculum really pushed students this year to be problem solvers. I loved that it was more "here's a problem, fix it!"

Watching the students' "Ah Ha" moments and knowing that they are enjoying what they are learning.

Getting the students who were in the program for the first time this year excited about science and being challenged.

The greatest success was allowing students who would not have the opportunity to see participate first hand in science, to see them engaged and excited about science. They were having fun and want to do more and more each week.

Engaging students in the expiration of potential careers in science and getting students to lead the class as opposed to be passive learners.

Being able to introduce those who are considered academically 'average' to STEM curriculum.

The greatest success of IMSA Fusion in our school was increasing students' interest in math and science school wide. We have shared their projects with peers and parents via the school newspaper and in turn I believe it has also increased their achievements in those areas.

I had several parents stop in to see what the kids were doing, because they were hearing such great things about the program. This was a great way to get the parents involved outside of a parent night.

The overall effort our students put forth toward their own well-being/education. Capstone activity of parent night was amazing. Big turn out and the students performed well.

Interest in the IMSA Fusion program increases every year. We have more and more students who want to be involved in the IMSA program which makes it harder and harder to turn students down. However, it is a great problem to have and shows the success of the program at our school. Students have really enjoyed both units this year, and we have seen their creativity and problem solving skills thrive.

Students in IMSA talked about our activities in the regular classroom. Other students also saw what we were working on. This generated excitement around the school.

The greatest success of IMSA FUSION in our school this year was having the opportunity to do hands-on activities and display the results in the halls of the building.

There was more mathematics involved which allowed a math teacher to be able to support more. I enjoyed being part of a math unit (chaos) where I didn't have to rely so much on the science teacher to provide the background information. By the end of the unit I felt the students were able to explain in detail what chaos theory was.

The greatest success was exposing students to information and concepts that they may have not been familiar with. They were able to work with materials or chemicals that they did not have previous knowledge of. The hands on activities were very beneficial and they were able to connect what they learned to the real world.

It has been wonderful to see all of these students learning so much. They tell their classroom teachers how much they love IMSA and even wear their t-shirts every week! It is great to actually HEAR the kids learn and SEE them put their learning into drawing and writing. I wish I could do more things IMSA related in my classroom.

The students really enjoyed "mailing the chip". Instead of mailing it, we made it personal and had it delivered to one of the teacher's 13 month old girl who got to "play" with it. It was video-taped, and the students loved seeing it on video. Also, the engineering unit offered several opportunities for them to design and figure out an answer to a problem where more than one solution would work.

I was able to see the growth in overall work ethic. The students at first thought it was all fun and games. By the end of the year the students had their groups picked quickly and were really picking each other's brains for ideas. They learned how to collaborate with each other, the importance of safety with chemicals and other unknown products, and how to think out of the box. I also believed they learned more than previous units because they were able relate these experiments and topics to real life jobs.

Challenges identified by teachers included setting up and completing the IMSA Fusion units/lessons in the time allotted for the program; recruiting and retaining students; providing students with adequate background knowledge on mathematics and science concepts; working with mixed-age and mixed-ability groups of students; and encouraging students to work in groups and think critically.

Respondents also mentioned using the Moodle website and not receiving timely feedback from Fusion staff; the challenges of finding time to attend IMSA Fusion professional development sessions during the summer and school year; overlapping schedules with other afterschool programs and sports teams; and malfunctioning of equipment/materials and/or inadequate supplies of equipment/materials for the number of participating students. Illustrative examples are provided.

> *The challenge was not feeling prepared for the lessons due to the professional development not going through the activities. Also, the set up for many of the activities was extremely time-consuming. I wound up using my plan periods to set up for the afternoon when I haven't had to do that before.*
>
> *The greatest challenge was the time that it actually took to conduct some of the experiments. It spanned over more than the 1-2 days that was expected. Another challenge was the short training day. I believe we should have at least 2 days to go over professional development. It seemed that things were rushed and we could not get through everything in the book, consequently we as facilitators were not as well versed on the experiments.*
>
> *Too much prep time for each lesson compared to in the past years. The units are difficult to follow and are not student centered. The curriculum book includes so much information when we also have our regular daily lessons to prep and teach. It is difficult when labs go on for 2 or 3 weeks. Less information in the manual would be helpful. More hands on student led activities. Kids need labs written for them to follow with less direct instruction from the teacher. Students do not want to sit after school and listen to us give oral directions. They want hands on labs which will keep them engaged.*
>
> *The biggest challenge was working through the books. The teachers' pages need to be consolidated and more emphasis needs to be placed on students running the lab/activity instead of following teacher lead instructions.*
>
> *The greatest challenge was the materials that were provided this year. In general, the original design many of the lessons were more teacher led rather than student led. This seemed to be different than in the past years.*
>
> *The new curriculum required way to much prep work and did not allow for the students to problem solve on their own because of the amount of necessary background knowledge that needed to be provided.*
>
> *The change of curriculum from 32 contact hours to 32 content hours. Our first unit did not need 32 content hours to complete because we have done that unit before. The 2nd unit has too much content in it - there is no way we can get it all done in 32 hours.*

The biggest challenge continues to be time. IMSA's curriculum is fantastic, but we do not have enough time to get into enough depth and the week interval between meetings sometimes diminishes the desire to continue a pursuit of an idea. In other words, they are excited to start an activity, we run out of time and by the following week, the students have lost interest in that 'investigative' thread that they were unravelling.

The Flight Curriculum was a challenge. It was sometimes difficult to find time to fit in the needed lessons due to our shorter meeting. There were also some discrepancies within the actual curriculum (for example, materials lists were sometimes wrong) and some websites/programs wouldn't work for us. Some of the lessons seemed to go over our students' heads or they weren't as interested in some of them.

The challenge was that many of the students were not familiar with how to do the math concepts, so we had to incorporate more teaching time for that. However, by the end they understood what to do and now had the knowledge to solve the different types of problems.

Providing enough challenge for our brightest students while providing enough scaffolding for our younger, new students and keeping all of them working together.

Having 6-8th grade is a great opportunity for older students to mentor the younger ones. The challenge is for them to have patience because the 6th graders are often rather immature. They have to remember they were once that way themselves.

The greatest challenge was probably teaching students to be independent and not be afraid to try.

The greatest challenge was to get the students to think for themselves. They are so use to the teachers holding their hand with every step that it was difficult for them to transition at first.

Getting students to be more dependent on one another and less dependent on the teacher.

The students continue to struggle with working in a group. They are learning to take turns and let everyone share their opinions without other comments being made. I also believe the math can be difficult for them, but when they take their time they are able to work right through it.

At the 7th/8th grade level, we have students that want to be involved in many different after-school activities. With the absent rule/policy, we have a lot of students that drop out mid-way through the program because of this.

Having students stay in the program on a regular basis. We have many activities after school, and they demand the student chooses one or the other. I have had students move, and also quit the program. Our numbers are down to 15-16 regular students weekly.

We had students drop to participate in other after school activities that were occurring at the same time as our weekly meetings.

Keeping students interested daily. They sometimes complained about the lessons not being as fun as before.

Keeping kids interested in the lesson when they were too long became a challenge.

We had many students drop out of the program because they found it "NOT to be FUN" anymore. We lost most of our 8th graders.

The curriculum seems more geared for during school. We have an after school program. It has also been very dry and not interesting for the students. We have had to add a lot to make it fun. Science should be fun.

Moodle, what a headache. We also were not able to get feedback like we used to the previous year.

The greatest challenge was the Moodle because the lack of feedback from previous years. We would complete the end of section reviews and receive no feedback, which caused us to be unsure if it was actually sent.

When asked how IMSA might support the teachers in their roles as Fusion instructors, respondents mentioned video-taping the professional development workshops so that instructors could review them just prior to implementing a unit/lesson and supplemental video-taped lessons of the activities not covered in the professional development workshops. Respondents also suggested providing materials lists for each unit's activities and an inventory list of those materials items to return to IMSA. They would like to have an increase in student-led and hands-on activities in the curriculum to encourage student engagement.

Another support noted by respondents included having IMSA Fusion staff members communicate more frequently and consistently on the Moodle website, especially to provide commentary on the feedback provided by the teachers for each unit; and to help teachers navigate how and where to access materials on the Moodle during the POP workshops and professional development sessions throughout the school year.

Table 1: Teacher Level of Agreement with Statements about IMSA Fusion Programming

Statement n=138	Strongly Disagree	Disagree	Agree	Strongly Agree	Do Not Know	Mean
Students in my school have developed deeper **interest** in **mathematics** because of IMSA Fusion.	2%	6%	**58%**	**30%**	4%	3.25
Students in my school have developed deeper **understanding** in **mathematics** because of IMSA Fusion.	2%	5%	**55%**	**33%**	4%	3.30
Students in my school have developed deeper **interest** in **science** because of IMSA Fusion.	2%	3%	**33%**	**57%**	4%	3.58
Students in my school have developed deeper **understanding** in **science** because of IMSA Fusion.	2%	2%	**31%**	**61%**	4%	3.63
IMSA Fusion has offered students who typically do not participate in mathematics and science activities access to STEM programming.	5%	6%	**34%**	**50%**	5%	3.49
My school now places more emphasis on **science** instruction in the school overall because of IMSA Fusion.	1%	33%	**33%**	**20%**	13%	2.84
My school now places more emphasis on **mathematics** instruction in the school overall because of IMSA Fusion.	2%	36%	**33%**	**16%**	13%	2.77
I have enhanced my regular classroom instruction because of IMSA Fusion.	4%	7%	**30%**	**55%**	4%	3.52
Parents of students in the program are more interested in their children's achievement in **mathematics** because of IMSA Fusion.	1%	9%	**39%**	**28%**	23%	3.25
Parents of students in the program are more interested in their children's achievement in **science** because of IMSA Fusion.	2%	9%	**33%**	**36%**	20%	3.35

Table 2: Teacher Level of Agreement with Statements about Student Learning in IMSA Fusion Programming

Statement n=130	Strongly Disagree	Disagree	Agree	Strongly Agree	Do Not Know	Mean
IMSA Fusion improves students' abilities to **identify problems/questions to be solved**.	1%	3%	**35%**	**60%**	1%	3.58
IMSA Fusion improves students' abilities to **collect** information/data.	2%	2%	**30%**	**66%**	0%	3.65
IMSA Fusion improves students' abilities to **organize** information/data.	1%	2%	**37%**	**59%**	1%	3.59
IMSA Fusion improves students' abilities to **analyze** information/data.	1%	2%	**31%**	**65%**	1%	3.64
IMSA Fusion improves students' abilities to **formulate solutions to problems**.	2%	2%	**28%**	**67%**	1%	3.66
IMSA Fusion improves students' abilities to **communicate orally**.	1%	2%	**35%**	**61%**	1%	3.61
IMSA Fusion improves students' abilities to **communicate in written form**.	2%	7%	**53%**	**38%**	0%	3.32
IMSA Fusion improves students' abilities to **use media/technology to access information**.	1%	5%	**43%**	**48%**	3%	3.46
IMSA Fusion improves students' abilities to **work productively in groups**.	1%	1%	**26%**	**70%**	2%	3.72
IMSA Fusion improves students' abilities to **work with their peers to achieve common goals**.	1%	1%	**25%**	**70%**	3%	3.72
IMSA Fusion improves students' abilities to **integrate mathematics and science content**.	1%	1%	**32%**	**65%**	1%	3.66
IMSA Fusion improves students' abilities to **connect new information with prior knowledge**.	1%	1%	**30%**	**66%**	2%	3.67
IMSA Fusion improves students' abilities to **direct their own learning**.	1%	3%	**39%**	**56%**	1%	3.54
IMSA Fusion improves students' abilities to **assess the quality of their own work**.	1%	4%	**42%**	**51%**	2%	3.48

Table 3: Classroom Teaching Duties/Instruction Directly Influenced by Experience as Instructor in IMSA Fusion Programming

Statement n=120	% and # of Respondents
How students identify problems/issues to address	73% (87)
How students formulate strategies for addressing problems/issues	69% (83)
How students work in pairs/teams to collect information	74% (89)
How students work in pairs/teams to analyze information	74% (89)
How students work in pairs/teams to report results	58% (70)
How students use journals/observation logs to record information	37% (44)
How students create oral presentations of their results	34% (41)
How students create written reports/summaries of their results	39% (35)
How students engage in group discussions to reflect on their learning	70% (84)
How students assess the quality of their work	35% (42)
How students use technology/media to conduct research on STEM topics	45% (54)
My use of open-inquiry strategies in questioning students about their knowledge	72% (86)
My use of real-world examples in teaching of content	**80% (96)**
How we discuss connections between previous knowledge and new knowledge	56% (67)
How we discuss connections across STEM subject areas (e.g., geometry, chemistry, astronomy)	47% (56)
How we discuss connections across STEM and non-STEM subject areas (e.g., estimation, biology, social studies, etc.)	46% (55)
I demonstrated Fusion hands-on investigations/experiments for all students in the class.	45% (54)
I had all students in the class conduct Fusion hands-on investigations/experiments.	39% (47)
I used Fusion supplemental science resources to teach STEM content (e.g., as reading materials for your classroom students).	34% (41)

Aggregate Summary IMSA Fusion Principal Surveys

This section of the report summarizes the IMSA Fusion principal surveys collected in spring 2015. Principals across the 133 program sites (operating in academic year 2014-2015) were asked to complete a brief survey through an online software program. Principals were given approximately 12-16 weeks to complete the survey (early January through April 30, 2015). CEEP researchers analyzed the survey responses using SPSS software.

Forty-one principals completed the survey, across 39 program sites. Twenty-nine percent (13) of respondents identified their schools as urban and 71% as suburban (32).

Principals were asked to rate their level of agreement with a set of statements about the impact of the IMSA Fusion program (See Table 4). No fewer than 73% of respondents **agree** or **strongly agree** with the statements about the IMSA Fusion programming. The three statements with the highest level of agreement (93%) were (1) *Students in my school have developed deeper interest in mathematics because of IMSA Fusion*, (2) *Students in my school have developed deeper interest in science because of IMSA Fusion*, and (3) *Students in my school have developed deeper understanding in science because of IMSA Fusion*.

Areas of success of the IMSA Fusion program identified by principals included engaging students in hands-on, challenging, and interactive activities; students' and parents' excitement and interest in the program; and increased instructor knowledge and teaching skills. Illustrative examples are provided.

