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

2015-2016 Program Year

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Introduction

This document summarizes data collected by the Center for Evaluation and Education Policy (CEEP) at Indiana University during the 2015-2016 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 2015-2016 academic school year.

This comprehensive report serves as the required deliverable for the evaluation contract from July 1, 2015-June 30, 2016. The report provides data summaries and findings for each of the four surveys and the observation tool.

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 89%) 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 (91-95%) 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 85%) 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 75%) 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, communicate orally, and identify problems/questions to be solved.

Eighty-seven percent of teachers and 84% 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-two percent of parent/guardian respondents agree or strongly agree that IMSA Fusion is a valuable part of their children's learning experiences and 91% would recommend the program to other parents and students. Ninety-three percent of student respondents agree or strong agree that Fusion is a good learning experience, and 82% of students would recommend IMSA Fusion to their friends.

Perceived Impact on Schools and Parental Interest

Seventy-seven percent of principal respondents agree or strongly agree that their schools place more emphasis on science instruction, and 72% of principals agree or strongly agree that their schools place more emphasis on mathematics instruction because of IMSA Fusion. Seventy 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 74% 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

Ninety-one 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; 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 2015-2016 program year demonstrated high fidelity and consistent quality. Out of 80 observations conducted by IMSA Fusion site observers, 33% (26) demonstrated moderate fidelity and 66% (53) 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 78% to 98% 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 learning new curricular units and becoming comfortable with the activities; setting up and completing the units/lessons in the time allotted for the program; providing students with adequate background knowledge on mathematics and science concepts; working with mixed-ability groups of students; and encouraging students to work in groups and think critically. Challenges identified by the principal respondents included securing funding for the program, scheduling the program, 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 providing training on how to adapt or create new lessons for younger students and students without in depth mathematics/science knowledge; continuing to provide additional resources on the IMSA website; and increasing student-led and hands-on activities in the curriculum to encourage student engagement.

Examples of how IMSA Fusion could further support respondents in their roles as principals included providing them the general program information and announcements that is disseminated to teachers (via email) so that they can be proactive in supporting their Fusion teachers; identifying strategies for integrating more STEM content and pedagogy across grade levels; and helping schools promote the program to students, parents, and the community, especially in urban settings.

Data Summaries and Findings

Aggregate Summary IMSA Fusion Teacher Surveys

This section of the report summarizes the IMSA Fusion teacher surveys collected in spring 2016. Teachers (who serve as instructors for the Fusion program) across the 141 program sites (operating in academic year 2015-2016) were asked to complete a brief survey through an online software program. Teachers were given approximately 12 weeks to complete the survey (February through April 30, 2016). CEEP researchers analyzed the survey responses using SPSS software.

One-hundred-eighty-four teachers completed the survey, across 99 program sites. Fifty-two percent (96) of respondents teach in the 4th-5th grade program and 48% (88) teach in the 6th-8th grade program.

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-eight percent of respondents **agree** or **strongly agree** that *Students in my school have developed deeper interest in science because of IMSA Fusion* (mean = 3.69).

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-two 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 3.79).

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-six percent (140 out of 163) of respondents noted that having students work in pairs/teams to collect information was directly influenced by their Fusion experiences.

Classroom successes in using IMSA Fusion pedagogy or curriculum included exposing students to a variety of mathematics and science activities, engaging them in hands-on activities and group learning; allowing them to learn through trial-error through scientific/engineering processes; and having students communicate their learnings to their peers and others. Illustrative examples are provided.

> *Many new students joined the program who normally do not have exposure to advanced math and science activities.*
>
> *Having a group of students come together and complete a variety of challenging activities and having the students have to rely on each other to solve problems and create solutions.*
>
> *One of the greatest successes was when our IMSA students created electronic game boards to share with younger students in our after school Latch Key program. The enthusiasm of everyone was contagious.*

The greatest successes this year was the new knowledge the students were able to come away with. The failure of many experiments was a wonderful learning opportunity for them. At the beginning of the program, the students had a difficult time accepting failure and sat there and did not know what to do. When you see them now, it is truly amazing how far some of them have come. They are continually redesign and rethinking and communicating their ideas.

We did the engineering unit and some of the concepts were very difficult. Students got frustrated and gave up, we had lots of great conversations about looking at things in a different way, starting over, and not being afraid to fail. I think this unit really helped my students learn about perseverance.

Seeing students being accountable and excited about their learning. Integrating Science and Math into real-world problems.

In my bilingual class, it offers so many opportunities for my students to practice academic vocabulary. This is the hardest thing, in my opinion, to teach them. Fusion has made it easier to teach, reinforce, and regularly use academic vocabulary.

Our greatest success was our IMSA Fusion Showcase Night. It's a great opportunity for the students to reflect on what they did and prepare a short presentation for parents/family members, teachers, and administrators. They love telling other people what they did and how much fun they had!

Our students really enjoyed the Life as a Star unit in the Electromagnetic Spectrum. They liked learning about the stages of a star and creating the H-R Diagram. When given the opportunity to research more about stars they are familiar with and present it to the class, they jumped at it.

Students were motivated to come to IMSA and continue their learning. They enjoyed the unit taught and shared their knowledge to classmates not in the IMSA program. Students made a lot of connections to the outside world with the unit taught.

Challenges identified by teachers included learning new curricular units and becoming comfortable with the activities; setting up and completing the units/lessons in the time allotted for the program; providing students with adequate background knowledge on mathematics and science concepts; working with mixed-ability groups of students; and encouraging students to work in groups and think critically.

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 certificate courses in STEM areas at a variety of universities/colleges and museums; attending professional association conferences (e.g., NSTA, NISE); and participating in professional development training on *Next Generation Science 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 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; and providing informal and formal coaching to peers on IMSA curricular units and general STEM topics.

When asked how IMSA might support the teachers in their roles as Fusion instructors, respondents mentioned providing training on how to adapt or create new lessons for younger students and students without in depth mathematics/science knowledge; continuing to provide additional resources on the IMSA website; and increasing student-led and hands-on activities in the curriculum to encourage student engagement.

