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Maricopa County Education Service Agency  
Engineering STEM Identity (ESI) project

## **FIDELITY OF IMPLEMENTATION REPORT**

School Year 2014 - 2015 (Year One)

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## BACKGROUND

In 2014, the U S Department of Education awarded the Maricopa County Education Service Agency an Investing in Innovation (i3) grant to fund the Engineering STEM Identity (ESI) project. The purpose of i3 is to expand the implementation of, and investment in, innovative educational practices. Accordingly, the goal of ESI is to address one of the most important challenges facing education: developing student interest and proficiency in the fields of Science, Technology, Engineering, and Mathematics (STEM).

As part of the evaluation of i3 funded projects, grantees must study and report on the degree to which a project is carried out as planned. This type of study provides researchers and practitioners a better understanding of how and why an intervention works, and the extent to which outcomes can be improved. Importantly, if it is found that the project was not implemented properly then it is not possible to clearly conclude that the project had an effect on the students' performance.

The Fidelity of Implementation (FOI) document presents a conceptual and analytic framework for assessing the quality of the implementation of the ESI project. The conceptualization of the present FOI was completed October 1, 2014 after reviewing the ESI grant activities and selected quantitative ratings to be employed. The approved FOI approach assesses the implementation of three constructs:

Construct 1: Curriculum and Instruction. This is defined by the extent to which participating teachers implement four key indicators (components) of the ESI program:

- Indicator 1.1: Modeling instruction
- Indicator 1.2: STEM Pro Spotlights
- Indicator 1.3: Challenge Cohorts
- Indicator 1.4: Peer Panels

Construct 2: Teacher Professional Development. Three indicators are studied:

- Summer Institute Modeling Curriculum
- STEM Coaching
- Leading Challenge Cohorts Discussions

Construct 3: Administrative Support of the principal or other administrative personnel. This is measured by studying one indicator:

- Principal and school district Central Office support

Each Construct requires three levels of evaluation:

1. The extent to which each participating teacher (Constructs 1 and 2) or administrative team (Construct 3) properly implemented a specific indicator.
2. An assessment of the extent to which each teacher or administrative team, in the case of Construct 3, implemented all of the Construct related indicators.
3. A determination of whether the program taken as a whole implemented the Construct.

The following report evaluates the fidelity of implementation for each of the three (3) Constructs and their associated indicators. A detailed presentation of the evaluation is provided in the Appendix.

# **FINDINGS**

## **Construct 1. Curriculum and Instruction**

Construct 1 is measured by the four indicators described below. For each fidelity measure there is a threshold that must be met or exceeded to result in a finding of “meeting or exceeding”.

**1.1: Modeling Instruction.** Adequate fidelity by a teacher is defined as:

Scoring twenty-two (22) points or more based on classroom observation by STEM Coach using Modeling Implementation Checklist.

**1.2: Stem Pro Spotlights.** Adequate fidelity by a teacher is defined as:

Scoring eleven (11) or more points based on observation by STEM PCK Expert using ESI STEM Pro Spotlight Observation Protocol. The STEM Coach and PCK Expert conduct all interactions.

**1.3: Challenge Cohorts.** Adequate fidelity by a teacher is defined as:

Scoring fifteen (15) or more points based on observation by STEM PCK Expert using ESI Challenge Cohort Observation Protocol.

**1.4: Peer Panels.** Adequate fidelity by a teacher is defined as:

Scoring nine (9) points or more based on observation by STEM Coach using Peer Panel Meeting Observation Log.

Each of the Construct 1 indicators was analyzed to determine if teachers met or exceeded the fidelity standards. The results are displayed in Table 1.

**Table 1. Fidelity of Indicators of Construct 1**

| <b>Indicator</b>                | <b>Percent of Teachers Meeting or Exceeding Fidelity</b> | <b>Standard Met</b> |
|---------------------------------|--|---------------------|
| <b>1.1 Modeling Instruction</b> | 86%  | Yes                 |
| <b>1.2 STEM Pro Spotlights</b>  | 100%   | Yes                 |
| <b>1.3 Challenge Cohorts</b>    | 93%  | Yes                 |
| <b>1.4 Peer Panels</b>          | 100%   | Yes                 |

In addition to determining if teachers met or exceeded the standard established for each indicator, the ESI is required to assess the fidelity of implementation for Construct 1: Curriculum and Instruction by studying: A) the Construct Level Fidelity for each Teacher and B) the Construct Level Fidelity for the Program.

**A. Construct Level Fidelity for Teachers:**

Teachers will meet fidelity standards by receiving top scores of 4 or 5 on indicators which mean the teachers met or exceeded fidelity standards. A teacher meets or exceeds adequate fidelity threshold for at least 3 of the 4 indicators (Indicators 1.1 - 4.).

**Findings:** 100% of the teachers met or exceeded the fidelity indicators. Accordingly, the standard for the Construct Level Fidelity for Teachers was met.

**B. Construct Fidelity for Program:**

Program will meet fidelity standards if 75% of the teachers will meet or exceed fidelity standards on three of the four indicators (Indicators 1.1- 4.).

**Findings:** 95% of the teachers met this threshold of Construct 1 Fidelity. Accordingly, the standard for the Construct Fidelity for Program was met.

**C. Overall: Construct 1 Curriculum and Instruction:**

**Findings:** **Met** Fidelity of Implementation standards or objectives.

## Construct 2. Teacher Professional Development

Construct 2 is measured by the three indicators described below. For each fidelity measure there is a threshold that must be met or exceeded to result in a finding of “meeting or exceeding”.