> *How they have incorporated the skills in other content areas. And students are more interested in Math & Science.*
>
> *The opportunity for so many students to participate in different activities that they would not normally have the opportunity to participate; in addition, the critical thinking features that all students have benefited from.*
>
> *The greatest success of IMSA fusion in our school this year was the excitement that he students have shown in the area of STEM. The students have had the opportunity to participate in various science experiments and activities that required them to think critically and work cooperatively to achieve success.*
>
> *The curriculum was outstanding, and the projects the students completed were quite impressive. There is also a great deal of interest in the program, as well as math and science in general.*
>
> *This school year, we have seen an increase of students that participate in the program making more growth in mathematics.*
>
> *Our greatest success is the influence IMSA FUSION has had on other teachers in our school.*
>
> *It imparted my two instructors with more knowledge concerning hands on math and science activities. It provided consistent hands on instruction for students and has made the students who were exposed to this program excited about learning math and science.*

The greatest success was watching the fourth and fifth graders have a hands-on science experience like this! Our teachers were amazing working with these kiddos and they were able to differentiate the experiences for their sixth, seventh, and eighth graders in their general science classes. So many great things!

The students and teacher who participated in IMSA fusion also participated in another local district program and won 1st place in a local competition and are going on to the state competition.

Students often share the experiences with parents and have also demonstrated improved understanding in classroom lessons as a result of the IMSA program.

The students and families talk more about science and math. The students can't wait until Wednesday.

The generated interested in math and science with our non-Fusion students because of what they see going on.

Our embedded program allows for us to reach many more students who need enrichment in math and science. We have enjoyed piloting the new flight unit for 8th grade.

Inclusion of non-Honors students in the after school program; these students excelled in the hands-on format and cooperative setting of the FUSION lessons.

Collaboration between students and inquiry based learning.

Great exposure to hands-on activities eliciting inquiry and engagement.

IMSA FUSION has provided a multitude of outstanding experiences for our students. Not only has it been a wonderful extracurricular activity, but it has also been a great resource for providing enrichment activities for well deserving and capable students.

A student engaging with STEM related activities, outside of the confines of the regular day, feels like success for me!

Giving the students the opportunity for exploration and discovery beyond the classroom.

Challenges identified by the principal respondents included securing funding for the program including for field trips and transportation, and selecting students when more students are interested in participating than the program is able to enroll.

Examples of how IMSA Fusion could further support respondents in their roles as principals included helping them identify strategies for integrating more STEM content and pedagogy into the regular day curriculum; allowing additional teachers in the schools to attend Fusion professional development held during the school year on STEM teaching strategies; bringing together teachers and principals from Fusion programs around the state at meetings of professional associations to discuss how each site selects

students (i.e., criteria) and implements its Fusion program; and helping school promote the program to students, parents, and the community.

Table 4: Principal Level of Agreement with Statements about IMSA Fusion Programming

Statement n=41	Strongly Disagree	Disagree	Agree	Strongly Agree	Do Not Know	Mean
Students in my school have developed deeper **interest** in **mathematics** because of IMSA Fusion.	0%	0%	**44%**	**49%**	7%	3.53
Students in my school have developed deeper **understanding** in **mathematics** because of IMSA Fusion.	0%	0%	**34%**	**56%**	10%	3.62
Students in my school have developed deeper **interest** in **science** because of IMSA Fusion.	0%	0%	**32%**	**61%**	7%	3.66
Students in my school have developed deeper **understanding** in **science** because of IMSA Fusion.	0%	0%	**27%**	**66%**	7%	3.71
IMSA Fusion has offered students who typically do not participate in mathematics and science activities access to STEM programming.	0%	7%	**29%**	**59%**	5%	3.54
My school now places more emphasis on **science** instruction in the school overall because of IMSA Fusion.	0%	17%	**50%**	**33%**	0%	3.15
My school now places more emphasis on **mathematics** instruction in the school overall because of IMSA Fusion.	0%	20%	**40%**	**38%**	2%	3.18
Fusion teachers in my school have enhanced their regular classroom instruction because of IMSA Fusion.	0%	2%	**20%**	**68%**	10%	3.73
Fusion teachers in my school have sought out additional professional development opportunities in STEM disciplines because of IMSA Fusion.	0%	5%	**39%**	**41%**	15%	3.43
Fusion teachers have sought out opportunities to serve as instructional mentors in STEM disciplines to their peers in my school because of IMSA Fusion.	0%	15%	**34%**	**39%**	12%	3.28
Parents of students in the program are more interested in their children's achievement in **mathematics** because of IMSA Fusion.	0%	2%	**44%**	**32%**	22%	3.37
Parents of students in the program are more interested in their children's achievement in **science** because of IMSA Fusion.	0%	2%	**49%**	**27%**	22%	3.31

Aggregate Summary IMSA Fusion Parent Surveys

This section of the report summarizes the IMSA Fusion parent surveys collected in spring 2015. Parents/guardians across the 133 program sites (operating in academic year 2014-2015) were asked to complete a brief survey through an online software program or in paper form. Parents/guardians were given approximately 16-20 weeks to complete the survey (early January through May 30, 2015). Both English and Spanish language versions of the parent survey were provided to all sites. CEEP researchers analyzed the survey responses using SPSS software.

Four-hundred-and-six (406) parents/guardians completed the survey, across 49 program sites. They reported that 19% of their children were in fourth grade, 27% in fifth grade, 18% in sixth grade, 20% in seventh grade, and 16% in eighth grade. Respondents estimated that 65% of their children attended all of the FUSION sessions during the 2014-2015 school year, 33% attended at least 75% of the sessions, 1% attended at least 50% of the sessions, and 1% attended less than 50% of the sessions. Eighty percent of respondents plan on having their child(ren) attend the IMSA Fusion program during the 2015-2016 academic year.

Parents/guardians were asked to rate their level of agreement with a set of statements about the IMSA Fusion program (See Table 5). No fewer than 84% of respondents **agree** or **strongly agree** with each of the statements about the IMSA Fusion programming. The statements with the highest mean were *The IMSA Fusion program is a valuable part of my child's learning experiences* and *I think that IMSA Fusion should be a permanent part of the afterschool programming at my child's school* (mean = 3.73).

Parents/guardians were also asked why they choose to have their child(ren) participate in the Fusion program. Responses included that the program provided advanced, hands-on learning opportunities in mathematics and science, not otherwise available in the regular classroom curriculum; to nurture their children's interest in mathematics and science and confidence in learning; to have the opportunity to interact with peers with similar interests and gain social skills; and to learn real world problem solving and critical thinking skills. Illustrative examples are provided.

> *We had an older daughter who had experience with it, and she loved it.*
>
> *My child wanted to apart of the program because she heard all about the program from previous students who loved it.*
>
> *I chose to have my child participate in this program because a teacher at my child's school recommended my child Also I wanted her to like math.*
>
> *My daughter benefits from the challenge she gets from extension and hands-on activities provided through FUSION.*
>
> *She has been in IMSA Fusion since 4th grade, where she learned about being nominated, fulfilling requirements, and earning her way to a coveted spot on the "team." Once she reapplied for 6th grade & made it, we knew she was completely aware of her abilities and strives to do her best to learn and share what she's learned with others. She has taken great interest in learning*

about particular fields of science and appreciates her Fusion teachers who take the time to help them to appreciate science (and math) more.

My child has always demonstrated a deep interest in science and I believe students need more hands on learning activities such as this program offers.

I feel science is very important in education at a young age. Due to time restrains, science is not as in depth as it could be.

I let my child participate in IMSA because I saw a sudden change in my child's love for math and science at the beginning of the year.

We chose to have our son participate because he was invited and he has an interest in Math and Science and going into a career in the engineering field.

He expressed an interest in the IMSA Fusion program. There was almost no way that I would have prevented him from exploring his interest in mathematics or science.

I wanted him to be part of a higher level of academic experience, an extension to his current curriculum and being part of a group of students with the same math and science interests.

I was excited about the opportunity for him to practice thinking skills and also skills related to solving problems as a group.

I thought it would be a good opportunity for him to learn more about things they do not focus on during class time. It was a good opportunity for him to do experiments with other kids from his school.

We had him participate mainly for the science aspect as that is a favorite subject of my son's. He also needs additional socialization with kids like him since he is not into sports as extracurricular activity.

I knew that my child had a lot of potential in math and science, but she lacked confidence. Before participating in IMSA, she made statements that math and science were hard for her. I wanted her to have hands-on experiences in math and science because I thought that a hands-on approach deepen her understandings of math and science concepts and increase her interest and confidence.

Excellent topics with excellent instructors. The instructors knew their information and made it very interesting to the children. The instructors were able to keep up at the pace of these kids and keep it motivating and organized for learning.

FUSION is providing my child with a deeper learning experience. His interest in math and science has noticeably increased and he is seeking out "science experiments" at home. FUSION has been a great dinner conversation piece as well!

My son has always enjoyed running different experiments to find answers to all sorts of problems. He also has strong math skills, so it was interesting watching him put science and math together for once.

My child has siblings who have previously participated in the Fusion program and have had positive experiences. I also wanted my child to have more practice and understanding of how science and math are linked.

The program provides opportunity for the child to experience math and science in a way that goes beyond just the state standards expectations to a real world scientific and mathematical context and application.

Math and Science are the core competencies to all careers in the future. Also this would help her to understand and develop important skills for use in the future. The Engineering field lacks females and this program helps to get females excited about math and science and real-world applications for their future.

It helps problem solve in a real world sense. It fuses book learning to practical applications and that not only strengthens, but enhances my son's inquisitiveness and desire to learn. This is a fantastic and a fun way to complement a child's learning of math and science. This program has helped teach my son to think through a problem and solve it.

I believe the Fusion program not only develops a child's interest and is educational but it also provides a child to become self-confident in their ideas. I strongly believe the Fusion is an all-around benefit to the children who participate -- qualities of self-esteem, adaptability, team work and of course education all qualities that will be desirable in the work force.

When asked to describe strengths of the Fusion program, respondents noted the hands-on, experiment-focused curriculum; the enjoyment and enthusiasm demonstrated by students in learning about mathematics and science; the supportive environment for students interested in mathematics and science; the collaborative and critical thinking skills gained by students; and the talented instructors. Illustrative examples are provided.

Increasing our child's interest in math and science while having fun.

Fun; let me explain - selected projects showed kids that science and math are not only rules and laws but there is a lot of fun that stimulates curiosity and further involvement of kids in math and science.

The activities are very engaging and educational. My child looks forward to IMSA and is always excited to tell me about what she has done and what she has learned.

I think the hands on exploration and inquiry was very strong.

They have cool projects to get the kids involved and thinking outside of the box.

The program exposes the kids to outside the box thinking. Which I think is a key attribute to develop early in life.

IMSA offers interesting, hands-on learning experiences that draw kids into a deeper interest in math and science.

Gives the student more hands-on math & science experiences that are more challenging than the regular school curriculum.

The program has many strengths; one valuable strength is the fact that it consistently provides hands-on experiences (both in the classroom and via field trips).

Interactive learning, projects and field trips expands child knowledge of science and math in a fun way; increases socialization with peers.

Opportunity for my students to socialize and learn with increased depth with students who are like-minded.

It challenges the kids that might not get challenged in the "normal" classroom.

A program to help develop social skills of children, who are gifted with abilities that could sometimes be mocked in school. It helps to encourage them to continue with their studies and shows them there are others like them. It also helps them understand it is OK to be intelligent and that they are not alone.

A learning environment that prioritizes problem solving and understanding how things in the real world work.

The projects had the students working in groups to solve problems. It created great working skills.

I'm not very familiar with the program since this is my child's first year but if another parent's child was interested in science I would definitely tell them to enroll in this program. My child seems to enjoy it.

Enhancing child's problem solving skills and self-confidence

Exposing young girls to what Math and Science are used for in Engineering.

It gives the kids time to actually apply science and math to everyday life at a younger age.

They are discussing and understanding science and math topics that usually aren't covered until high school

The instructors are wonderful.

The most valuable learning experiences for children identified by parents/guardians included having students working in teams; solving problems through critical thinking and discussion; gaining a greater interest and appreciation of STEM content and careers; the interesting, hands-on experiments across a variety of topics; and social and life skills. Illustrative examples are provided.

Working in a group or team environment has helped him handle these situations in other classes.

My child really enjoyed the group projects and interacting with the other students to solve math and science problems.

Socializing and interacting with peers who are the same level as her. Learning and working as a team to accomplish goals.

She has been excited about each session. As a family we enjoyed working together to make a boat at the family night.

She really developed a deeper love for math.

My son has gained deeper insights into the math and science used in everyday life. He wants to attend summer camp at IMSA. I can see his deeper understanding of math and science leading to a deeper desire to learn more.

That math and science go hand in hand. With the new Common Core learning system in the schools, science and social studies seem to be taking a back seat. My daughter likes to see how both math and science are part of the real world.

Has developed a passion for aviation and the engineering behind it.

My daughter has enjoyed the engineering projects (being presented with a problem and constructing/testing solutions).

She is experiencing science and math through new outlets such as electronics and engineering.

He's become more confident with his thinking.

My son learned to challenge himself.

I think she learned to ask questions.

Exposure to challenges in critical thinking.

The steps of problem solving. That it is okay to try something to see if it works (experiment). He learned that not all of his ideas worked but it was good for him to try to make them work.

I think it was when she found out that there were other ways to explain and show her work as well as thinking in different ways.

Not everyone gets in, so when you make it, it's important to make the best of it.

The possibilities of these lessons extending into their future schooling or possibilities; deeper understanding of career choices that include math and science.

One of the most valuable things is the multitude of field trips and the experiences they provide. Children are able to discuss things with experts in their field.

Actually it isn't math or science related. Our program is before school. He is unable to take the bus so in order for him to attend we have to drive him. He was not prepared to leave on time and as a result missed part of the activity. He came home that afternoon and told us IMSA FUSION is too fun and too important to him to be late again. This was a valuable lesson in time management and his change in habits has made our mornings less stressful!

When asked to describe one thing they would change about the Fusion program, parents/guardians mentioned expanding the program to provide the opportunity for more students to participate and across more grade levels; integrating more mathematics into the curriculum; and occasionally providing a brief newsletter or list of topics (to be covered in the curriculum) to parents.

Table 5: Parent Level of Agreement with Statements about IMSA Fusion Programming

Statement n=406	Strongly Disagree	Disagree	Agree	Strongly Agree	Do Not Know	Mean
My child developed deeper **interest in mathematics** because of IMSA Fusion.	3%	8%	**43%**	**41%**	5%	3.29
My child developed deeper **understanding in mathematics** because of IMSA Fusion.	2%	4%	**43%**	**46%**	5%	3.39
My child developed deeper **interest in science** because of IMSA Fusion.	2%	3%	**30%**	**63%**	2%	3.57
My child developed deeper **understanding in science** because of IMSA Fusion.	2%	1%	**31%**	**64%**	1%	3.60
IMSA Fusion provides meaningful afterschool experiences for my child.	1%	1%	**21%**	**73%**	3%	3.68
The IMSA Fusion program is a valuable part of my child's learning experiences.	2%	1%	**20%**	**75%**	2%	3.73
My child's overall social experience in the IMSA Fusion program has been satisfactory.	2%	1%	**28%**	**67%**	2%	3.63
Expectations for my child in the IMSA Fusion program were reasonable and appropriate.	2%	1%	**25%**	**70%**	2%	3.67
IMSA Fusion staff communicated effectively with parents.	4%	4%	**29%**	**60%**	3%	3.50
I would recommend IMSA Fusion to other parents and students.	2%	1%	**21%**	**74%**	2%	3.71
I think that IMSA Fusion should be a permanent part of the afterschool programming at my child's school.	2%	1%	**17%**	**76%**	3%	3.73

Aggregate Summary IMSA Fusion Student Surveys

This section of the report summarizes the IMSA Fusion student surveys collected in spring 2015. Students across the 133 program sites (operating in academic year 2014-2015) were asked to complete a brief survey through an online software program or in paper form. Students were given approximately 16-20 weeks to complete the survey (early January through May 30, 2015). CEEP researchers analyzed the survey responses using SPSS software.