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

Statement n=184	Strongly Disagree	Disagree	Agree	Strongly Agree	Do Not Know	Mean
Students in my school have developed deeper **interest** in **mathematics** because of IMSA Fusion.	1%	5%	**45%**	**44%**	5%	3.40
Students in my school have developed deeper **understanding** in **mathematics** because of IMSA Fusion.	1%	5%	**51%**	**38%**	5%	3.34
Students in my school have developed deeper **interest** in **science** because of IMSA Fusion.	1%	1%	**26%**	**71%**	1%	3.71
Students in my school have developed deeper **understanding** in **science** because of IMSA Fusion.	1%	1%	**28%**	**70%**	0%	3.69
IMSA Fusion has offered students who typically do not participate in mathematics and science activities access to STEM programming.	3%	7%	**38%**	**49%**	3%	3.39
My school now places more emphasis on **science** instruction in the school overall because of IMSA Fusion.	3%	29%	**45%**	**19%**	4%	2.82
My school now places more emphasis on **mathematics** instruction in the school overall because of IMSA Fusion.	4%	31%	**44%**	**16%**	5%	2.76
I have enhanced my regular classroom instruction because of IMSA Fusion.	1%	5%	**27%**	**63%**	4%	3.59
Parents of students in the program are more interested in their children's achievement in **mathematics** because of IMSA Fusion.	1%	10%	**43%**	**31%**	15%	3.21
Parents of students in the program are more interested in their children's achievement in **science** because of IMSA Fusion.	1%	8%	**46%**	**33%**	12%	3.25

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

Statement n=176	Strongly Disagree	Disagree	Agree	Strongly Agree	Do Not Know	Mean
IMSA Fusion improves students' abilities to **identify problems/questions to be solved**.	1%	1%	**28%**	**70%**	0%	3.69
IMSA Fusion improves students' abilities to **collect** information/data.	1%	1%	**24%**	**74%**	0%	3.72
IMSA Fusion improves students' abilities to **organize** information/data.	1%	3%	**32%**	**64%**	0%	3.61
IMSA Fusion improves students' abilities to **analyze** information/data.	1%	2%	**26%**	**71%**	0%	3.69
IMSA Fusion improves students' abilities to **formulate solutions to problems**.	1%	2%	**25%**	**72%**	0%	3.69
IMSA Fusion improves students' abilities to **communicate orally**.	1%	1%	**35%**	**63%**	0%	3.61
IMSA Fusion improves students' abilities to **communicate in written form**.	1%	6%	**56%**	**37%**	0%	3.30
IMSA Fusion improves students' abilities to **use media/technology to access information**.	1%	4%	**51%**	**41%**	3%	3.37
IMSA Fusion improves students' abilities to **work productively in groups**.	1%	1%	**16%**	**81%**	1%	3.79
IMSA Fusion improves students' abilities to **work with their peers to achieve common goals**.	1%	1%	**17%**	**80%**	1%	3.79
IMSA Fusion improves students' abilities to **integrate mathematics and science content**.	1%	1%	**31%**	**67%**	0%	3.65
IMSA Fusion improves students' abilities to **connect new information with prior knowledge**.	1%	1%	**25%**	**72%**	1%	3.67
IMSA Fusion improves students' abilities to **direct their own learning**.	1%	3%	**30%**	**65%**	1%	3.60
IMSA Fusion improves students' abilities to **assess the quality of their own work**.	1%	3%	**42%**	**53%**	1%	3.50

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

Statement n=163	% and # of Respondents
How students identify problems/issues to address	83% (135)
How students formulate strategies for addressing problems/issues	75% (123)
How students work in pairs/teams to collect information	86% (140)
How students work in pairs/teams to analyze information	85% (138)
How students work in pairs/teams to report results	77% (126)
How students use journals/observation logs to record information	44% (72)
How students create oral presentations of their results	38% (62)
How students create written reports/summaries of their results	29% (48)
How students engage in group discussions to reflect on their learning	82% (134)
How students assess the quality of their work	42% (69)
How students use technology/media to conduct research on STEM topics	46% (75)
My use of open-inquiry strategies in questioning students about their knowledge	72% (118)
My use of real-world examples in teaching of content	81% (132)
How we discuss connections between previous knowledge and new knowledge	64% (104)
How we discuss connections across STEM subject areas (e.g., geometry, chemistry, astronomy)	57% (93)
How we discuss connections across STEM and non-STEM subject areas (e.g., estimation, biology, social studies, etc.)	55% (90)
I demonstrated Fusion hands-on investigations/experiments for all students in the class.	47% (76)
I had all students in the class conduct Fusion hands-on investigations/experiments.	48% (78)
I used Fusion supplemental science resources to teach STEM content (e.g., as reading materials for your classroom students).	35% (57)

Aggregate Summary IMSA Fusion Principal Surveys

This section of the report summarizes the IMSA Fusion principal surveys collected in spring 2016. Principals across the 141 program sites (operating in academic year 2015-2016) were asked to complete a brief survey through an online software program. Principals were given approximately 12 weeks to complete the survey (February through April 30, 2016). CEEP researchers analyzed the survey responses using SPSS software.

Forty-five principals completed the survey, across 52 program sites. Thirty percent (14) of respondents identified their schools as urban, 59% as suburban (27), and 11% as rural (5).

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 70% of respondents **agree** or **strongly agree** with the statements about the IMSA Fusion programming. The two statements with the highest level of agreement (935) were *Students in my school have developed deeper interest in science because of IMSA Fusion* and *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 a variety of students in hands-on, challenging, and interactive activities; students' excitement and interest in the program; and increased instructor collaboration and teaching skills. Illustrative examples are provided.

> *The fusion teachers are fantastic.*
>
> *This year our teachers were worked together very well and brought in parents to help share their expertise.*
>
> *Just being able to have the engineering aspect in our school was very exciting!*
>
> *Being able to provide higher level thinking to our students.*
>
> *Provided an opportunity for our higher students to advance their science and math knowledge.*
>
> *Students are excited to actively participate in IMSA.*
>
> *The IMSA Fusion program brought in students that do not normally participate in after school activities.*

Challenges identified by the principal respondents included securing funding for the program, scheduling the program, 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 providing them the general program information and announcements that is disseminated to teachers (via email) so that they can be proactive in supporting their Fusion teachers; identifying strategies for integrating more STEM content and pedagogy across grade levels; and helping schools promote the program to students, parents, and the community, especially in urban settings.