One-thousand-eight-hundred-ninety-one (1891) students completed the survey, across 92 program sites. Of those respondents that identified their gender, 51% (953) were female and 49% (937) were male. Sixteen percent (299) of students were in fourth grade, 22% (417) in fifth grade, 23% (441) in sixth grade, 22% (406) in seventh grade, and 17% (328) in eighth grade.

Students were asked to rate their level of agreement with a set of statements about the IMSA Fusion program (see Table 6). No fewer than 77% of respondents **agree** or **strongly agree** with the statements about the IMSA Fusion programming. The statements with the highest level of agreement (98%) were *I think understanding mathematics and science is important to the world's future* (mean = 3.69) and *I think mathematics and science are useful subjects to know* (mean = 3.68).

Seventy-eight percent (1465) of students plan to participate in IMSA Fusion during the 2015-2016 academic year. For those respondents who do not plan to participate, their reasons included not enjoying Fusion this year and not wanting to continue in the program; transferring to another school that does not have a Fusion program; enrolling in high school; or pursuing sports and hobbies that conflict with the schedule of the IMSA Fusion program.

Ninety percent (1605) of respondents would recommend the Fusion program to their friends. For those respondents who would not recommend the program their reasons included that they themselves had not enjoyed Fusion this year; there we not enough hands-on activities in the program that were interesting; their friends were not interested in mathematics and science and thus would not likely enjoy the program; or their friends were already involved in alternative afterschool activities including sports, hobbies, and clubs.

Respondents noted that learning math and science in Fusion is different than learning math and science in their classes because of the use of interactive hands-on experiments, the integration of mathematics and science in the same activity/lesson, and more complex and in depth learning within mathematics and science topics. Students also noted increased interactions with peers and working in groups in Fusion. Illustrative examples are provided.

> *Fusion is different because it is more advanced and creates a diverse learning environment which lets students like me learn to work with others as well as approach mathematics and sciences with a new look.*
>
> *Learning math and science in math in fusion is different than learning it in regular classes because we are working together and are not getting graded on this after school activity.*

It's different because we all get share are opinions and sometimes we as students work together to figure something out.

Learning math and science in IMSA is different because I think it is more interesting and fun with all the activities we do. Also we work with other people from different grades.

IMSA Fusion is a better learning experience because this takes it to the next level. In our classes we have advanced classes, but this is like taking it to the next grade, speaking of which, we work with other grade levels, and people from others schools. In our normal classes we have to have a limit of the extensions and experiments to what we can do, but in IMSA we can do more learning experiments and calculations than people not in IMSA are able to do.

In class we learn about rocks and minerals for science, in IMSA we use science to learn about circuits and electricity. In class we learn about whole numbers and converting measurements, in IMSA we use math to figure out a distance or something.

In Fusion I learned more about science; also being in [it] has made me become more appreciative of math. I understand math a little more because of the fusion class.

It helps me understand more science words than before. I feel better when I do math in IMSA.

We actually do the science and don't just read about what we are doing.

In Fusion, we can do more experiments and games that relate to math or science instead of just reading a textbook for information.

Learning math and science is different from learning in class because it focuses on a more hands-on approach to things. In class, we focus more on tests and worksheets, while IMSA mixes things up.

In IMSA Fusion, the material is different than concepts that we learn in class. The activities in IMSA are more hands-on while in your daily mathematics and science class, it is learn the lesson, practice, then [do] homework.

Learning math and science in Fusion is different than learning math and science in my classes because in Fusion we learn things in a more fun way. We get to do a lot more experiments and get to try different things - which makes learning more fun.

It is different because we use more hands on learning rather than doing worksheets or learning from a textbook. It is more fun and appeals to my interests, I like hands on learning. It makes learning more fun!

Learning math and science in Fusion is different than learning math and science in my classes because it is more hands-on. In IMSA for science we had many experiments that would be different in my normal science class. Since there are two teachers, each student is able to make sure they understand the lessons. In IMSA math, we do more math while doing something for science as well.

Learning math and science in IMSA is totally different from learning science and math in class because in IMSA, the science we learn is always somehow related to math. In science class, we learn about the solar system, ecosystems, and plant life etc. but in IMSA, everything that we do has a different part that involves math and it makes it a lot more interesting and fun. We also learned more advanced stuff that we would not normally learn or talk about in science class.

Table 6: Student Level of Agreement with Statements about IMSA Fusion Programming

Statement n=1891	Strongly Disagree	Disagree	Agree	Strongly Agree	Mean
Because of Fusion I am more **interested in mathematics**.	4%	19%	**52%**	**25%**	2.99
Because of Fusion I better **understand mathematics**.	3%	19%	**49%**	**29%**	3.05
Because of Fusion I am more **interested in science**.	2%	10%	**38%**	**50%**	3.36
Because of Fusion I better **understand science**.	2%	9%	**46%**	**43%**	3.31
The Fusion program was a good learning experience.	2%	3%	**31%**	**64%**	3.57
The Fusion program was fun.	3%	8%	**28%**	**61%**	3.46
I think understanding mathematics and science will be important to me in the future.	1%	2%	**25%**	**72%**	3.67
I think understanding mathematics and science is important to the world's future.	1%	1%	**25%**	**73%**	3.69
I think mathematics and science are useful subjects to know.	1%	1%	**26%**	**72%**	3.68

Summary of IMSA Fusion Site Observations

This section of the report summarizes data collected by IMSA Fusion site observers as of May 31, 2015 using the observation tool developed by the Center for Evaluation and Education Policy at Indiana University for use in the 2014-2015 academic year. The observation tool serves two purposes: (1) as a formative feedback process provided by the site observers to the IMSA Fusion instructors (teachers) on the nature and quality of their implementation of the Fusion curriculum; and (2) as a data source for the overall evaluation of the IMSA Fusion program. Typically each site is observed 1-2 times during an academic year by an IMSA Fusion site observer.

General demographics are provided on the observations entered by the Fusion site observers into the CEEP electronic database as of May 31, 2015. Aggregate observer ratings across eight program areas and overall fidelity are summarized, as well as examples of observed evidence noted by the observers. A table of descriptive statistics for the eight program areas is also provided in this section of the report.

One-hundred-and-forty (140) observations were entered into the CEEP *Qualtrics* online survey database, representing 122 of 133 Fusion programs. The time span in which these 140 observations took place is September 9, 2014 through April 24, 2015.

Sixty-one observations were of the 4-5th grade program and 79 were of the 6-8th program. Five different units were observed in the 4-5th grade program and six in the 6-8th grade program (see Table 7). Twenty-two observations were of teachers who had taught their observed Fusion unit before, 110 were of teachers who had not taught the unit before, and in eight observations the teachers' experiences with the units were unknown.

Table 7: Fusion Units Observed

4-5th Grade Curriculum	6-8th Grade Curriculum
Climate Change: The Future is Now (7 observations)	Secret Communications: Sharing Concealed Messages (6 observations)
Electric Expressions (6)	Take Flight: Investigating the Aviation Industry (19)
Engineering: Design & Build (22)	From Butterflies to Weather: Finding Order Amid Chaos? (11)
Now You See It, Now You Don't: The Electromagnetic Spectrum (2)	Rock 'n' Roll: Tectonics and Seismicity (6)
You Be the Judge (23)	Twisted and Tangled: Making Sense of Your Senses (12)
	MEDIEVAL: STEM Through the Middle Ages (25)

Summary of Observation Rubric Program Areas

The observer ratings and examples of observed evidence for overall fidelity and across the eight program areas provide an overview of the current extent to which the IMSA Fusion PD Training and curricular units are being implemented as designed. Seventy-three percent of observations were rated as *High Fidelity* (102 out of 140).

The expectation of IMSA Fusion staff members is that all sites should work toward achieving a rating of Reasonable Evidence (rating =3) on the observational scale for all eight program areas. Those sites that demonstrate extraordinary quality in a given area receive a rating of Exceptional Evidence (rating =4).

Across the eight program areas, the percent of observations that received a rating of *Reasonable Evidence* ranged from 40% to 65%. For a rating of Exceptional Evidence the range was 39% to 55%. Between two and twelve percent of observations received a rating of *Limited Evidence*; the area with the highest percent of *Limited Evidence* rating was *Area 7: Inquiry and Problem Solving* at 12%.

Fidelity. Seventy-three percent of the observed lessons were rated as *High Fidelity* (102 out of 140). Three of the observed lessons received a rating of *Little or No Fidelity*.

Table 8: Fidelity Mean = 2.71

Little or No Fidelity 1	Moderate Fidelity 2	High Fidelity 3
There is little or no evidence that the unit/lesson has fidelity to the IMSA Fusion design.	There is moderate evidence that the unit/lesson has fidelity to the IMSA Fusion design.	There is consistent evidence that the unit/lesson has fidelity to the IMSA Fusion design.
2% **(3)**	**25%** **(35)**	**73%** **(102)**

Description: The extent to which the Unit/Lesson demonstrated Fidelity to the Fusion curriculum design.

Observed Evidence:

These instructors have been with Fusion for a long time. They work well together and get the curriculum! They did a great job of presenting the day's challenge - find a path through Illinois without retracing any pathway! They also did a great job of helping and encouraging the struggling students, while letting the students who were more able work independently.

Throughout the lesson the teachers maintained high fidelity to the goals and objectives of the lesson. At the beginning of the lesson the teachers state the goals and objectives to allow the students to grasp an understanding of what they would be doing in the lesson. Throughout the lesson the teachers asked to students to relate the activity to the goals and objectives.

The instructors followed the designed procedure from the professional development workshop. They were very good about reminding the students about wearing safety goggles and following the procedure. They made sure that all groups had the correct labels on the baggies and went over the procedures before turning the groups loose to do their own experiment. (This is a great activity to watch!! The students are very excited by the results!)

The teachers brought high fidelity to the lesson through their effective implementation of the strategies that they learned at the professional development session. The lesson incorporated all the goals and objectives as outlined in the lesson guide. The activity for the *Topsy Turvy* lesson met the goals and objectives developed by the writers. The teachers held high fidelity to the objectives throughout the lesson. The development of the prototype and its functionality were reflected and discussed by the students throughout the entire two hour site visit.

The lesson followed the guidelines and the objectives as designed by the writers of the unit. The teachers implemented the teaching strategies that learned at the professional development session held in the summer. They also incorporated additional information/video from research that they had done online about buoyance for demonstrating the concept to the students.

Scenario read to students...sequencing of activities greatly aligned to design of lesson. Teacher has very good command of questioning techniques. I would have rated this lesson as "high fidelity" but the sessions are only 40 minutes in length, and as a result, the lesson felt "chopped up". It took me multiple sessions to observe most of this lesson. Teacher is teaching the entire year by herself.

One of the teachers was not trained in this unit. It showed. The teacher that led the lesson seemed to go off track and her partner could not jump in and help. Kids were confused.

The activity followed the Fusion design and pedagogy. During professional development, the teachers were encouraged to add things to the curriculum. The teachers at Gray did that, setting a tone for the day's medieval activities. The activity was completed within the time scheduled. There was ample time remaining to debrief the activity and start work on the next activity by cutting out game pieces.

The teachers used a "hands-off" pedagogy for the lesson, quite similar to the teaching that was demonstrated at the professional development. Students reviewed the directions for the activity and in small groups were allowed to design, and then build their coasters. While students were building and testing their coasters, the teachers moved from group to group, helping is asked, questioning what was being done and what the students might change to improve the coaster. The activity was completed in time for a debrief of the designs and a review of points of kinetic and potential energy.

The lesson was well orchestra with the students heavily engaged inquiry as per the goals and objectives of the unit. Students had limited prior knowledge of what crystals are. The teachers skillful guided the student inquiry to discover what they were. The teachers incorporated strategies that they acquired at their professional development.

Teachers not only followed our curriculum, but followed the pedagogy as well. The teachers also added materials that enhanced the lesson. When working with the students, teachers allowed the students to answer questions and let them build their own knowledge. Teachers asked good follow up questions, but did not give students answered. Also, while the students tested their designs, teachers asked good questions and did not just provide tips for better designs.

Area 1: Preparation, Organization, and Implementation. Forty percent of the observed lessons were rated as *Reasonable Evidence* (56 out of 139) in *Area 1: Preparation, Organization, and Implementation*. Fifty-five percent of the observed lessons were rated as *Exceptional Evidence* (76 out of 139) in *Area 1*.

Table 9: Preparation, Organization, and Implementation Mean = 3.49

No Evidence 1	Limited Evidence 2	Reasonable Evidence 3	Exceptional Evidence 4	Not Observed
There is little or no evidence that the instructor(s) is/are prepared and deliver(s) the activities in an organized manner.	There is limited, inconsistent evidence that the instructor(s) is/are prepared and deliver(s) the activities in an organized manner.	There is clear evidence that the instructor(s) is/are prepared and deliver(s) the activities in an organized manner.	There is consistent and compelling evidence that the instructor(s) is/are prepared and deliver(s) the activities in an organized manner.	**0%** **(0)**
1% **(1)**	**4%** **(6)**	**40%** **(56)**	**55%** **(76)**	

Description: The extent to which the instructor(s) appropriately plan, prepare, and implement the curricular activities.

Evidence includes having full sets of instructional materials readily available for all participants (e.g., copies of instructions and worksheets); equipment has been cleaned, checked for all pieces/elements, and is fully operational; and disposable materials are organized at workstations. Instructors act as co-teachers, sharing responsibility for the organization and delivery of instruction; present activities in a logical order with smooth transitions between activities; make efficient use of time; and adapt and accommodate to changes in the learning environment as needed. Classroom management minimizes distractions, disruptions, confusion, or boredom for students.

Observed Evidence:

Because they are veteran Fusion teachers, these teachers had their materials ready to go and the students had folders where they kept their Fusion materials from week to week. Snack time had a defined time slot and then they moved on! There was no waiting or wasting time!