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

Statement n=44	Strongly Disagree	Disagree	Agree	Strongly Agree	Do Not Know	Mean
Students in my school have developed deeper **interest** in **mathematics** because of IMSA Fusion.	5%	2%	**41%**	**50%**	2%	3.39
Students in my school have developed deeper **understanding** in **mathematics** because of IMSA Fusion.	5%	2%	**36%**	**57%**	0%	3.45
Students in my school have developed deeper **interest** in **science** because of IMSA Fusion.	5%	0%	**29%**	**66%**	0%	3.57
Students in my school have developed deeper **understanding** in **science** because of IMSA Fusion.	5%	0%	**25%**	**70%**	0%	3.61
IMSA Fusion has offered students who typically do not participate in mathematics and science activities access to STEM programming.	5%	9%	**45%**	**39%**	2%	3.21
My school now places more emphasis on **science** instruction in the school overall because of IMSA Fusion.	5%	16%	**52%**	**25%**	2%	3.00
My school now places more emphasis on **mathematics** instruction in the school overall because of IMSA Fusion.	5%	18%	**47%**	**25%**	5%	2.98
Fusion teachers in my school have enhanced their regular classroom instruction because of IMSA Fusion.	7%	2%	**41%**	**50%**	0%	3.34
Fusion teachers in my school have sought out additional professional development opportunities in STEM disciplines because of IMSA Fusion.	5%	5%	**47%**	**34%**	9%	3.22
Fusion teachers have sought out opportunities to serve as instructional mentors in STEM disciplines to their peers in my school because of IMSA Fusion.	7%	14%	**43%**	**29%**	7%	3.02
Parents of students in the program are more interested in their children's achievement in **mathematics** because of IMSA Fusion.	7%	5%	**41%**	**29%**	18%	3.19
Parents of students in the program are more interested in their children's achievement in **science** because of IMSA Fusion.	7%	5%	**43%**	**31%**	14%	3.21

Aggregate Summary IMSA Fusion Parent Surveys

This section of the report summarizes the IMSA Fusion parent surveys collected in spring 2016. Parents/guardians across the 141 program sites (operating in academic year 2015-2016) were asked to complete a brief survey through an online software program or in paper form. Parents/guardians were given approximately 16 weeks to complete the survey (February 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.

Six-hundred-and thirty-five (635) parents/guardians completed the survey, across 70 program sites. They reported that 23% of their children were in fourth grade, 26% in fifth grade, 19% in sixth grade, 16% in seventh grade, and 16% in eighth grade. Respondents estimated that 67% of their children attended all of the FUSION sessions during the 2015-2016 school year, 29% attended at least 75% of the sessions, 3% attended at least 50% of the sessions, and 1% attended less than 50% of the sessions. Eighty-six percent of respondents plan on having their child(ren) attend the IMSA Fusion program during the 2016-2017 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 85% of respondents **agree** or **strongly agree** with each of the statements about the IMSA Fusion programming. The statement with the highest mean was *I think that IMSA Fusion should be a permanent part of the afterschool programming at my child's school* (mean = 3.67).

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 to learn real world problem solving and critical thinking skills. Illustrative examples are provided.

> *She loves math and science and I wanted to expand her opportunities to grow and learn in these areas.*
>
> *I think it's great to have non-traditional learning opportunities for kids to be able explore subjects like math and science in a different way.*
>
> *It was offered as an elective during the regular school day and we felt she would receive greater benefits from IMSA Fusion than from the regular science offered as an alternative.*
>
> *My daughter needed a more demanding curriculum. Her regular schoolwork was not challenging her. To encourage her natural talents and abilities in a positive way.*
>
> *Think outside the box. It offers real hands on experiences that are difficult to replicate in a standard classroom setting. The students do not simply learn math and science concepts. The*

students are asked to apply these concepts to solve problems with creative thinking and teamwork.

I wanted him to develop his math and science skills and hoped he would be able to apply these skills to real world experiences as well as develop more interest in these two subject areas.

To continue to develop skills and interest level in mathematics and science. To work on team building and problem solving skills. To be exposed to critical thinking and the scientific process.

I left the final decision up to her. I really wanted her to participate though because I felt that it would give her the chance to experience more hands on and group activities using math and science. It was a different setting that I thought she would really benefit from.

She was in this program last year along with stellar girls and absolutely loved both. She loves doing the experiments and comes home excited about what she is doing. I know she understands well what she's learning there, she's able to come home, walk her brother through what she's done and get him interested in the program too.

To be with kids whose parent value education. Also, to be in an advisory/class which tracks to enable my child to be with their intellectual equals.

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 critical thinking skills gained by students; and the talented instructors. Illustrative examples are provided.

My daughter really liked the practical applications; seeing how math and science can be applied in everyday settings.

This experience demonstrated all different ways science and math are involved in our everyday lives. It just enhanced their knowledge immensely.

The program has really challenged my child and made him become a better student.

A greater understanding of math and science due to great projects and experiments.

Hands on experiments to teach about math and science concepts. Participation makes it more interesting.

It really gets the kids hands on. My kids get it much better, such a better understanding then only reading through a text book. This program has made her so excited to learn more and even try her own experiments at home. I love that she requests science kits and going to places like the science and industry museums over places like Chuck E. Cheese.

The program is more observational and participatory than traditional modes of learning which leads to more self- discovering and a longer lasting understanding of material. They are not "teaching" to a "test."

Social interaction in an academic setting.

The teachers are great. They work well with the students and really know how to engage them in group activities accessing more out of the box thinking, which is under-utilized and difficult for the kids to do sometimes. They are used to trying to give the appropriate answers, not necessarily looking for a solution, no matter what it might be.

The teachers keep it interesting and retain the students' attention and willingness to learn.

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

Creative thinking and group-based problem solving.

Learning to work in cooperative teams to solve problems.

Working together to build team trust and teamwork.

Seeing the everyday applications of math and science.

The most valuable learning experience has been his drive to learn more. To look at things and try to figure out how and why, further than his curiosity did before.

I feel my child is more interested in math and science than he previously was before he started IMSA.

There was not a specific experience because the entire experience was valuable. Not only did she learn new things but she developed an interest and a love for science and math.

Overall continuing to engage her in the fields of math and science to explore her interests in these fields and prepare her for high school.

I think the overall experience of science in motion has been valuable. Rather than just observing, they are doing. She comes home and shares her knowledge and tries to do the activities with her younger brother.

My child loves to learn about electricity. She now asks for circuit board activities and materials to build robots. She amazes me every time she completes a circuit or project.