These teachers had all their materials and were ready to go. It is hard for them because they meet in the middle school science lab - where neither of them teaches! So, they have to set up the room as the students are having a snack. But, they have everything ready and are very efficient. There is a water source in the room, tables to work on and the hallway outside to spread out if needed. The computer lab is in another area if they want to use that.

These teachers are Fusion veterans. They are also very organized classroom teachers. All the materials were on a tray ready for the groups. The folders for each student are saved from week to week and the students had their investigations from before. One teacher oversees snacks and attendance while the other sets up the equipment and folders in the meeting room. Very organized.

Advanced organizer posted to wall (both classrooms) listing unit goal and flow of unit and activities -- reviewed at start by teacher. Materials in place, desk in place, class was “walk in” ready when teacher and students arrived (done early in day) NOTE: Due to time constraints (1.5 hours for 6th and 1 hour for 5th, adjustments made to activities to allow students to do observation, measurement, and reflection (Note: 5th Graders given less time to measure in favor of moving into sharing of observations, and relevance/reflection discussion).

The teachers were well prepared for the lesson. All materials were organized for easy access by the students. There is a definite classroom management implemented for the Fusion session. Students are held accountable for following the protocol. This observer could tell that this protocol started on day of the program in the fall. The protocol helps assist in the successful implementation of the lesson's activity. Remember these are 4th and 5th graders whose concentration is quite limited in the length of time that they can focus on something. Management is a must. All materials and equipment were laid out prior to the students entering the cafeteria for the lesson and activity. A definite order was established by the teachers for students to select materials and equipment needed for the activity to avoid and confusion. Teacher that was not trained in Fusion did not seem to have gone over the lesson on [his/her] own. They were not as ready as they could have been. Partly due to the fact that they are using someone else's classroom and cannot set up ahead of time. Teacher preparation was definitely evident throughout the lesson. All materials were arranged and placed on a table prior to the entrance of the students to the classroom. The materials were laid out in the order of sequence for the activity so that students were able to select appropriate materials for the activity. The teachers implemented a plan of action for the students to complete the activity successfully and in the time delegated for the activity. The materials for this part of the snowflake lesson were prepared before the session. The only disruption in the session was the move to the computer lab from the classroom in which the group usually meets. The computers worked well, no crashes, no frozen screens. Though the group meets for 75 minutes, the time was sufficient for this part of the activity to be completed. The only distractions for the students were other students sharing some of the pictures of snowflakes that they had found. These were good disruptions. The coded clues had been prepared and organized well before the start of the day's session. The clues had been placed in envelopes and, with the cooperation of several teachers, placed in rooms during the school day so there was no need to use time from the session to hide the clues. The teachers moved from room to room as students hunted for the clues and then deciphered them. Assistance was provided only when the students seem to be stumped in deciphering the clues. The students raced from room to room, trying to be the wining team. The competition played a part in the student engagement with the activity. The teachers had all materials ready prior to the students entering the room for the session. Classroom management is well organized with students having specific jobs to assist in the successful distribution of materials for the activity. The teachers implemented the activity effectively and employed strategies that they acquired at the professional development seminar for the unit.	

Area 2: Use of Facilities, Space, and Equipment. Sixty-two percent of the observed lessons were rated as *Reasonable Evidence* (86 out of 139) in *Area 2: Use of Facilities, Space, and Equipment*. Thirty-five percent were rated as *Exceptional Evidence* (48 out of 139) in *Area 2*.

Table 10: Use of Facilities, Space, and Equipment Mean = 3.31

No Evidence 1	Limited Evidence 2	Reasonable Evidence 3	Exceptional Evidence 4	Not Observed
There is little or no evidence that the space is utilized in a manner that is conducive to STEM learning.	There is limited, inconsistent evidence that the space is utilized in a manner that is conducive to STEM learning.	There is clear evidence that the space is utilized in a manner that is conducive to STEM learning.	There is consistent and compelling evidence that the space is utilized in a manner that is conducive to STEM learning.	**1%** **(1)**
1% **(1)**	**2%** **(3)**	**62%** **(86)**	**35%** **(48)**	

Description: The extent to which the facilities, space, and equipment are conducive to STEM learning.

Evidence includes ample space that allows for student movement, working in groups, hands-on activities, and peer discussions; appropriate use of science instruments and expendable materials; and access to technology to research, document, analyze, and/or communicate information. Safety procedures are in place and followed by students and instructors.

Observed Evidence:

This is a very nice science lab, with desks in the front and lab space in the back. Even though this activity did not need a large area, others will, and they had plenty of room. In addition, computers are readily available and there is a water source and tables to work on.

Program is held in the cafeteria. Students do some work seated at round tables and other work on the floor in small groups. The tables seem to be of great use for opening and closing activities. The students don't seem to mind doing their work on the floor and often spread out their supplies.

This group meets in a typical elementary classroom. There is no water supply in the room. The students have computers on a cart to use when needed. When extra room is necessary, they can use the hallways and the library. The students all wore their safety goggles when experimenting with the plastics.

This group meets in a classroom in an older building. There is not a water source in the room. There is a smart board and computers are available for the students to use. As they meet after school, the hallways are available if they need to expand.

The classroom was formerly a home economics room. Students worked at large tables and were able to put their backpacks and coats in an adjacent room. The only drawback was insufficient space for teachers to walk around and visit individually with students.

The teachers relocated this activity to the school's cafeteria instead of their classroom because of the need to use water troughs for the floatation of the boats. The ample size of the cafeteria allowed students to move about freely without disrupting other groups of students during their boat floatation trials. The space and equipment met the needs of the activity.

The room tables were arranged to encourage teamwork. Computers were available, though they were not used during this activity. There was more than enough space for students to move around to gather material for this activity. At times, some lines did develop while students were filling their chemplates but few disruptions developed in the line. Safety rules were reviewed and goggles were consistently worn during the testing part of the activity. Two sinks with running water were part of the facilities in the room in which Fusion meets. With water playing a role in the activity, in was nice to be able to fill cups and dispose of then used water with limited student movement. No spills anywhere! Desks had been arranged to improve collaboration. They were spaced apart far enough to allow for student and teacher movement between the groupings. One student had asked which side to use and another replied that because this was science he was to use centimeters. Indeed,, they used metric measurements. Students followed safety procedures when filling, carrying and emptying water. Desks were arranged in a manner that encouraged collaboration. There were a sufficient number of computers for group use. Computers had to be reconnected to the school's wifi system, something which the students were able to accomplish with little lost time. Safety procedures were posted but did not come into play during this session.	

Area 3: Appropriate Participation and Team Work. Forty-two percent of the observed lessons were rated as *Reasonable Evidence* (59 out of 140) in *Area 3: Appropriate Participation and Team Work.* Fifty-five percent were rated as *Exceptional Evidence* (77 out of 140) in *Area 3.*

Table 11: Appropriate Participation and Team Work Mean = 3.52

No Evidence 1	Limited Evidence 2	Reasonable Evidence 3	Exceptional Evidence 4	Not Observed
There is little or no evidence that students are appropriately participating in the activities.	There is limited, inconsistent evidence that students are appropriately participating in the activities.	There is clear evidence that students are appropriately participating in the activities.	There is consistent and compelling evidence that students are appropriately participating in the activities.	**0% (0)**
0% (0)	**3% (4)**	**42% (59)**	**55% (77)**	

Description: Extent to which students appropriately participate in individualized, paired, and team-based activities.

Evidence includes students following directions and guidance from the instructor(s) and/or curricular materials, staying on task, conducting individual and group hands-on experiments/activities, and completing observation/documentation activities (journals, observation logs, worksheets, etc.). Students constructively work together and share ideas and findings. Interactions among students and between the instructor(s) and students are consistently positive, creating a supportive and friendly learning environment.

Observed Evidence:

This activity was a great teamwork builder! It was great for an activity near the beginning of the school year and the beginning of Fusion activities! All the students had to work together to complete the maze, follow the discoveries made by the previous maze "try-er" and support one another in their efforts. These students were very positive and helpful -- no one was critical of their teammates. It was a very positive session.

The majority of students were actively involved in teamwork activities. Some students were more excited and expressed a deeper level of interest and diligence than others. For the most part, team responsibilities were shared.

The students are assigned to groups, where they discuss and help one another. In this activity, they were working individually on creating the Koch Snowflake. This involved following directions, understanding the directions, and some fine motor skills of folding and cutting. Students helped one another "keep up" and get the paper folding correct! When they were analyzing the geometry and the perimeter of the shape, they had lively discussions in their groups.

The students worked in teams to plan their investigation, then to conduct it! They had used colored plastic strips to investigate the physical properties of plastics. They had a data table describing how each plastic behaved when tested (folding, touch, mass, scratching with a paper clip, floating, etc.) The new set of plastics was different colors than the ones in activity 1, and the students had to perform selected experiments on the new plastics to determine what they were. The students did a great job of planning and carrying out their plans! All of the students were very focused and supported one another. The teams worked well together and got the job done!

These student groups worked very well together. Some got right to it and were pacing themselves quickly. Other groups spent more time in discussion, but soon got busy with the actual experimentation. I was impressed with their independence! Although the teachers were circulating, they did not "help" much - the students knew what they wanted/needed to do and did not need help from the instructors! The teachers employed team teaching strategies throughout the lesson. When one is teaching the other is circulating among the students and facilitating when and wherever possible. These are veteran teachers who have developed a collegial team teaching strategy to implement during the instructional part of the lesson. They have also encouraged and guided their students to become team members through their examples as co-teachers. This is the first year for these two teachers to do IMSA Fusion. The collegiality they showed during this observation would make one think that they had been doing this program for a few years. The students as well worked well together because of the modelling the teachers did with regards to teamwork and the success it can bring to a group. Too much direct instruction and leading the group. Overly formally style. This caused kids to become bored and passive. Occasionally kids worked as a team. Off task and talking. Students were highly motivated and engaged. They followed directions, sought guidance when unsure, and asked lots of great questions. It was evident that they were working cooperatively and strategizing how they could minimize cost and weight of supplies. Very friendly, positive learning environment. Great relationship between teachers and students! “Illuminating the Journey Ahead” is one of the few individual activities in the Fusion program. Most of the students were engaged in the completion of their “letters” and were also interested in what other students were including in their “letters.” There were numerous questions for the speaker. Surprisingly, the questions that were asked were not repeatedly asked. There were a few questions that focused on clarifying the given answers. The students were an attentive audience. “Illuminating the Journey Ahead” is one of the few individual activities in the Fusion program. Most of the students were engaged in the completion of their “letters” and were also interested in what other students were including in their “letters.” There were numerous questions for the speaker. Surprisingly, the questions that were asked were not repeatedly asked. There were a few questions that focused on clarifying the given answers. The students were an attentive audience. The introduction got the students excited about the activity. The students were all engaged in making the new materials from polyvinyl alcohol and sodium borate. The students made comments about looking like chemists once safety goggles were donned. The group members made sure that each had recorded their observations during the activity. The instructors created an environment that was relaxed and supportive. During the debriefing of the activity, all members in each group were active participants.	

Area 4: Purposeful Activities. Fifty-one percent of the observed lessons were rated as *Reasonable Evidence* (72 out of 140) in *Area 4: Purposeful Activities*. Forty-six percent were rated as *Exceptional Evidence* (65 out of 140) in *Area 4*.

Table 12: Purposeful Activities **Mean = 3.44**

No Evidence 1	Limited Evidence 2	Reasonable Evidence 3	Exceptional Evidence 4	Not Observed
There is little or no evidence that the activities are purposeful and guide students toward STEM learning goals.	There is limited, inconsistent evidence that the activities are purposeful and guide students toward STEM learning goals.	There is clear evidence that the activities are purposeful and guide students toward STEM learning goals.	There is consistent and compelling evidence that the activities are purposeful and guide students toward STEM learning goals.	**0%** **(0)**
0% **(0)**	**2%** **(3)**	**51%** **(72)**	**46%** **(65)**	

Description: The extent to which instructional techniques and program activities are structured so that students have a clear understanding of the learning goals for each activity and how the program's activities support attainment of the learning goals.

Evidence includes clear opportunities for students to engage in hands-on activities related to clear, cohesive STEM topics; instructional activities that scaffold student thinking and deepen understanding of STEM; activity learning goals related to fundamental STEM concepts and topics; and instructional pedagogy that supports the learning goals.

Observed Evidence:

Investigating Multiple Intelligences was a new way of looking at intelligence for these students. Taking the survey, doing the scavenger hunt, and drawing their self-portrait all were activities that showed them the different ways that someone can excel and be "smart".

The students had already performed these experiments, now they were on their own to see if they could do it on their own! They had to refer to their data tables to see which experiments would give them the most useful conclusions for determining the type of plastic they had. The students felt very empowered to be planning their own experiment! They could see how their past work had enabled them to design and conduct a meaningful series of experiments to reach some conclusions.

The students had completed activity one, which was the Sierpinski Triangle, so they had some background knowledge of what the pyramid might look like. They were eager to make it. The straw/pipe cleaner activity made the building of the pyramid go quickly. The students were eager to get to the second and third iterations to see exactly what the structure would look like. They loved it! They could see the self-similarity that they found in the triangle.

The students were surprised at the chaotic motion of the double pendulum. They were clear about a regular pendulum and could predict its motion. So, when the double pendulum began moving in a seemingly chaotic way - they were a bit taken aback - then fascinated! They spent a great deal of time trying different angles and trying to predict and track the motion of the double pendulum.

The lesson designed by the writers of the unit correlated the previous week lesson on acids, bases and neutrals into today's lesson. Students were able to use information from the previous lesson to successfully identify acids, bases and neutrals. Students were actively engaged throughout today's lesson because of the prior knowledge that was developed in last week's lesson.

Students seemed to understand the learning goals as the teachers did a fabulous job of explaining the purpose of the activity. Working in small groups, students developed an understanding of early agriculture. They brainstormed why farming was such an important industry in medieval times and demonstrated great insight into this time period! This lesson was hard b/c of little to no prior knowledge of the Dust Bowl and struggling readers. They did not understand some of the terms. This led them to become very confused. Teachers gave way too much time for this activity which added to disinterest. May not be appropriate for this age group, worked better with 6-8 group. This activity required students to set up stream tables, make numerous volume and linear measurements and draw conclusions based upon that data. The students had a discussion of erosion during the previous session, so they were able to relate to what was happening during the simulation. Several students mentioned effects of water erosion in the real world such as landslides, roads being washed away, and the Dust Bowl, which was the topic of the previous session. Students did note that erosion was greater with the sandy soil that with the heavy dirt soil. This activity had the students creating a new product by combing three separate fluids. Students completed a "lab" report that included the observations that they made and the results of the tests that they did with the newly created substance. After food coloring was added to the material, the students were able to discuss the difference between the physical and chemical changes that had been made. The student pages were structured so that an airline company had specific requirements for a fuselage. The students knew the requirements and had materials to make the section. (They also knew their section was only one of three that ultimately had to fit together -- hence the specific requirements!) They also had to evaluate their own design outcome. The students learned how important it is to be exact - especially when you are making a part of a whole! Everything must come together in the end. It was eye opening about manufacturing procedures and engineering design! Discussion at the beginning of session helped focus the kids and tapped into their prior knowledge. This helped set up the rest of the discussion and the activity and some of the thoughts of the students as they made their ski jumps. Finally, the additional movie helped provide information and reinforced the points made by the students in the initial discussion. After their initial research, much great discussion occurred. Students contributed their findings and teachers interacted with students and elaborated through the use of a PowerPoint. Activity goals were clear to students. The problem was introduced, then they were to observe and evaluate the spread of an epidemic by participating in a kinesthetic simulation. Productive learning environment--students were motivated to determine who "patient zero" was.	