This program has really helped build her confidence. Having the kids work the stem expo and teach others the experiments they've done and to be able to explain why it's happening.

The most valuable experience for my daughter was that she got to create things scientifically; things she never thought she will be creating, but most of all the confidence in her to do it bloomed.

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; creating semester-long programs rather than year-long programs; adding more field trips to see professionals in math and science fields; and integrating more mathematics into the curriculum.

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

Statement n=635	Strongly Disagree	Disagree	Agree	Strongly Agree	Do Not Know	Mean
My child developed deeper **interest in mathematics** because of IMSA Fusion.	2%	9%	**45%**	**40%**	4%	3.27
My child developed deeper **understanding in mathematics** because of IMSA Fusion.	2%	7%	**43%**	**42%**	6%	3.32
My child developed deeper **interest in science** because of IMSA Fusion.	2%	3%	**32%**	**61%**	2%	3.55
My child developed deeper **understanding in science** because of IMSA Fusion.	2%	2%	**33%**	**61%**	2%	3.55
IMSA Fusion provides meaningful afterschool experiences for my child.	3%	4%	**22%**	**65%**	6%	3.59
The IMSA Fusion program is a valuable part of my child's learning experiences.	2%	2%	**24%**	**68%**	4%	3.62
My child's overall social experience in the IMSA Fusion program has been satisfactory.	2%	3%	**30%**	**62%**	3%	3.56
Expectations for my child in the IMSA Fusion program were reasonable and appropriate.	2%	1%	**33%**	**60%**	4%	3.56
IMSA Fusion staff communicated effectively with parents.	3%	7%	**37%**	**49%**	4%	3.36
I would recommend IMSA Fusion to other parents and students.	2%	2%	**24%**	**67%**	5%	3.63
I think that IMSA Fusion should be a permanent part of the afterschool programming at my child's school.	3%	2%	**18%**	**71%**	6%	3.67

Aggregate Summary IMSA Fusion Student Surveys

This section of the report summarizes the IMSA Fusion student surveys collected in spring 2016. Students across the 141 program sites (operating in academic year 2015-2016) were asked to complete a brief survey through an online software program or in paper form. Students were given approximately 16 weeks to complete the survey (February through May 30, 2015). CEEP researchers analyzed the survey responses using SPSS software.

Two-thousand-and-eighty-nine (2089) students completed the survey, across 110 program sites. Of those respondents that identified their gender, 50% (1034) were female and 50% (1052) were male. Twenty percent (408) of students were in fourth grade, 25% (514) in fifth grade, 21% (446) in sixth grade, 18% (379) in seventh grade, and 16% (339) 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 70% of respondents **agree** or **strongly agree** with the statements about the IMSA Fusion programming. The statement with the highest level of agreement (97%) was *I think mathematics and science are useful subjects to know* (mean = 3.61).

Seventy-seven percent (1608) of students plan to participate in IMSA Fusion during the 2016-2017 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; enrolling in high school; or pursuing sports and hobbies that conflict with the schedule of the IMSA Fusion program.

Eighty-two percent (1711) 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.

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 and more complex and in depth learning within mathematics and science topics. Students also noted increased interactions with peers, independence in conducting experiments, and discussing their learnings in groups in Fusion. Illustrative examples are provided.

> *Learning math and science in Fusion is more fun and entertaining than in my regular math classes. Fusion has a way to make the material fun and make it stick in your heads after you even learned it. It isn't boring coming to Fusion sessions, I look forward to it and being with my friends make it even better, it makes me want to learn more.*
>
> *It is different because it is more advanced and we do a lot more hands on activities.*
>
> *We can be more independent, and we can have more elaborate labs because IMSA lasts longer than a class period.*

In Fusion we may sometimes start from scratch instead of having a piece of paper tell us every little detail of how to create our project.

When learning math and science in other classes we focus on usually one thing for a period of time and don't really get to do our own pace and it seems more boring and less fun, but in IMSA FUSION we get to have experiments and talk about how we feel about science and math and what we would like to learn it makes learning more fun {and} appealing.

You get to learn more advanced topics and expand on them. You get to do more fun activities with better utensils and materials. Also, you actually enjoy what you are being taught.

Learning math and science in IMSA Fusion is different that learning math and science because they teach more complex science lessons in IMSA, and also for both math and science the classmates are actually more interested in your ideas that you state rather than in normal math and science classes.

In Fusion we are able to do more hands-on experiments. We also do more advanced math than in regular classes. We are expected to read directions that are more complicated than most we do in class. And we are supposed to work with others on most projects.

Learning math and science in fusion is different than learning them in class because in fusion it is a mixture of both and we do activities to learn about science and math. I think the activities are cool because you get to do group work and everyone has different ideas so you can try all the ideas. Plus, in class we use huge books but in fusion we use packets and can work out what to do to figure out the problem.

It is more interesting and more hands on the experiments are interesting and fun to do. Also the teachers help a lot more and there are less students. You also feel very comfortable talking and participating out loud.

In math class, we learn about ratios, fractions, decimals, etc. but in IMSA Fusion, we learn about cracking codes, which is more fun than math class. And in science class, we learn about cells, ecosystems, periodic table, etc. but in IMSA Fusion, we learn about the history of airplanes and how airplanes are built, which is so much cool and fun to learn.

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

Statement **n=2089**	**Strongly Disagree**	**Disagree**	**Agree**	**Strongly Agree**	**Mean**
Because of Fusion I am more **interested in mathematics**.	4%	21%	**51%**	**24%**	2.95
Because of Fusion I better **understand mathematics**.	4%	20%	**50%**	**26%**	2.99
Because of Fusion I am more **interested in science**.	3%	9%	**37%**	**51%**	3.38
Because of Fusion I better **understand science**.	2%	8%	**47%**	**43%**	3.31
The Fusion program was a good learning experience.	2%	5%	**36%**	**57%**	3.49
The Fusion program was fun.	5%	8%	**31%**	**56%**	3.38
I think understanding mathematics and science will be important to me in the future.	2%	3%	**26%**	**69%**	3.63
I think understanding mathematics and science is important to the world's future.	2%	2%	**26%**	**70%**	3.66
I think mathematics and science are useful subjects to know.	1%	2%	**31%**	**66%**	3.61
The Fusion program helped me feel more comfortable talking about math and science.	5%	20%	**48%**	**27%**	2.97
I have more confidence in myself because of the Fusion program.	7%	23%	**42%**	**28%**	2.91
I felt comfortable asking questions in the Fusion program.	3%	14%	**50%**	**33%**	3.13
I could make decisions **by myself** in the Fusion program.	3%	10%	**50%**	**37%**	3.21
I could make decisions **with my classmates** in the Fusion program.	2%	5%	**43%**	**50%**	3.41

Summary of IMSA Fusion Site Observations

This section of the report summarizes data collected by IMSA Fusion site observers using the observation tool developed by the Center for Evaluation and Education Policy at Indiana University for use in the 2015-2016 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 30, 2016. 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.