Area 5: Student Engagement with STEM. Fifty percent of the observed lessons were rated as *Reasonable Evidence* (69 out of 137) in *Area 5: Student Engagement with STEM*. Forty-five percent were rated as *Exceptional Evidence* (62 out of 137) in *Area 5*.

Table 13: Student Engagement with STEM Mean = 3.42

No Evidence 1	Limited Evidence 2	Reasonable Evidence 3	Exceptional Evidence 4	Not Observed
There is little or no evidence that students are engaged with hands-on and interesting activities where they explore STEM content.	There is limited, inconsistent evidence that students are engaged with hands-on and interesting activities where they explore STEM content.	There is clear evidence that students are engaged with hands-on and interesting activities where they explore STEM content.	There is consistent and compelling evidence that students are engaged with hands-on and interesting activities where they explore STEM content.	**1%** **(1)**
0% **(0)**	**4%** **(5)**	**50%** **(69)**	**45%** **(62)**	

Description: The extent to which students engage in hands-on activities that contribute to constructing their skills and knowledge of STEM.

Evidence includes students performing experiments and using a range of materials and manipulatives; using technology for research and experimentation; and documenting their actions and data/findings through oral and written communication. Students are not passive recipients of knowledge, but rather perform cognitive work and make meaning from their work. Instructors are aware of and address variety of learning styles. The instructional activities challenge students' critical thinking skills.

Observed Evidence:

The students got better and better at traveling the networks and "seeing" the pattern. It was amazing to see how much better the students were at this than their teachers were at professional development!! After the initial problem of the Illinois whistle stop, the students enthusiastically attacked the next network problems. They were very engaged and could see a pattern!

This was the perfect balance of a hands-on activity leading to a mental mathematical activity! The students enjoyed the discovery of the fractal as they repeated the pattern. They also were engaged in trying to make an "iteration rule" to mathematically explain the fractal. This was challenging for some of the students, especially the younger ones, but they were all trying to put their experience into a formula!

This really furthered the students' knowledge of physical and chemical reactions, as well as how to follow an experimental procedure. At this age, they do very little hands on science in their regular classrooms, so they were very focused and enthusiastic to do this chemistry!! As the baggie grew hot and started to swell, they knew right away that it was a chemical reaction!

This lesson afforded the students a chance at being engineers. The students had to design boats with tinfoil and the boat need to hold pennies and stay afloat. Prior to placing the boat in the water the students view a video on boat forms before making their design. Science and math were also included in the lesson with regards to volume of pennies for weight and the concept of buoyance.

Teachers opened cans of different flavors of Pringles and one can of Lays chips. Students observed the chips

and speculated which chips would be more likely to withstand shipment in their student-created packages and why. They discussed the thickness of the chip, the flavors, and read the ingredients on the canister. They also compared and contrasted the two different types of canisters and noted the materials used to create them. Students were very excited to explore materials provided by teachers for packaging and even brought in some of their own! The students performed experiments--they used rennet and vinegar to produce cheese. They tested and documented the initial pH levels for milk, rennet, and vinegar. Then they observed any changes within each of these cups and recorded observations based on consistency, smell, and texture of the substance. Finally, they tested the pH of the whey and cheese and recorded this information as well. Teachers stressed need for students to brainstorm several ideas and draw them on handout provided. After drawing, each pair of students came to the front of class and verbally explained their sketches to the rest of the class. The audience was very respectful during each presentation, listened carefully, and asked amazing questions that demonstrated critical thinking skills!!! For example, students in the audience asked how the presenters how they would keep their car's wheels from falling off, why they chose popsicle sticks, what will support the index cards, why use paper clips and not the free hot glue? Students were then given the opportunity to incorporate their peers' feedback (or ideas learned from other presentations) and make changes to their sketches, if they so desired. This activity provided the students then opportunity to perform an experiment in which they were making a new material using common products. Every student was an active participant in the session. They were excited to do real “chemistry.” Once the instructors provided the directions and materials, the students worked, for the most part, independently form the teachers. Discussions between students were focused on what was happening as the materials were mixed. Discussions between teachers and students were informal and most of the talking was done by the students. This scavenger hunt had students review how to decipher a number of different. They were engaged with a number of technologies including invisible ink, decoder wheels and Morse code. The students were also required to use a number of mathematics skills to decipher the Route Transportation coded message. The activity was definitely hands-on. The students performed an experiment in which they created a new material by adding sodium borate to polyvinyl alcohol. The students made and recorded observations during the experiment. These observations were reported to the entire group during the debrief session. Once the students were engaged in the activity, the teachers became facilitators, moving between groups, asking questions and reminding students about the need to use goggles and other safety procedures. The students talked between themselves how the material today was similar and different from the material that had been made during the previous session. The points they made included color, density and “feel.”	

Area 6: STEM Content Learning. Sixty-five percent of the observed lessons were rated as *Reasonable Evidence* (91 out of 140) in *Area 6: STEM Content Learning*. Twenty-nine percent were rated as *Exceptional Evidence* (41 out of 140) in *Area 6*.

Table 14: STEM Content Learning **Mean = 3.25**

No Evidence 1	Limited Evidence 2	Reasonable Evidence 3	Exceptional Evidence 4	Not Observed
There is little or no evidence that activities support students in developing meaningful STEM content learning.	There is limited, inconsistent evidence that activities support students in developing meaningful STEM content learning.	There is clear evidence that activities support students in developing meaningful STEM content learning.	There is consistent and compelling evidence that activities support students in developing meaningful STEM content learning.	**1%** **(2)**
0% **(0)**	**4%** **(6)**	**65%** **(91)**	**29%** **(41)**	

Description: The extent to which students are supported in the development of meaningful science, mathematics, technological, and engineering content though the program's curriculum and activities.

Evidence includes instructors who are knowledgeable about STEM content and accurate in their presentation of vocabulary, concepts, strategies, evidence, and application. Students have required background knowledge to engage in activities and are able to apply their knowledge beyond memorization/rote repetition. Students demonstrate STEM skills and knowledge through completion of tasks, questioning of peers and instructor, data analysis, discussion of findings, and application of learnings. Instructors informally assess students' understanding of STEM content.

Observed Evidence:

This lesson built on the last one that they had done - where they just discovered the Sierpinski Triangle. Now they constructed one and worked on the mathematical formula for it. The following week they built Sierpinski's Pyramid and they sent a photo to me! The concepts of iterations, self- similarity, fractals, pyramids, triangles and mathematical formulas were all concepts the students embraced.

This was the third in a series of three experiments that showed physical versus chemical reactions. Doing this series of activities really let the students learn by experiment what the difference between physical and chemical reactions really is. They learned to be specific and list examples of why they chose one or the other.

The students discussed how they learned the maze. Some students learned the numeric sequence, while others learned the geometric pattern of the maze. They were surprised to realize how differently they all learned and remembered. They connected this to all learning, realizing that everyone has to find their own methods of learning and remembering.

Reinforcement: For volume, had algorithms for volume of 3 different shapes posted on whiteboard. Activity post-shipment measure reinforced concept and required students to appropriately use STEM vocabulary to describe findings and respond to discussion questions during reflection and debrief. Inquiry questions from teacher reinforced connections: i.e. what do companies care about when evaluating chip shipment? (Ideas students discussed: crunch, breakage, flavor, # of chips, how chip looks).

These activities at the 5 stations helped the students understand what an airfoil actually is and how this design could aid an airplane in lifting off the ground! They also further understood moving air and what happens as it moves around various shapes. In the debrief process this knowledge was connected to both Newton's Third Law

and Bernoulli's Principle. This activity supports students in their STEM content learning. The students learned to create a shape which exhibits self-similarity as the number of iterations increase. They also saw how a simple algorithm can create a shape with some potentially complex properties. The students quickly identified the pattern identified it as a fractal (last lesson was the dragon fractal). With this activity, the students became familiar with the engineering/design process. During the debrief, concepts like kinetic and potential were discussed, with the students creating their own definitions of the terms. The teachers were comfortable with the material. They also allowed the students time to explore the coaster designs and make changes to the constructions. They teachers shared responsibilities throughout the session. Instruction was excellent. Discussion and student actions while working on the activity demonstrated some understanding of the concepts that were addressed in this activity. The students began to understand the concept of density when they began to explain why same shaped objects had different mass. The teachers did reference the previous activity to further assist student understanding of density. The students began developing the idea that the weight of the paint on an airplane would affect the fuel consumption of the plane during its flight, which, of course, affected the bottom line. A student asked, “If the paint adds so much weight, why would companies paint their planes?” The group that researched the question of polishing the plane rather than painting the plane was able to discuss the answer to the question. Because the students had previously discussed airlines and the livery of each company, there was discussion about advertising and name recognition, based on a planes appearance. Southwest Airlines and their orange, red and blue planes were mentioned as an example of plane recognition.	

Area 7: Inquiry and Problem Solving. Forty-two percent of the observed lessons were rated as *Reasonable Evidence* (59 out of 140) in *Area 7: Inquiry and Problem Solving*. Forty-one percent were rated as *Exceptional Evidence* (58 out of 140) in *Area 7.*

Table 15: Inquiry and Problem Solving **Mean = 3.31**

No Evidence 1	Limited Evidence 2	Reasonable Evidence 3	Exceptional Evidence 4	Not Observed
There is little or no evidence that students engage in STEM practices and inquiry-based learning during the activities.	There is limited, inconsistent evidence that students engage in STEM practices and inquiry-based learning during the activities.	There is clear evidence that students engage in STEM practices and inquiry-based learning during the activities.	There is consistent and compelling evidence that students engage in STEM practices and inquiry-based learning during the activities.	**4%** **(6)**
0% **(0)**	**12%** **(17)**	**42%** **(59)**	**41%** **(58)**	

Description: The extent to which instructional activities support the use of STEM practices and tools while exploring content through inquiry.

Evidence includes opportunities for students to engage in STEM practices of observations, modeling, questioning, investigating, analyzing data, and constructing explanations. Students develop/expand upon strategies to solve problems, evaluate the validity of information, and repeat experiments to confirm results. Instructors use open-ended questions and encourage questions from students. Instructors require students to supply evidence to support claims and meet desired criteria, and encourage students to consider implications of conclusions. The level of support for student inquiry provided by the instructor is appropriate for the age level and STEM content being addressed.

Observed Evidence:

This was a great guided inquiry lesson. The students were given basic instructions and it was fun to see them talk to one another about what they thought might be a pattern, and then see it more and more. After they combined their results - there was no question about the pattern -- which reinforced the repeated trials!

This lesson had the opportunity for guided inquiry as the students explored Multiple Intelligences. They all engaged in problem solving - both in figuring out their own self portrait, and when analyzing their peer's portraits to discover his/her strengths. They had to point out the trait (long ears) and connect it to musical ability, etc. It was a fun time!

The students did a great job of designing their own experiment and made the connection between mathematical and scientific concepts. They could use the formula that they had learned in math to apply to a problem that was presented to them. They learned a great deal about designing an experiment - it is not as easy as they first thought!

The students used inquiry practices and had to perform the experiment of counting the dendrites. They had to document, analyze and report on the data from the rat brain experiment. They used their problem solving skills trying to match the data to the various choices for the environment that the data came from.

This was true inquiry for 4th and 5th graders!! They had their knowledge from the unit - but they had to design and conduct their own comparison of antacids. The designs were very different - but each group could defend and make sense out of their choices and conclusions. Success!

I am very pleased with this new teacher. He has really improved in his use of inquiry. He will catch himself in mid-sentence and rework it so he goes from direct instruction to inquiry; kudos to him. This is a first year school and they are doing a great job. They have really changed their style of teaching from direct instruction to inquiry. And are finding the inquiry style to be a challenge to break old habits, but admit they like it and they can let go of the sage on the stage and enjoy the process. Students were actively engaged in finding the full center of mass for this activity. They repeatedly tried different scenarios to find the center of mass during the activity. Frustration was not a component in this activity. Students were determined to find the center and apply their discovery to its relationship with engineering. Students played the role of "engineers" as they designed their package to safely ship a *Pringles* chip. This lesson was designed to enhance student problem-solving skills and team work. Students worked in pairs and communicated clearly and effectively as they brainstormed what materials to use and how their selection would meet their objective all while minimizing costs in the production of said package. Students engaged in the STEM practices of making observations, questioning, investigating, researching best practices, testing their products and making enhancements when necessary. There was definite inquiry and problem solving while doing this activity since the students have such limited experience in the area of change the forms, as in this case from liquid to solid. Throughout the lesson the students wanted the teachers to respond to questions they posed but the teachers encouraged and guided the students to explore more and develop a rationale for what they were experiencing. Sometimes the rational was a little off but the teachers merely as the students to rethink what they saw and the results of what they were doing.	

Area 8: Reflection, Relevance, and Making Connections. Forty-two percent of the observed lessons were rated as *Reasonable Evidence* (59 out of 139) in *Area 8: Reflection, Relevance, and Making Connections*. Thirty-five percent were rated as *Exceptional Evidence* (49 out of 139) in *Area 8*.

Table 16: Reflection, Relevance, and Making Connections Mean = 3.29

No Evidence 1	Limited Evidence 2	Reasonable Evidence 3	Exceptional Evidence 4	Not Observed
There is little or no evidence that students engage in explicit and meaningful reflection about STEM content or learnings.	There is limited, inconsistent evidence that students engage in explicit and meaningful reflection about STEM content or learnings.	There is clear evidence that students engage in explicit and meaningful reflection about STEM content or learnings.	There is consistent and compelling evidence that students engage in explicit and meaningful reflection about STEM content or learnings.	**14% (19)**
1% (2)	**7% (10)**	**42% (59)**	**35% (49)**	

Description: The extent to which instructional activities support explicit reflection on the STEM content; the quality of the reflections made by the students; and how they make connections between the activities and their own experiences, other subject areas, and broader STEM issues.

Evidence includes instructors encouraging students to use information and insights from a variety of subject areas; students recognizing connections within and across subject areas; and students reflecting on relevant applications of their learnings to real-world situations. Activities connect STEM to students' experiences and backgrounds, and link to STEM careers and community issues. Instructors assess students' abilities to apply learning to new situations through oral, written, and multi-media communications.

Observed Evidence:

These students did an excellent job in the debrief process. They were very aware of how they were learning the maze and how each step added to the next. The next day they were going to extend this activity and do a maze without numbers (challenging the number sequence learners!) and then the students wanted a chance to create a "harder" maze for their peers. There was a lot of discussion on the various ways people learned, and how they are different.

The students really connected their work to how a real scientist might investigate a problem. They understood the initial experiments, and could see how using that data would connect to an unknown material. They have seen TV shows about lab work and now they see how you can identify a material based on previous knowledge and experimentation.

The students made connections to how they learned. They realized that different people have different learning styles and challenges. Some of them liked using the numeric sequence, while others learned the kinesthetic pattern. They could connect this to all their learning and it prompted a discussion of how they study and remember things.

The students made very relevant connections to how the environment can influence brain development. It became clear that impoverished environments had negative impact on brain development and that enriched environments could encourage dendrite length and branching. Students made connections with other animals and humans during discussion.

The teachers connected this lesson with the month of February which is Dental Month. The lesson on the candy identification as an acid, base or neutral was tied in to dental care. Students reflected at then of the lesson on the importance of knowing the types of food they eat (acid, base, neutral) since there will be an effect on their digestive system and their teeth. The reflection for this lesson was phenomenal. Students were able to make connections between the size and shape of their boat with the weight of the pennies in relationship to whether it floated or did not. Students were determined to try again next week based upon the observations they recorded during the trials. The instructors made sure that there was time for debriefing. Students were able to discuss what they had done, discuss terms introduced during the session informally and suggest changes to the designs to improve the outcomes. Students also talked about what they could have done had more materials been available. Several students related that the real starting point of the roller coasters at the local amusement park were the highest point of the coaster, just like their own coasters. The teachers were able to spend time with individuals and small groups working at tables to ask questions about procedures and what was being observed. The whole group debrief session provided the opportunity for students to discuss the procedures they followed, their observations and the reasons for use of safety goggles. Their understanding of chemical and physical changes was apparent when, during the debrief session, they were asked if they wanted to color their new material. All of the participants did and after the color was added and stirred, the students, when questioned, were able to identify the coloring as a physical change and were able to explain why it was a physical change. Connections: Students were asked what they know about historical paper production: Responses were: Paper came from China, Egypt. Also, student comments included use of berry juice as ink... and connected this to possibility of animals eating paper. Reflection: Students were asked which paper making technique worked best: Responses: Water + Cotton + Screen, Water + Corn Starch + Cotton + Screen. Students were asked to explain the effect of Corn Starch: Responses included "stickiness," "It's like glue," "it's made a sludge (when cotton, water and corn starch were mixed)" During the debriefing, the students identified the code that was easiest to decipher, Morse code, and which was the most difficult. The most difficult turned out to be the Route Transportation code. Students discussed how codes had been used in the past and speculated on how codes might be used in the future. Movies that contained codes, such as National Treasure and The Imitation Game, were discussed, with students explaining how codes were integrated into the films. At the end of the lesson the teachers asked the students to reflect on why or why not the t-shirt bags could be the solution to the plastic bag problem. Students gave definitive answers such as durability of the t-shirts bags compared to the plastic, how much could be placed in the t-shirt bags, and what about cost effective. The teachers decided that for next week lesson they would search the internet for possible answers to their questions.	

IMSA Fusion Observation Program Areas: Summary of Descriptive Statistics. As noted earlier, the expectation of the IMSA Fusion Program is that all sites should work toward achieving a rating of *Reasonable Evidence* (rating = 3) on the observational scale for all eight program areas. Those sites that demonstrate extraordinary quality in a given area receive a rating of *Exceptional Evidence* (rating = 4).

The program area with the highest aggregate mean was *Area 3: Appropriate Participation and Team Work* (3.52), and the area with the lowest mean was *Area 6: STEM Content Learning* (3.25) (See Table 17). Each of the eight program areas had means that fell within a *Reasonable Evidence* rating.

Table 17: Descriptive Statistics for the Eight Program Areas

Program Area	Number of Observations	Minimum Rating	Maximum Rating	Mean	Std. Deviation
AREA 1: Preparation, Organization, and Implementation	139	1	4	3.49	.618
AREA 2: Use of Facilities, Space, and Equipment	138	1	4	3.31	.551
AREA 3: Appropriate Participation and Team Work	140	2	4	3.52	.556
AREA 4: Purposeful Activities	140	2	4	3.44	.540
AREA 5: Student Engagement with STEM	136	2	4	3.42	.565
AREA 6: STEM Content Learning	138	2	4	3.25	.528
AREA 7: Inquiry and Problem Solving	134	2	4	3.31	.685
AREA 8: Reflection, Relevance, and Making Connections	120	1	4	3.29	.691

Rating Scale: No Evidence (1), Limited Evidence (2), Reasonable Evidence (3), Exceptional Evidence (4)

Appendices

IMSA Student Survey 2014-2015

This survey is for you to tell us about your experience in the IMSA Fusion program. Your answers will help us improve the program.

We are interested in what you would like to tell us about the program.

We have received permission from your parents/guardians to give you the survey, but you have the choice to not participate. You can any skip questions you wish. There are no right or wrong answers.

We thank you very much for your feedback!

Q1: What is the name of your school? (drop down list)

Q2: What grade are you in? 4^{th}, 5^{th}, 6^{th}, 7^{th}, 8^{th}

Q3: What is your gender? Female, Male

Q4: Please rate your level of agreement with the following statements about IMSA Fusion.
Scale: strongly disagree, disagree, agree, strongly agree

a. Because of Fusion I am more interested in mathematics.
b. Because of Fusion I better understand mathematics.
c. Because of Fusion I am more interested in science.
d. Because of Fusion I better understand science.
e. The Fusion program was a good learning experience.
f. The Fusion program was fun.
g. I think understanding mathematics and science will be important to me in the future.
h. I think understanding mathematics and science is important to the world's future.
i. I think mathematics and science are useful subjects to know.

Q5: I plan to participate in IMSA Fusion next year: YES NO
If no, why not?

Q6: I would recommend Fusion to my friends: YES NO
If no, why not?

Q7: How is learning math and science in Fusion different than learning math and science in your classes?

Q8: What was one interesting thing that you learned about science in the Fusion program?

Q9: What was one interesting thing you learned about mathematics in the Fusion program?

IMSA Parent Survey 2014-2015 (English Language)

The staff at IMSA Fusion are interested in your feedback about the experience of your child so that we can continue to enhance the IMSA Fusion program.

This survey has been approved through IMSA's Human and Animal Subjects Review Committee.

Participation in the survey data collection processes is entirely voluntary. No individual will receive any compensation for participating in the survey data collection process.

All responses will be anonymous. Any demographic data (e.g., school name, grade level, gender) will only be reported in the aggregate in all evaluation reports the program staff. Individual comments will not be reported with any combination of demographics that would allow for identification of individuals.

No questions on the survey are required. You may skip any items you wish. The survey should take approximately 10 minutes to complete. The survey data collection will close at 5pm (EST) on May 30, 2015.

If you consent to participate in this survey data collection process please proceed to the next page of the survey/*first question on the surve*y.
If you do NOT consent, please close the link to the survey/*return the survey blank*.

If you have more than one child enrolled in the program, please complete this survey based on feedback on the OLDEST child.

Q1: What school does your child attend? (drop-down list on electronic version; open-ended blank on printed version)

Q2: What grade is your child in? 4^{th}, 5^{th}, 6^{th}, 7^{th}, 8^{th}

Q3: Please rate your level of agreement with the following statements about IMSA Fusion.
Scale: strongly disagree, disagree, agree, strongly agree, do not know

a. My child developed deeper interest in mathematics because of IMSA Fusion.
b. My child developed deeper understanding in mathematics because of IMSA Fusion.
c. My child developed deeper interest in science because of IMSA Fusion.
d. My child developed deeper understanding in science because of IMSA Fusion.
e. IMSA Fusion provides meaningful afterschool experiences for my child.
f. The IMSA Fusion program is a valuable part of my child's learning experiences.
g. My child's overall social experience in the IMSA Fusion program has been satisfactory.
h. Expectations for my child in the IMSA Fusion program were reasonable and appropriate.
i. IMSA Fusion staff communicated effectively with parents.
j. I would recommend IMSA Fusion to other parents and students.
k. I think that IMSA Fusion should be a permanent part of the afterschool programming at my child's school.

Q4: Why did you choose to have your child participate in the Fusion program?

Q5: If you could pick one strength of the program to tell other parents and students, what would it be?

Q6: What has been the most valuable learning experience for your child in the program?

Q7: If you could change one thing about the program, what would it be?

Q8: My child attended (your best estimate): All of the Fusion sessions this school year, at least 75% of the Fusion sessions this school year, at least 50% of the Fusion sessions this school year, less than 50% of the Fusion sessions this school year

Q9: I plan to have my child participate in IMSA Fusion next year: YES NO

If no, why not?

IMSA Parent Survey 2014-2015 (Spanish Language)

IMSA Encuesta de padres 2014-2015 año del programa

El personal de IMSA FUSIAN está interesado en Su comentario sobre la experiencia de su niño para que podamos continuar a mejorar el programa de IMA Fusion.

Esta encuesta ha sido aprobada a través del Comité de Revisión de IMSA de Sujetos Humanos y Animales.

Su participación en los procesos de recolección de datos de la encuesta es completamente voluntaria. Ningún individuo recibirá ninguna compensación por su participación en los procesos de recolección de datos de la encuesta.

Todas las respuestas son anónimas. Los datos demográficos (por ejemplo, el nombre de la escuela, el grado escolar, el género) sólo se reportaran en el conjunto de los informes de evaluación al personal del programa. Los comentarios individuales no se reportaran a cualquier combinación de los datos demográficos que permita la identificación de los individuos.

Ninguna pregunta en la encuesta es obligatoria. A Usted se le permite saltar cualquier ítem que desee. La encuesta debe tomar aproximadamente 10 minutos para completar. La recolección de datos de la encuesta concluirá a las cinco de la tarde el May 30, 2015.

Si Usted consiente en participar en este proceso de recolección de datos, por favor, pase a la próxima pagina de la encuesta/a la primera pregunta de la encuesta. Se Usted no consiente, por favor, cierre el enlace a la encuesta/devuelva la encuesta en blanco.

Si Usted tiene más de un hijo matriculado en el programa, por favor, llene esta encuesta a partir del comentario sobre el hijo MAYOR.

Q1: ¿A cuál escuela asiste su hijo?

Q2: ¿En qué grado escolar está su hijo? 4º, 5º, 6º, 7º, 8º

Q3: Por favor califique su nivel de acuerdo con las siguientes afirmaciones sobre IMSA Fusion.

Escala: totalmente en desacuerdo, en desacuerdo, de acuerdo, muy de acuerdo, no sé

a. Mi niño desarrolló un interés más profundo por las matemáticas, debido a IMSA Fusion.
b. Mi niño desarrolla una comprensión más profunda de las matemáticas debido a IMSA Fusion.
c. Mi niño desarrolló un interés más profundo en la ciencia debido a IMSA Fusion.
d. Mi niño desarrolla una comprensión más profunda de la ciencia debido a IMSA Fusion.
e. IMSA Fusion ofrece experiencias significativas después de la escuela para mi hijo.
f. El programa IMSA Fusion es una parte valiosa de las experiencias de aprendizaje de mi hijo.
g. La experiencia social general de mi hijo en el programa IMSA Fusion ha sido satisfactoria.
h. Las expectativas para mi hijo en el programa IMSA Fusion eran razonables y apropiadas.
i. El personal de IMSA Fusion comunicó de manera efectiva con los padres.

j. Yo recomendaría IMSA Fusion a otros padres y estudiantes.
k. Creo que la fusión IMSA debe ser una parte permanente de la programación después de clases en la escuela de mi hijo.

Q4: ¿Por qué eligió a que su hijo participe en el programa Fusion?

Q5: Si Ud. pudiera elegir una fortaleza del programa para informar a los padres y alumnos, ¿qué sería?

Q6: ¿Cuál ha sido la experiencia de aprendizaje más valiosa para su niño en el programa?

Q7: Si Ud. pudiera cambiar una cosa sobre el programa, ¿cuál sería?

Q8: Mi hijo asistió (mejor estimación): Todas las sesiones Fusion este año escolar, al menos el 75% de las sesiones Fusion este año escolar, al menos el 50% de las sesiones Fusion este año escolar, menos del 50% de las sesiones Fusion este año escolar.

Q9: Pienso que mi hijo participe en IMSA Fusion el próximo año: SÍ NO

Si no, ¿por qué no?

IMSA Teacher Survey 2014-2015

The staff members of IMSA Fusion are interested in your feedback about how the program is being implemented in your school. We are particularly interested in how the IMSA Fusion program has influenced instructional practices and student learning. Your feedback will be used to enhance the IMSA Fusion program.

This survey has been approved through IMSA's Human and Animal Subjects Review Committee.

Participation in the survey data collection processes is entirely voluntary. No individual will receive any compensation for participating in the survey data collection process.

All responses will be anonymous. Any demographic data (e.g., school name, grade level, gender) will only be reported in the aggregate in all evaluation reports to the program staff. Individual comments will not be reported with any combination of demographics that would allow for identification of individuals.

No questions on the survey are required. You may skip any items you wish. The survey should take approximately 20 minutes to complete. The survey data collection will close at 5pm (EST) on April 30, 2015.

If you consent to participate in this survey data collection process please proceed to the next page of the survey.

If you do NOT consent, please close the link to the survey.

Q1: What is the name of your school? (drop-down list)

Q2: In which IMSA Fusion Program do you teach? Grade 4-5 Program, Grade 6-8 Program

Q3: Please rate your level of agreement with the following statements about IMSA Fusion.
Scale: strongly disagree, disagree, agree, strongly agree, do not know

j. Students in my school have developed deeper interest in mathematics because of IMSA Fusion.
k. Students in my school have developed deeper understanding in mathematics because of IMSA Fusion.
l. Students in my school have developed deeper interest in science because of IMSA Fusion.
m. Students in my school have developed deeper understanding in science because of IMSA Fusion.
n. IMSA Fusion has offered students who typically do not participate in mathematics and science activities access to STEM programming.
o. My school now places more emphasis on science instruction in the school overall because of IMSA Fusion.
p. My school now places more emphasis on mathematics instruction in the school overall because of IMSA Fusion.
q. I have enhanced my regular classroom instruction because of IMSA Fusion.
r. Parents of students in the program are more interested in their children's achievement in mathematics because of IMSA Fusion.

s. Parents of students in the program are more interested in their children's achievement in science because of IMSA Fusion.