Eighty observations were entered into the CEEP *Qualtrics* online survey database, representing 65 of 141 Fusion programs. It should be noted that due to reductions in Fusion staff available to conduct site visits the observation tool was used with only a subset of programs during 2015-16. Thirty-eight observations were of the 4-5th grade program and 42 were of the 6-8th program. Six different units were observed in the 4-5th grade program and six in the 6-8th grade program (see Table 7). Fifteen observations were of teachers who had taught their observed Fusion unit before, fifty-seven 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 (3 observations)	Secret Communications: Sharing Concealed Messages (4 observations)
Electric Expressions (5 observations)	Take Flight: Investigating the Aviation Industry (2 observations)
Engineering: Design & Build (12 observations)	From Butterflies to Weather: Finding Order Amid Chaos? (9 observations)
Now You See It, Now You Don't: The Electromagnetic Spectrum (4 observations)	Twisted and Tangled: Making Sense of Your Senses (10 observations)
You Be the Judge (1 observations)	MEDIEVAL: STEM Through the Middle Ages (4 observations)
Synthetic Scorecard: Building the Future of Biology (13 observations)	Materials Science: Living in a Material World (11 observations)

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. Sixty-six percent of observations were rated as *High Fidelity* (53 out of 80).

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 34% to 58%. For a rating of Exceptional Evidence the range was 35% to 63%. Between one and ten percent of observations received a rating of *Limited Evidence*.

Fidelity. Sixty-six percent of the observed lessons were rated as *High Fidelity* (53 out of 80). One of the observed lessons received a rating of *Little or No Fidelity*.

Table 8: Fidelity Mean = 2.65

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.
1% (1)	**33% (26)**	**66% (53)**
Description: The extent to which the Unit/Lesson demonstrated Fidelity to the Fusion curriculum design. Observed Evidence: Instructor is a very experienced IMSA Fusion teacher who uses strong inquiry facilitation techniques and questioning strategies. Instructor challenges students and uses reflection periodically to have students organize their thinking about the topic. Well-managed classroom with students who are willing to take chances and share their discoveries. Lesson appropriately adapted for size of group to perform activity "Move Over for a Different Code." The teachers followed the curriculum, served as facilitators, and spent time at the end debriefing the activity and putting it into perspective. The teachers made sure to move around the room and talk with all of the students and made sure that each group understood what was happening and were staying on track to complete the activity. Teachers did a great job keeping fidelity to the program. They worked their way through the curriculum as written, stopped to make sure that the debrief questions were being asked, and taught in an inquiry method. Very few “answers” were given during the period and the students were questioning and answering each other more than the teacher. The teachers followed the activity perfectly. They did a great job balancing the teacher-centered nature of the activity with giving the students time to lead the activity by reading the steps and the time to do what they needed without telling them every step and letting them make mistakes building the models. The teachers followed the activity and served as facilitators. They started the session with some review questions and then turned the students loose. The teachers worked the room to give advice to the students, but did not steer the students or stifle any of their creativity. When it came time to share, the students could talk freely and ask questions of each other. All of this was done in an appropriate way with no issues with discipline.		

Area 1: Preparation, Organization, and Implementation. Thirty-five percent of the observed lessons were rated as *Reasonable Evidence* (28 out of 80) in *Area 1: Preparation, Organization, and Implementation*. Fifty-eight percent of the observed lessons were rated as *Exceptional Evidence* (46 out of 80) in *Area 1*.

Table 9: Preparation, Organization, and Implementation Mean = 3.50

<table>
<tr><th>No Evidence
1</th><th>Limited Evidence
2</th><th>Reasonable Evidence
3</th><th>Exceptional Evidence
4</th><th>Not Observed</th></tr>
<tr><td>There is little or no evidence that the instructor(s) is/are prepared and deliver(s) the activities in an organized manner.</td><td>There is limited, inconsistent evidence that the instructor(s) is/are prepared and deliver(s) the activities in an organized manner.</td><td>There is clear evidence that the instructor(s) is/are prepared and deliver(s) the activities in an organized manner.</td><td>There is consistent and compelling evidence that the instructor(s) is/are prepared and deliver(s) the activities in an organized manner.</td><td rowspan="3">0%
(0)</td></tr>
<tr><td>0%
(0)</td><td>8%
(6)</td><td>35%
(28)</td><td>58%
(46)</td></tr>
<tr><td colspan="4">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:
Additional materials were available for two new students that were unexpected. Printed schedules of meeting dates were available for students. All time was used appropriately; no down time but did not seem rushed. Class was combined with other group for part of session and teachers shared instructional duties. Transitions between activities were smooth.

All materials are organized and prepared prior to session. Students proceed at their own pace, but time is mentioned to students as a guideline to their completion of a particular part of the activity. All instructors have contact with all of the groups and continually rotate among the different groups. Classroom management is evident; students are well-behaved.

Teacher was extremely well-prepared! Each student had a packet for today's lesson within a folder. She assigned partners as she distributed the folders in pairs once the actual activity began. Equipment functioned well. Ample time for students to do activities.

All of the materials were ready to go for the students. Additional supplies were readily available as the students moved through the activity. Also, the teachers knew where they were going and how to give the students enough time to complete the parts of the activity and for them do it student-led.</td></tr>
</table>

Area 2: Use of Facilities, Space, and Equipment. Forty-one percent of the observed lessons were rated as *Reasonable Evidence* (32 out of 79) in *Area 2: Use of Facilities, Space, and Equipment*. Fifty-seven percent were rated as *Exceptional Evidence* (45 out of 79) in *Area 2*.