Q4: What, if any, professional development opportunities in STEM disciplines have **you sought out** because of your involvement in IMSA Fusion? Please describe.

Q5: What, if any, professional development opportunities in STEM disciplines have you participated in on the recommendation of your principal and/or district? Please describe.

Q6: What, if any, opportunities to serve as an instructional mentor in STEM disciplines to your peers in your school have **you sought out** because of your involvement in Fusion? Please describe.

Q7: Please rate your level of agreement about the following statements about student learning in IMSA Fusion.
Scale: strongly disagree, disagree, agree, strongly agree, do not know

a. IMSA Fusion improves students' abilities to identify problems/questions to be solved.
b. IMSA Fusion improves students' abilities to collect information/data.
c. IMSA Fusion improves students' abilities to organize information/data.
d. IMSA Fusion improves students' abilities to analyze information/data.
e. IMSA Fusion improves students' abilities to formulate solutions to problems.
f. IMSA Fusion improves students' abilities to communicate orally.
g. IMSA Fusion improves students' abilities to communicate in written form.
h. IMSA Fusion improves students' abilities to use media/technology to access information.
i. IMSA Fusion improves students' abilities to work productively in groups.
j. IMSA Fusion improves students' abilities to work with their peers to achieve common goals.
k. IMSA Fusion improves students' abilities to integrate mathematics and science content.
l. IMSA Fusion improves students' abilities to connect new information with prior knowledge.
m. IMSA Fusion improves students' abilities to direct their own learning.
n. IMSA Fusion improves students' abilities to assess the quality of their own work.

Q8: What was the greatest success of IMSA Fusion in your school this year?

Q9: What was the greatest challenge of IMSA Fusion in your school this year?

Q10: How might the IMSA Fusion further support you in your role as a Fusion teacher?

Q11: If you could change one thing about the IMSA Fusion program, what would it be?

Q12: Please indicate those areas of your <u>regular teaching duties/classroom instruction</u> that have been **directly influenced** by your experiences as an instructor in the IMSA Fusion program. Check ALL that apply

a. How students identify problems/issues to address
b. How students formulate strategies for addressing problems/issues
c. How students work in pairs/teams to collect information
d. How students work in pairs/teams to analyze information
e. How students work in pairs/teams to report results

f. How students use journals/observation logs to record information
g. How students create oral presentations of their results
h. How students create written reports/summaries of their results
i. How students engage in group discussions to reflect on their learning
j. How students assess the quality of their work
k. How students use technology/media to conduct research on STEM topics
l. My use of open-inquiry strategies in questioning students about their knowledge
m. My use of real-world examples in teaching of content
n. How we discuss connections between previous knowledge and new knowledge
o. How we discuss connections across STEM subject areas (e.g., geometry, chemistry, astronomy)
p. How we discuss connections across STEM and non-STEM subject areas (e.g., estimation, biology, social studies, etc.)
q. I demonstrated Fusion hands-on investigations/experiments for all students in the class
r. I had all students in the class conduct Fusion hands-on investigations/experiments
s. I used Fusion supplemental science resources to teach STEM content (e.g., as reading materials for your classroom students)

Q13: If you selected any of the activities in Question 12, please briefly describe a success when you used IMSA Fusion pedagogy or curriculum in your regular classroom:

IMSA Principal Survey 2014-2015

The staff at IMSA Fusion are interested in your feedback about how the program is being implemented in your school. We are particularly interested in how the IMSA Fusion program has influenced instructional practices and student learning. Your feedback will be used to enhance the IMSA Fusion program.

This survey has been approved through IMSA's Human and Animal Subjects Review Committee.

Participation in the survey data collection processes is entirely voluntary. No individual will receive any compensation for participating in the survey data collection process.

All responses will be anonymous. Any demographic data (e.g., school name, grade level, gender) will only be reported in the aggregate in all evaluation reports to the program staff. Individual comments will not be reported with any combination of demographics that would allow for identification of individuals.

No questions on the survey are required. You may skip any items you wish. The survey should take approximately 10 minutes to complete. The survey data collection will close at 5pm (EST) on April 30, 2015.

If you consent to participate in this survey data collection process please proceed to the next page of the survey.

If you do NOT consent, please close the link to the survey.

Q1: What is the name of your school? (drop down list)

Q2: What is your school's geographic designation? Urban, Suburban, Rural

Q3: Please rate your level of agreement with the following statements about IMSA Fusion.
Scale: strongly disagree, disagree, agree, strongly agree, do not know

a. Students in my school have developed deeper interest in mathematics because of IMSA Fusion.
b. Students in my school have developed deeper understanding in mathematics because of IMSA Fusion.
c. Students in my school have developed deeper interest in science because of IMSA Fusion.
d. Students in my school have developed deeper understanding in science because of IMSA Fusion.
e. IMSA Fusion has offered students who typically do not participate in mathematics and science activities access to STEM programming.
f. My school now places more emphasis on science instruction in the school overall because of IMSA Fusion.
g. My school now places more emphasis on mathematics instruction in the school overall because of IMSA Fusion.
h. Fusion teachers in my school have enhanced their regular classroom instruction because of IMSA Fusion.

i. Fusion teachers in my school have sought out additional professional development opportunities in STEM disciplines because of IMSA Fusion.
j. Fusion teachers have sought out opportunities to serve as instructional mentors in STEM disciplines to their peers in my school because of IMSA Fusion.
k. Parents of students in the program are more interested in their children's achievement in mathematics because of IMSA Fusion.
l. Parents of students in the program are more interested in their children's achievement in science because of IMSA Fusion.

Q4: What was the greatest success of IMSA Fusion in your school this year?

Q5: What was the greatest challenge of IMSA Fusion in your school this year?

Q6: How might the IMSA Fusion support you in your role as instructional leader in your school?

Q7: If you could change one thing about the IMSA Fusion program, what would it be?

Consent Form English Language

IMSA Fusion Program Evaluation 2014-2015
Parent/Guardian Consent Form for Student Survey Participation

Illinois Mathematics and Science Academy (IMSA) Fusion is an after-school enrichment program for Illinois late elementary and middle school students who are talented, interested and motivated in mathematics and science. IMSA Fusion program evaluation is designed to provide formative and summative feedback on the progress and results of the program toward its goals across sites.

Fusion is conducting an evaluation of its programs during the 2014-2015 program year. Because IMSA is focused on the short and long-term benefits and impact of Fusion for students' interest and achievement in mathematics and science, the evaluation is designed to collect feedback from students, parents/guardians, teachers, and principals.

We are asking your permission to provide your child with a brief survey to gather feedback on the IMSA-Fusion program at your school. The survey consists of rating scale and open-ended questions about children's experiences in the program. There are nine questions on the survey. It should take no longer than 15 minutes to complete.

This survey has been approved through IMSA's Human and Animal Subjects Review Committee. Your child's/children's participation in the survey is completely voluntary. No individual will receive any compensation for participating in the survey data collection process. All responses are anonymous. Any demographic data (e.g., school name, grade level, gender) will only be reported in the aggregate in all evaluation reports. Individual comments will not be reported with any combination of demographics that would allow for identification of individuals. No questions on the survey are required; participants may skip any items they wish.

Participation in program evaluation will contribute valuable information needed for program improvement and provide evidence of IMSA's accountability and benefits to the people of Illinois by helping to identify patterns of success among students, and to make any necessary changes to the program.

If you have any questions about the evaluation, please contact Dora Phillips, Director of Statewide Educator Initiatives at 630-907-5858 or dphillips@imsa.edu Please return this signed consent form to your Fusion teacher(s) by **February 2, 2015**.

By signing below, I/we recognize that IMSA is an educational laboratory for the State of Illinois, and is mandated to regularly gather demographic, academic, and other formative information from students about their IMSA experiences, as well as their subsequent school and career experiences. Research, assessment, and evaluation efforts for this Fusion research will comply with the standards and the review process of IMSA's Human and Animal Subjects Review Committee (IMSA's Institutional Review Board). In some cases, when necessary for purposes of institutional research or accreditation, data may be collected, analyzed, and/or used by organizations outside of IMSA. In these cases, all applicable legal and ethical guidelines will be followed to protect students' rights to privacy.

☐ I **consent** to my child participating in the IMSA-Fusion student survey

☐ I **do NOT** consent to my child participating in the IMSA-Fusion student survey

_____

Name of Child's School

_____

Child's Name

_____

Parent Name (please print)

_____

Parent Signature **Date**

Consent Form Spanish Language

Evaluación del programa IMSA Fusion 2014-2015
Formulario de consentimiento padre / guardián para la participación en la encuesta estudiantil

Illinois Mathematics and Science Academy (IMSA) Fusion es un programa de enriquecimiento después de la escuela para los estudiantes de Illinois al final de la escuela primaria y de la escuela secundaria que son talentosos, interesados y motivados en matemáticas y ciencias. La evaluación del programa IMSA Fusion se ha diseñado para proveer comentario formativo y sumario de los avances y resultados del programa hacia sus objetivos a través de los sitios.

Fusion está llevando a cabo una evaluación de sus programas durante el año 2014-2015 del programa. Ya que IMSA se centra en los beneficios a corto y a largo plazo y el impacto de Fusion a los intereses de los estudiantes y el logro en matemáticas y ciencias, la evaluación está diseñada para recoger la opinión de los estudiantes, padres / tutores, maestros y directores de escuela.

Estamos pidiendo su permiso para proveer a su hijo una breve encuesta para recoger información sobre el programa de IMSA-Fusion en su escuela. La encuesta consiste en preguntas de escala de calificación y preguntas abiertas sobre las experiencias de los niños en el programa. Hay nueve preguntas en la encuesta. Se tardará más de 15 minutos para completar.

Esta encuesta ha sido aprobada a través del Comité de Revisión de IMSA de Sujetos Humanos y Animales. La participación de su hijo en la encuesta es completamente voluntaria. Ningún individuo recibirá ninguna compensación para su participar en los procesos de recolección de datos de la encuesta. Todas las respuestas son anónimas. Los datos demográficos (por ejemplo, el nombre de la escuela, el grado escolar, el género) sólo se reportaran en conjunto en los informes de evaluación al personal del programa. Los comentarios individuales no se reportaran con cualquier combinación de datos demográficos que permitan la identificación de los individuos. Ninguna pregunta en la encuesta es obligatoria. Los participantes se les permite saltarse cualquier ítem que deseen.

La participación en la evaluación del programa contribuirá con información valiosa necesaria para la mejora del programa y proveerá la evidencia de la responsabilidad de IMSA y de los beneficios a la población de Illinois, ayudando a identificar los patrones de éxito entre los estudiantes y para hacer los cambios necesarios en el programa.

Si Ud. tiene alguna pregunta sobre la evaluación, por favor póngase en contacto con Dora Phillips, Director of Statewide Educator Initiatives at 630-907-5858 or dphillips@imsa.edu. Por favor devuelva este formulario de consentimiento firmado a los maestros de Fusion por el **Febrero 2, 2015**.

Al firmar abajo, yo / nosotros reconocemos que IMSA es un laboratorio educativo para el estado de Illinois, y está encargada de reunir regularmente información demográfica, académica y otra información formativa de los estudiantes sobre sus experiencias de IMSA, así como sus experiencias escolares y profesionales subsiguientes. Los esfuerzos de investigación, de evaluación y la evaluación de esta investigación de Fusion cumplirá con las normas y el proceso de revisión del Comité de Revisión de IMSA de Sujetos Humanos y Animales (Institutional Review Board IMSA). En algunos casos, cuando sea necesario para fines de investigación o acreditación institucional, los datos pueden ser recogidos, analizados y / o utilizados por organizaciones fuera de IMSA. En estos casos, todas las directrices legales y éticas se deben seguir para proteger los derechos de los estudiantes a la privacidad.

☐ **Doy mi consentimiento** para que mi hijo participe en la encuesta de los estudiantes de IMSA Fusion.

☐ **No doy mi consentimiento** para que mi hijo participe en la encuesta de los estudiantes de IMSA Fusion.

_____

Nombre de la escuela del estudiante

_____

Nombre del niño

_____

Nombre del padre (por favor, en letra)

_____

Firma del padre **Fecha**

IMSA Fusion Site Observation Tool 2014-2015

IMSA Fusion Site Observation Formative Feedback Notes

1. The students seemed most engaged when/during…
2. Successes/Best Practices that I observed include…
3. Some tips/techniques that could enhance your instruction/program are…
4. General notes from discussion/debrief with instructor(s):

IMSA Fusion Site Observation Demographics

Name of Site Support Specialist:
Name of School (and City/Town as appropriate):
Last name(s) of instructor(s) observed:

Date of observation (MM/DD/YYYY):

Grade Level of Program (based on curriculum being used) (circle): Grade 4-5 Program Grade 6-8 Program

Name of Unit (circle): Grade 4-5 Program	Grade 6-8 Program
1. Climate Change 2. Electric Expressions 3. Engineering: Design & Build 4. Now You See It, Now You Don't: The Electromagnetic Spectrum 5. You Be the Judge	1. From Butterflies to Weather: Finding Order Amid Chaos? 2. MEDIEVAL: STEM Through the Middle Ages 3. Rock 'n Roll: Tectonics and Seismicity 4. Secret Communications: Sharing Concealed Messages 5. Take Flight: Investigating the Aviation Industry 6. Twisted and Tangled: Making Sense of Your Senses
Lesson Name:	

Has/have the instructor(s) taught this unit before (circle): NO YES Do Not Know

Observation Rubric

Extent to which the Unit/Lesson demonstrated **Fidelity** to the Fusion curriculum design/lessons/units:

Rating: 1 2 3

Little or No Fidelity **1**	**Moderate Fidelity** **2**	**High Fidelity** **3**
There is little or no evidence that the unit/lesson has fidelity to the IMSA Fusion design.	There is moderate evidence that the unit/lesson has fidelity to the IMSA Fusion design.	There is consistent evidence that the unit/lesson has fidelity to the IMSA Fusion design.
Example: Content and pedagogy does not reflect Fusion curriculum design or professional development training. Sequencing is out of order and/or has missing steps in the activities presented. Instructional techniques do not reflect best practices in STEM education. Some activities are incomplete, and the session lacks discussion/debrief with students.	Example: Content and pedagogy mostly reflect Fusion curriculum design and professional development training. Sequencing of activities generally follows Fusion curriculum design. Instructor(s) uses scientific inquiry techniques from Fusion professional development sessions. Most activities are completed, and session includes discussion/debrief with students.	Example: Content and pedagogy completely reflect Fusion curriculum design and professional development training. Sequencing of activities aligns with Fusion curriculum design. Instructor(s) has strong command of scientific inquiry techniques from Fusion professional development sessions. All activities are completed and ample time is devoted to discussion/debrief with students.
Observed Evidence:		

Area 1: Preparation, Organization, and Implementation

Description: The extent to which the instructor(s) appropriately plan, prepare, and implement the curricular activities.

Evidence includes having full sets of instructional materials readily available for all participants (e.g., copies of instructions and worksheets); equipment has been cleaned, checked for all pieces/elements, and is fully operational; disposable materials are organized at workstations. Instructors act as co-teachers, sharing responsibility for the organization and delivery of instruction; present activities in a logical order with smooth transitions between activities; make efficient use of time; and adapt and accommodate to changes in the learning environment as needed. Classroom management minimizes distractions, disruptions, confusion, or boredom for students.

Rating: 1 2 3 4 Not Observed

No Evidence **1**	**Limited Evidence** **2**	**Reasonable Evidence** **3**	**Exceptional Evidence** **4**	**Not Observed**
There is little or no evidence that the instructor(s) is/are prepared and deliver(s) the activities in an organized manner.	There is limited, inconsistent evidence that the instructor(s) is/are prepared and deliver(s) the activities in an organized manner.	There is clear evidence that the instructor(s) is/are prepared and deliver(s) the activities in an organized manner.	There is consistent and compelling evidence that the instructor(s) is/are prepared and deliver(s) the activities in an organized manner.	
Example: Instructor repeatedly interrupts the activities to gather or prepare materials; equipment does not function correctly and/or has missing pieces. Instructors repeatedly under- or overestimate time required; instructors work independently of each other (lack co-teaching behaviors). Instructors become flustered by changes in learning environment. Most students appear to be distracted or confused. Excessive amount of time is spent on snack-time.	Example: Some materials are readily available, but there is loss or time or disruption for gathering and preparing other materials. Equipment occasionally malfunctions. There is loss or time or disruption during activities, and at beginning and end of session (snack-time, cleanup). Instructors occasionally work together, but do appear to have clearly defined roles. Transitions are weak and disrupt flow of activities.	Example: The majority of materials are readily available, with only minimal disruptions. Equipment functions correctly and disposable materials are provided for all students. The time allotted for activities is appropriate and transitions create a consistent flow between activities. Instructors function as a team and share responsibilities for implementing the curricular activities. Very few disruptions or distractions for students.	Example: All materials are readily available for planned and extended/contingency activities. Equipment functions correctly and disposable materials are provided for all students, including materials for extended activities. Time allotted allows for all activities to run smoothly and fully completed. Instructors function as a team, co-teach the activities, and have collegial rapport. Students move seamlessly between activities, with no disruptions.	
Observed Evidence:				

Area 2: Use of Facilities, Space, and Equipment

Description: The extent to which the facilities, space, and equipment are conducive to STEM learning.

Evidence includes ample space that allows for student movement, working in groups, hands-on activities, and peer discussions; appropriate use of science instruments and expendable materials; and access to technology to research, document, analyze, and/or communicate information. Safety procedures are in place and followed by students and instructors.

Rating: 1 2 3 4 Not Observed

No Evidence 1	**Limited Evidence 2**	**Reasonable Evidence 3**	**Exceptional Evidence 4**	**Not Observed**
There is little or no evidence that the space is utilized in a manner that is conducive to STEM learning.	There is limited, inconsistent evidence that the space is utilized in a manner that is conducive to STEM learning.	There is clear evidence that the space is utilized in a manner that is conducive to STEM learning.	There is consistent and compelling evidence that the space is utilized in a manner that is conducive to STEM learning.	
Example: Space is overcrowded; lacks appropriate furnishings to set up activities; lacks access to basic technology and electricity; not enough space to conduct experiments; too hot/cold. No evidence of safety procedures.	Example: Space allows for some activities, but students cannot consistently hear the instructor or each other, observe demonstrations, or fully implement the lesson. Limited access to technology and/or inconsistent quality of technology. Safety procedures largely ignored.	Example: Space is well utilized for planned activities; equipment set up allows for use by instructor and students; space provides ample access to technology for most students; most students consistently follow safety procedures.	Example: Space is creatively organized for planned and extended/contingency activities. Students move efficiently though the space and equipment set up allows for exploration/experimentation. Appropriate technology is readily available to all students. Instructor and all students consistently follow safety procedures.	
Observed Evidence:				

Area 3: Appropriate Participation and Team Work

Description: Extent to which students appropriately participate in individualized, paired, and team-based activities.

Evidence includes students following directions and guidance from the instructor(s) and/or curricular materials, staying on task, conducting individual and group hands-on experiments/activities, and completing observation/documentation activities (journals, observation logs, worksheets, etc.). Students constructively work together and share ideas and findings. Interactions among students and between the instructor(s) and students are consistently positive, creating a supportive and friendly learning environment.

Rating: 1 2 3 4 Not Observed

No Evidence 1	**Limited Evidence 2**	**Reasonable Evidence 3**	**Exceptional Evidence 4**	**Not Observed**
There is little or no evidence that students are appropriately participating in the activities.	There is limited, inconsistent evidence that students are appropriately participating in the activities.	There is clear evidence that students are appropriately participating in the activities.	There is consistent and compelling evidence that students are appropriately participating in the activities.	
Example: Most students do not follow directions, participate in the activities, or show interest in the curriculum. Students zone out, discuss unrelated topics, play on computers or cell phones, or leave the program space without permission. Team work is dysfunctional and students are disrespectful to each other and to the instructor.	Example: Subsets of students participate, but participation is uneven across the activities and students need prompting to stay on task. Group work is dominated by a few students and/or most students choose to conduct activities on their own. Learning environment is overly formal.	Example: The majority of students participate in individual and group activities, follow directions without the need for additional prompting or correction. Group work is not dominated by a few students and the majority of students engage in discussions. Team responsibilities are shared by most students and interactions are consistently positive.	Example: All students actively participate in individual and group activities, follow directions, and complete tasks efficiently. All students are equally involved and support each other during the activities. Students vary the roles they play on teams and discuss emergent findings with each other and the instructor. The learning environment is friendly and positive.	
Observed Evidence:				

Area 4: Purposeful Activities

Description: The extent to which instructional techniques and program activities are structured so that students have a clear understanding of the learning goals for each activity and how the program's activities support attainment of the learning goals.

Evidence includes clear opportunities for students to engage in hands-on activities related to clear, cohesive STEM topics; instructional activities that scaffold student thinking and deepen understanding of STEM; activity learning goals related to fundamental STEM concepts and topics; and instructional pedagogy that supports the learning goals.

Rating: 1 2 3 4 Not Observed

No Evidence 1	**Limited Evidence 2**	**Reasonable Evidence 3**	**Exceptional Evidence 4**	**Not Observed**
There is little or no evidence that the activities are purposeful and guide students toward STEM learning goals.	There is limited, inconsistent evidence that the activities are purposeful and guide students toward STEM learning goals.	There is clear evidence that the activities are purposeful and guide students toward STEM learning goals.	There is consistent and compelling evidence that the activities are purposeful and guide students toward STEM learning goals.	
Example: Activity goals are not provided or are unrelated to STEM. Instructor does not provide scaffolding for activities and most students are unable to complete tasks. Instructor's questions are unrelated to STEM topics.	Example: Activity goals are partially clear to students and activities are peripherally related to STEM learning goals. Scaffolding is provided by instructor for a few activities but some students appear to be confused throughout the lesson.	Example: Activity goals are generally clear to students and activities are related to STEM learning goals. Minimal aspects of activities appear to require additional scaffolding and connections, and overall learning environment is productive.	Example: Activity goals are consistently clear to students and activities support STEM learning goals by having clear, cohesive relationship to the goals. All students appear to have clear grasp of learning expectations.	
Observed Evidence:				

Area 5: Student Engagement with STEM

Description: The extent to which students engage in hands-on activities that contribute to constructing their skills and knowledge of STEM.

Evidence includes students performing experiments and using a range of materials and manipulatives; using technology for research and experimentation; and documenting their actions and data/findings through oral and written communication. Students are not passive recipients of knowledge, but rather perform cognitive work and make meaning from their work. Instructors are aware of and address variety of learning styles. The instructional activities challenge students' critical thinking skills.

Rating: 1 2 3 4 Not Observed

No Evidence 1	**Limited Evidence 2**	**Reasonable Evidence 3**	**Exceptional Evidence 4**	**Not Observed**
There is little or no evidence that students are engaged with hands-on and interesting activities where they explore STEM content.	There is limited, inconsistent evidence that students are engaged with hands-on and interesting activities where they explore STEM content.	There is clear evidence that students are engaged with hands-on and interesting activities where they explore STEM content.	There is consistent and compelling evidence that students are engaged with hands-on and interesting activities where they explore STEM content.	
Example: Students are passive throughout most of the activities. Students mostly observe instructor demonstration or listen to the instructor talk. Hands-on engagement is hampered by incomplete materials, limited access to technology, and/or insufficient time.	Example: Students engage in hands-on activities, but there is limited evidence that the activities encourage understanding of STEM (i.e., students going through the motions = hands-on and minds-off). Instructor sometimes demonstrates activities rather than having students engage in them.	Example: Most students engage in the hands-on activities, allowing them to explore STEM content. Most students show excitement and interest in the activities. Very few activities where instructor does cognitive work and students are passive.	Example: All students engage in the hands-on activities, allowing them to explore STEM content. Students are excited and show positive interest in activities. Instructor maintains role of facilitator of learning rather than lecturer. Students discuss STEM content and what/how they are learning.	
Observed Evidence:				

Area 6: STEM Content Learning

Description: The extent to which students are supported in the development of meaningful science, mathematics, technological, and engineering content though the program's curriculum and activities.

Evidence includes instructors who are knowledgeable about STEM content and accurate in their presentation of vocabulary, concepts, strategies, evidence, and application. Students have required background knowledge to engage in activities and are able to apply their knowledge beyond memorization/rote repetition. Students demonstrate STEM skills and knowledge through completion of tasks, questioning of peers and instructor, data analysis, discussion of findings, and application of learnings. Instructors informally assess students' understanding of STEM content.

Rating: 1 2 3 4 Not Observed

No Evidence 1	**Limited Evidence 2**	**Reasonable Evidence 3**	**Exceptional Evidence 4**	**Not Observed**
There is little or no evidence that activities support students in developing meaningful STEM content learning.	There is limited, inconsistent evidence that activities support students in developing meaningful STEM content learning.	There is clear evidence that activities support students in developing meaningful STEM content learning.	There is consistent and compelling evidence that activities support students in developing meaningful STEM content learning.	
Example: Instruction presents STEM content with numerous errors. Connections are not made between activities and STEM content. Students' comments and questions indicated they have weak understanding of the content presented and/or cannot go beyond basic memorization/rote feedback.	Example: Instruction presents STEM content with some errors. Superficial connections are made between activities and STEM content. Students' comments and questions indicate they are developing a basic understanding of STEM content but lack connections among ideas.	Example: Instruction is primarily error free. Connections are made between the majority of activities and STEM content. Students' comments and questions indicate they understand STEM content well and are beginning to make connections among ideas.	Example: Instruction is accurate and error free. Connections are made between activities and STEM content that deepen students' understanding of concepts. Students' comments and questions indicate that all students fully understand the STEM content and are able to make connections among ideas.	
Observed Evidence:				

Area 7: Inquiry and Problem Solving

Description: The extent to which instructional activities support the use of STEM practices and tools while exploring content through inquiry.

Evidence includes opportunities for students to engage in STEM practices of observations, modeling, questioning, investigating, analyzing data, and constructing explanations. Students develop/expand upon strategies to solve problems, evaluate the validity of information, and repeat experiments to confirm results. Instructors use open-ended questions and encourage questions from students. Instructors require students to supply evidence to support claims and meet desired criteria, and encourage students to consider implications of conclusions. The level of support for student inquiry provided by the instructor is appropriate for the age-level and STEM content being addressed.

Rating: 1 2 3 4 Not Observed

No Evidence 1	**Limited Evidence 2**	**Reasonable Evidence 3**	**Exceptional Evidence 4**	**Not Observed**
There is little or no evidence that students engage in STEM practices and inquiry-based learning during the activities.	There is limited, inconsistent evidence that students engage in STEM practices and inquiry-based learning during the activities.	There is clear evidence that students engage in STEM practices and inquiry-based learning during the activities.	There is consistent and compelling evidence that students engage in STEM practices and inquiry-based learning during the activities.	
Example: Students observe rather than participate in STEM practices or only complete partial activities on their own. Instructors use close-ended questions and do not ask students to provide evidence or support for their conclusions.	Example: Students use some inquiry practices, but they do not engage students in the thinking and reasoning of STEM professionals. Instructor uses some open-ended questions but most inquiry practices are highly-scripted (i.e., directed inquiry).	Example: Most students use inquiry practices and engage in problem solving of scientific questions. Instructor uses suggested and open inquiry techniques.	Example: All students use inquiry practices and engage in problem solving of scientific questions. Students observe, document, analyze, and report on data/findings. Instructor often uses open inquiry techniques.	
Observed Evidence:				

Area 8: Reflection, Relevance, and Making Connections

Description: The extent to which instructional activities support explicit reflection on the STEM content; the quality of the reflections made by the students; and how they make connections between the activities and their own experiences, other subject areas, and broader STEM issues.

Evidence includes instructors encouraging students to use information and insights from a variety of subject areas; students recognizing connections within and cross subject areas; and students reflecting on relevant applications of their learnings to real-world situations. Activities connect STEM to students' experiences and backgrounds, and link to STEM careers and community issues. Instructors assess students' abilities to apply learning to new situations through oral, written, and multi-media communications.

Rating: 1 2 3 4 Not Observed

No Evidence 1	**Limited Evidence 2**	**Reasonable Evidence 3**	**Exceptional Evidence 4**	**Not Observed**
There is little or no evidence that students engage in explicit and meaningful reflection about STEM content or learnings.	There is limited, inconsistent evidence that students engage in explicit and meaningful reflection about STEM content or learnings.	There is clear evidence that students engage in explicit and meaningful reflection about STEM content or learnings.	There is consistent and compelling evidence that students engage in explicit and meaningful reflection about STEM content or learnings.	
Example: The instructor creates no opportunities for the students to connect ideas within or across activities, or to reflect on new understandings. Students do not see relevance of STEM to their lives.	Example: The instructor briefly prompts students for reflection but provides little time for students' responses. Instructor reviews learning goals rather than allowing students to articulate their own learnings. Instructor provides examples of connections to students' lives but students do not contribute to the discussion.	Example: The instructor uses prompts and questions that encourage reflection. Students' reflections include connections among ideas and explanations of concepts. Some students provide applications to real-world situations and discuss connections to their lives and communities.	Example: The instructor uses prompts and questions throughout the activities to encourage reflection. All students actively reflect individually and in groups on STEM content and concepts, and provide real-world applications. Students independently make links between STEM and their lives and communities.	
Observed Evidence:				