Table 10: Use of Facilities, Space, and Equipment Mean = 3.54

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.	**0%** **(0)**
0% **(0)**	**3%** **(2)**	**41%** **(32)**	**57%** **(45)**	
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: All students had either personal laptops or access to laptops for session. Students were grouped for partner and small group discussion and to share materials. Students utilized hand lenses to investigate surfaces of broken candies. Instructors were able to move through room as students worked on activity. Open area was used for kinesthetic activity adjacent to science classrooms. The space is dedicated to science and was able to handle the activity that they were working on and the students had all of the supplies that they needed. The teachers had a projector to show instructions and the students work. Also the students were safe and followed all of the rules. Teachers used classroom with desks to introduce activity. Some students groups stayed in the classroom and other went in hallway to develop their mazes with ample privacy afforded for all. Ample space in gym to conduct two maze activities without interference from other groups of Fusion students. Space was ideal! Tables in the library were used for the brain teaser; students then moved to the carpet to focus on recapping last week's main ideas and introduce today's activity, then moved into the computer lab, where each student had his or her own computer, then utilized tables within the computer lab to do the hands-on activities. Teachers did move the class to the kindergarten classroom because it had more room and would work better for some of the activities. The teachers have access to technology and used it appropriately to make sure that the students were able to complete their activities and be on the same page. The teachers were able to move around and get to all of the students. Also, the tables were perfect for group work and the groups could be far enough from each other to not distract, but still collaborate.				

Area 3: Appropriate Participation and Team Work. Thirty-four percent of the observed lessons were rated as *Reasonable Evidence* (27 out of 79) in *Area 3: Appropriate Participation and Team Work*. Sixty-three percent were rated as *Exceptional Evidence* (50 out of 79) in *Area 3*.

Table 11: Appropriate Participation and Team Work Mean = 3.61

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% (2)**	**34% (27)**	**63% (50)**	

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:

Students are very positive and happy and actively engage in conversation. Three different schools are part of the consortium and students from different schools were partnered together. New students were welcomed, and other students debriefed prior activity so new students could see what was missed in the previous activity in the unit. Student partners had to reach consensus on functions of E. coli "parts" to share with class. Partners took turns delivering post-it responses to the front of the room.

This activity was done in groups of 4 and everyone participated. They did a great job of listening and following the steps, they were very engaged during the activity. The teachers enforced and the students followed without question to make sure that everyone one got to be a part of the activity, every student had a role.

Students worked well together to complete the activities. For both activities, they were in teams and were required to come to a consensus on their decisions. The teams changed for each different activity, so that the students were able to experience and learn how to work with other people.

Students followed directions and completed tasks efficiently. Although they worked independently doing the research, they discussed their findings with their partner. During the "extension" activity when they applied what they learned, they designed and built bridges out of popsicle sticks to withstand a predetermined amount of weight. Students worked very cooperatively with their partners at such time.

This entire part of the activity was team work. All of the students participated in their groups to build their products. There was not one group that had one person doing all the work. A couple of students did not come to this meeting and the students easily readjusted groups so that nobody worked alone. This could only happen if team work was a standard part of the program.

***Area 4: Purposeful Activities*.** Fifty-four percent of the observed lessons were rated as *Reasonable Evidence* (43 out of 80) in *Area 4: Purposeful Activities*. Forty percent were rated as *Exceptional Evidence* (32 out of 80) in *Area 4*.

Table 12: Purposeful Activities **Mean = 3.34**

<table>
<tr><th>No Evidence
1</th><th>Limited Evidence
2</th><th>Reasonable Evidence
3</th><th>Exceptional Evidence
4</th><th>Not Observed</th></tr>
<tr><td>There is little or no evidence that the activities are purposeful and guide students toward STEM learning goals.</td><td>There is limited, inconsistent evidence that the activities are purposeful and guide students toward STEM learning goals.</td><td>There is clear evidence that the activities are purposeful and guide students toward STEM learning goals.</td><td>There is consistent and compelling evidence that the activities are purposeful and guide students toward STEM learning goals.</td><td rowspan="3">1%
(1)</td></tr>
<tr><td>1%
(1)</td><td>4%
(3)</td><td>54%
(43)</td><td>40%
(32)</td></tr>
<tr><td colspan="4">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:
Students were actively working towards an understanding of the effects of cooling a liquid to a solid on crystalline structure. Elements of the lesson were designed to take an activity (kinesthetic movement) and apply directly their findings and observations. Students present finding with justification without prompting. Inquiry investigation with candy supports initial activity and allow students to make connections, now using new terminology.

Students conducted the activities with purpose. Every minute of the meeting had a purpose – they had time in the beginning to eat their snack and transition from their school day to the FUSION program. This time was well-delineated and from the moment students were told they were moving on to the moment they were dismissed, students were engaged in learning.

Teacher placed key terms on a large flip chart paper (i.e., standardization, synthetic biological system, etc.) and asked the students to tell her what they thought each term meant. Students used their prior knowledge from the previous activity, as well as their understanding of the world, to make sense of these words. Finally, they were asked "Why would allowing a tree to naturally grow into a treehouse be considered efficient?" Students replied that it would save unnecessary tree wood from being destroyed, it would take less human time, energy, and effort, etc. Students definitely deepened their knowledge and understanding of STEM concepts through this rich discussion as well as the subsequent activities.

Clear learning goals; productive learning environment; students interacting well with their partners and assisting others where appropriate.

The objective of the activity was to relate the importance of the development of the printing press to the difficulty of mass producing print items manually through block printing, which was popular in medieval China. They began with a discussion highlighting the differences between Chinese and Western manuscripts. Students seemed to have a good understanding of the learning goals of using block printing to create reproductions.</td></tr>
</table>

Area 5: Student Engagement with STEM. Forty-four percent of the observed lessons were rated as *Reasonable Evidence* (35 out of 79) in *Area 5: Student Engagement with STEM*. Fifty-three percent were rated as *Exceptional Evidence* (42 out of 79) in *Area 5*.

Table 13: Student Engagement with STEM Mean = 3.49

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.	**0% (0)**
1% (1)	**1% (1)**	**44% (35)**	**53% (42)**	

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:

All students investigating with hand lenses, discussing their choices with each other, and making connections. Instructor does an excellent job questioning students and allowing them to productively struggle with content. Their own ideas are used to discuss the content and content is not "delivered" to them. Students can "phone-a-friend" if they get stuck on an explanation or need clarification. Student discussion was on-task when walking around room observing student behavior.

Students were incredibly engaged in the activity where they had to determine what materials they would utilize (and for what purpose) in their underwater robot. They tried to meet budget challenges as well. All students participated in discussion, decision making and justifying their choices. When moving on to categorizing the materials by property, the discussion was harder to do for the students, but all students were still engaged in the discussion (at least through listening to thought of other students).

This activity was 100% hands on and the students took the lead. They came up with the criteria for the activity and then they followed through with it. They even got up and wrote their findings on the board. The students were in control.

The students ran the class, the teachers at times would ask thought provoking questions but for the most part the students were thinking ahead as to what the outcome would be. All students were hands-on and working well with each other. The teachers did a great job as taking a back seat and letting the students facilitate.

The students titled, rotated, and shook the black boxes to determine the internal shape or design. They documented their actions and findings through oral and written communication--at first they discussed with peers within their small groups and then later as a whole class. This activity definitely challenged students' critical thinking skills!

All students engaged in the hands-on activities and showed a positive interest. Some were very careful and thoughtful in their attempt to anticipate and control various variables, such as consistently holding the paper towels in the same manner, holding the sword in the same manner, etc. Teachers were effective in maintaining the role of a facilitator rather than

teachers. They continually challenged the students to stop and think about the impact their approaches may have on their results. Students were constantly engaged with challenging concepts and used a variety of methods to explore their way toward solutions. Computers were used to select standard parts of synthetic biology, students had to draw those parts, describe them in writing, and discuss them in their groups, and report their ideas to entire class. The students were engaged from the beginning to the end of the session. They were asking good questions of each other and having a great debate with only little interjections from the teacher. Once the students stated the research and making their plant cards, they kept working and the teacher again gave very few answers, but asked a lot of questions. The questions were coming from almost all of the students and not just a couple of them.	

Area 6: STEM Content Learning. Fifty-eight percent of the observed lessons were rated as *Reasonable Evidence* (46 out of 79) in *Area 6: STEM Content Learning*. Thirty-five percent were rated as *Exceptional Evidence* (28 out of 79) in *Area 6*.

Table 14: STEM Content Learning Mean = 3.29

<table>
<tr><th>No Evidence
1</th><th>Limited Evidence
2</th><th>Reasonable Evidence
3</th><th>Exceptional Evidence
4</th><th>Not Observed</th></tr>
<tr><td>There is little or no evidence that activities support students in developing meaningful STEM content learning.</td><td>There is limited, inconsistent evidence that activities support students in developing meaningful STEM content learning.</td><td>There is clear evidence that activities support students in developing meaningful STEM content learning.</td><td>There is consistent and compelling evidence that activities support students in developing meaningful STEM content learning.</td><td rowspan="3">1%
(1)</td></tr>
<tr><td>1%
(1)</td><td>4%
(3)</td><td>58%
(46)</td><td>35%
(28)</td></tr>
<tr><td colspan="4">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:
Students were making connections to prior knowledge and activities and had a wonderful discussion on "function" as it related to parts of a human which they then transferred to E. coli. Students used descriptive languages such as "genetic code" and "instruction center" to describe the DNA of the E. coli; "command center" and "factories" to describe ribosomes; "movement" for flagella; "sharing" for pili; "cell protection" and "gooey stuff" for cytoplasm; "holds it all together" for plasma membrane; and "small DNA" for plasmids, all without instructor prompting by reading a short passage and looking at a model of E. coli.

Students used sensory cues to complete a maze. Their comments and questions indicated that they understood the skills they used during the maze activity (i.e., memory, teamwork, observation, cooperation, note taking, and logic--that is, anticipating moves would eliminate choices).

Great connections made between activities and STEM content. Many new terms were introduced (i.e., plasmid, promoter, ribosome binding site, open reading frame, and terminator). Students were challenged, once again, to use critical thinking skills to determine the role of each part/term.

Students were very excited when they discovered possible explanations to the bridge failure. / Students found that the higher concentration of chlorides and sulfates, found in fill material near base of bridge, can weaken steel. Bedrock, again found near base of bridge, can cause erosion of steel. / They also concluded that the ground below the steel "cracked" and caused the pillar to shift--the fill material and natural soil (made of silt and clay) may have moved around.

After students drew on the board what they thought a parallel circuit would look like, one student assessed all of the drawings and remarked "Many of these designs look like the series circuit we did last week, so they can't be parallel circuits as our teacher told us they operate differently."</td></tr>
</table>

Area 7: Inquiry and Problem Solving. Thirty-eight percent of the observed lessons were rated as *Reasonable Evidence* (30 out of 79) in *Area 7: Inquiry and Problem Solving*. Fifty-six percent were rated as *Exceptional Evidence* (44 out of 79) in *Area 7*.

Table 15: Inquiry and Problem Solving **Mean = 3.50**

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.	**1%** **(1)**
1% **(1)**	**4%** **(3)**	**38%** **(30)**	**56%** **(44)**	

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:

Students observed through a kinesthetic activity different crystal structures, analyzed candy to classify as a given solid, documented results in student pages, and discussed findings with teams and as a class. Questioning strategy was open to allow students to present their findings and debate their merit without preconceived information or direct instruction on the part of the instructor. Students were constructing their own meanings behind cooling a solid quickly/slowly and the effect on structure.

Students developed strategies to solve the maze problem. They carefully observed others' successes and failures in navigating through the maze and quickly made modifications to their own strategies. They recognized that their senses were key to solving the maze--it was important to carefully hear and listen to the other team's responses to let the player know if each move was correct. The sense of sight was equally important as some students visualized the pattern of correct steps, which was critical upon their own turn of navigating the maze.

Students moved boxes in different manners to assess whether the ball would roll, drop, or be blocked by a baffle. They assessed for vibrations and different sounds to determine a pattern. Once again, students made indirect observations to inference, hypothesize, and develop models. Once students were done observing, they took turns drawing their hypothesis on the board. All other students gave their thoughts and the teacher then revealed the actual pattern.

Students made "sword blades" from pasta, treating their blades with hot and cold water. As a class, they determined the treatment methods. Each pair of students used the same treatment methods and therefore thought they would obtain very similar results. Students then pushed the treated blades, as well an untreated (control) blade through paper towels to see if temperature treatment could improve the performance of the blades. They recorded their results on a large chart on the board and informally began to compare their results with other groups. Teachers used open-ended questions when asking students the rationale behind their treatment choices.

Students had the freedom to choose their design process and ink blotter. Once they transferred the ink image to the paper, the students removed the ink plate and analyzed their image. Often times, they recognized and problem-solved ways in which to get a more clear, crisp replication of their image (i.e., use less ink, smooth out ink, be careful not to break plate). They recognized these incidents as challenges to effective "printing presses" but thought that they would become quicker with each additional copy.

Teacher used open-ended questions to help students dig deeper and ultimately discover how the interdependence of the components can be affected by variables which will alter the predictability of the outcomes.	

Area 8: Reflection, Relevance, and Making Connections. Forty-one percent of the observed lessons were rated as *Reasonable Evidence* (32 out of 78) in *Area 8: Reflection, Relevance, and Making Connections*. Thirty-seven percent were rated as *Exceptional Evidence* (39 out of 78) in *Area 8*.

Table 16: Reflection, Relevance, and Making Connections   Mean = 3.27

<table>
<tr><th>No Evidence
1</th><th>Limited Evidence
2</th><th>Reasonable Evidence
3</th><th>Exceptional Evidence
4</th><th>Not Observed</th></tr>
<tr><td>There is little or no evidence that students engage in explicit and meaningful reflection about STEM content or learnings.</td><td>There is limited, inconsistent evidence that students engage in explicit and meaningful reflection about STEM content or learnings.</td><td>There is clear evidence that students engage in explicit and meaningful reflection about STEM content or learnings.</td><td>There is consistent and compelling evidence that students engage in explicit and meaningful reflection about STEM content or learnings.</td><td rowspan="3">10%
(8)</td></tr>
<tr><td>1%
(1)</td><td>10%
(8)</td><td>41%
(32)</td><td>37%
(29)</td></tr>
<tr><td colspan="4">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:
Students reflected on "what surprised them" about the large and small objects they sorted in the prior activity. Students were told that it's okay to make mistakes since we always can learn from our mistakes, so buy-in for students to try activities is high. Students are prompted to share with partners and then share with groups. Students were asked, "Why is this little bacteria important to study" and all student hands shot up.

During the debrief of the "learning styles" activity, almost all students reported receiving a different result than what they initially thought they were. 50% was the highest score and several students were equally split between visual, auditory, and kinesthetic learning styles. They reported that it's important to understand your strength and to think of ways to appeal to your preferred method. (i.e., turning auditory information into pictures or charts to help retain the material better.)

Students shared examples of their work, which they then compared to the original. Much discussion ensued as they continued to compare and contrast the different methods (with a printing press, you could start over if you messed up. When scribing, it would be very time consuming, hard to start over, require much concentration, and overall, plain boring!) The majority of students though that books could be printed in this manner by using "full-page" stamps. They agreed that it was faster to block print rather than copy the poem by hand as the scribes did. Once again, they noted that with any new skill, one should become more efficient with more practice.

Students were asked what are the similarities and differences between series and parallel circuits. They were able to provide several examples: They are the same in that both can light up more than one light bulb. Both need a battery source. / Both are circuits and need a resistor. They are different in that if you lose a bulb in a series circuit, none will work. But if you lose a bulb in a parallel circuit, the others will still work because there are other paths. All students said that parallel circuits produced brighter lights.

All activities involve real-world issues such as food safety. Students made connections between their classroom and their kitchens at home during discussions.</td></tr>
</table>

These activities definitely connect STEM to students' experiences and backgrounds as many have rode over bridges and may have wondered about their structure. Teachers effectively used prompts and questions throughout activity to encourage reflection on STEM content and concepts. Teacher did an excellent job of processing this activity. She asked if their ability to sense the internal structure of each of the 10 black boxes became easier with more "experience and exposure". Only 1/3 of the students felt this to be the case. When they thought they were "getting the hang of it", they would encounter a black box that really stumped them. Most students admitted to changing their strategy during the observation session. At first they looked at the black box to gather information but then realized their sight was of little help. They then placed it next to their ear to "hear a pattern" and then moved it around with their hands to gather more information in support of their initial data obtained by hearing alone.	

Program Area	Number of Observations	Minimum Rating	Maximum Rating	Mean
AREA 1: Preparation, Organization, and Implementation	80	2	4	3.50
AREA 2: Use of Facilities, Space, and Equipment	79	2	4	3.54
AREA 3: Appropriate Participation and Team Work	79	2	4	3.61
AREA 4: Purposeful Activities	80	1	4	3.34
AREA 5: Student Engagement with STEM	79	1	4	3.49
AREA 6: STEM Content Learning	79	1	4	3.29
AREA 7: Inquiry and Problem Solving	79	1	4	3.50
AREA 8: Reflection, Relevance, and Making Connections	78	1	4	3.27

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

Appendices

IMSA Student Survey 2015-2016

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? 4th, 5th, 6th, 7th, 8th

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.
j. The Fusion program helped me feel more comfortable talking about math and science.
k. I have more confidence in myself because of the Fusion program.
l. I felt comfortable asking questions in the Fusion program.
m. I could make decisions by myself in the Fusion program.
n. I could make decisions with my classmates in the Fusion program.

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 2015-2016 (English Language)

The staff members of 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, 2016.

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 2015-2016 (Spanish Language)

IMSA Encuesta de padres 2015-2016 año del programa

El personal de IMSA Fusion 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, 2016.

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 elegió 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 2015-2016

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 the program staff. Individual comments will <u>not</u> 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, 2016.

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

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

x. 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 2015-2016

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 the program staff. Individual comments will <u>not</u> 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, 2016.

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?

IMSA Fusion Program Evaluation 2015-2016
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 2015-2016 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 <u>not</u> 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, 2016.

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

Evaluación del programa IMSA Fusion 2015-2016
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 2015-2016 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 populación 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, 2016**.

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.

IMSA FUSION Site Observation 2015-16 FORM

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 1. Climate Change: The Future is Now 2. Electric Expressions 3. Engineering: Design & Build 4. Now You See It, Now You Don't: The Electromagnetic Spectrum 5. You Be the Judge 6. Synthetic Scorecard: Building the Future of Biology	Grade 6-8 Program 1. Secret Communications: Sharing Concealed Messages 2. Take Flight: Investigating the Aviation Industry 3. From Butterflies to Weather: Finding Order Amid Chaos? 4. Twisted and Tangled: Making Sense of Your Senses 5. MEDIEVAL: STEM Through the Middle Ages 6. Materials Science: Living in a Material World
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:				