**2.1: Summer Institute Modeling Curriculum.** Adequate fidelity is defined as: 100% of the teachers will participate in the 15 days of summer training onsite or offsite through differentiated training throughout the year.

**2.2: STEM Coaching.** Adequate fidelity is defined as: 75% of the teachers will have been determined to be at the Refinement (4) or the Integration/ Renewal (5) levels based on STEM Coaches observation and review.

**2.3: Leading Challenge Cohorts Discussions:** Adequate fidelity is defined as: 75% of the teachers will be at the Refinement (4) or the Integration/ Renewal (5) levels based on STEM experts assessments and their meetings with individual teachers at which time they review and develop challenge designs.

Each of the Construct 2 indicators was analyzed to determine if teachers met or exceeded the fidelity standards. The results are displayed in Table 2.

**Table 2. Attendance at Summer Modeling Institute Indicator 2.1**

| Number Teachers | Onsite/Offsite | Attendance and Offsite Training | Attendance |
|-----------------|----------------|---------------------------------|------------|
| 2               | Onsite/Offsite | 100%                            | 5          |
| 1               | Onsite/Offsite | 100%                            | 12         |
| 1               | Onsite/Offsite | 100%                            | 13         |
| 9               | Onsite/Offsite | 100%                            | 14         |
| 6               | Onsite         | 100%                            | 15         |
| 1               | Offsite        | 100%                            | 0          |
| <b>Total 20</b> |                | 100%                            |            |

Note. One Science teacher did not attend the Institute but received the Institute differentiated training completely offsite via.

**Findings:** A total of 100% of the 20 teachers attended all fifteen days of the Institute or received differentiate training throughout the year.

**Table 3. Teachers Meeting Fidelity Indicators for Construct 2**

| Indicator   | Percent of Teachers Meeting or Exceeding Fidelity | Standard Met |
|---|---|--------------|
| <b>2.1: Summer Institute Modeling Curriculum</b>  | 100%  | Yes          |
| <b>2.2: STEM Coaching</b>                         | 85%   | Yes          |
| <b>2.3: Leading Challenge Cohorts Discussions</b> | 85%   | Yes          |

In addition to determining if teachers met or exceeded the standard established for the indicator, the ESI is required to assess the overall fidelity of implementation for Construct 2: Teacher Professional Development by studying: A) the Construct Level Fidelity for each Teacher and B) Construct Level Fidelity for the Program.

**A. Construct Level Fidelity for Teachers:**

Teachers will meet fidelity standards: if they have been determined to have met or exceeded adequate fidelity threshold for *both* indicators 2.2 (STEM Coaching) and 2.3 (Leading Challenge Cohorts Discussions).

**Findings:** 85% of the teachers met or exceeded adequate fidelity threshold for both indicators 2.2 and 2.3. Standard met.

**B. Construct Fidelity for Program:**

The ESI Program will meet fidelity standards if 100% of the teachers will participate in the ESI Summer Institute or receive the Institute training through differentiated training throughout the year. (Indicator 2.1) AND at least 75% of the teachers have a score of “1” for the Teacher Professional Development construct (Teachers meet adequate fidelity threshold for both indicators 2.2 (STEM Coaching) and 2.3 (Leading Challenge Cohorts Discussions)).

**Findings:** 100% institute participation and 85% of the teachers met the standards for indicators 2.2 and 2.3. Accordingly, the standard for Construct 2, Fidelity for the Program was met.

**C. Overall: Construct 2: Professional Development:**

**Findings:** Met Fidelity of Implementation standards or objectives.

### Construct 3. Administrative Support

Construct 3 is measured by one indicator. The threshold for this indicator must be met or exceeded to result in a finding of “meeting or exceeding” the threshold.

**3.1: Principal and administrative personnel support.** Each principal/school will be rated on a 1-30 point scale using the Principal Support Checklist that measures five areas: 1) overall school environment, 2) obtaining/leveraging resources to support STEM, 3) principal/ central office participating in STEM activities, 4) establishing time for STEM teachers to collaborate with classroom teachers, and 5) actively expand STEM curriculum and instruction. Adequate fidelity by a principal/school is defined as scoring 20 or more points.

**Table 4. Principals/Schools Meeting Fidelity Indicator 3.1**

| Indicator  | Percent Meeting or Exceeding Fidelity | Standard Met |
|--|---------------------------------------|--------------|
| <b>3.1: Principal and school district Central Office support</b> | 94%                                   | Yes          |

In addition to determining if Principals / Schools met or exceeded the standard established for the indicator, the ESI is required to assess the overall fidelity of implementation for Construct 3: Administrative Support by studying : A) Construct Level Fidelity for principals/schools and B) Construct Level Fidelity for the Program.

#### **A. Construct Level Fidelity for Principals/Schools:**

A principal/school will met or exceeded the threshold for adequate fidelity if the principal/school scored 20 or more points in at least 2 of the 3 reporting periods per school year.

**Findings:** 97% of principals met the fidelity standard. Standard met.

#### **B. Construct Fidelity for Program:**

The ESI Program will meet fidelity standards if 75% of the principals demonstrate administrative support during 2 of the 3 reporting periods.

**Findings:** 97% of principals met the fidelity standard. Standard met.

#### **C. Overall: Construct 3 Administrative Support**

**Findings:** Met Fidelity of Implementation standards or objectives.

## SUMMARY

### Construct 1 Curriculum and Instruction:

The Level of Fidelity of Implementation of the teachers will meet or exceed standards (100%), and 95% of the teachers met the Fidelity of Program implementation.

Determination: Fidelity standards of teachers and program were met.

### Construct 2 Teacher Professional Development:

Level of Fidelity of Implementation of teacher professional development in STEM Coaching and Leading Challenge Cohorts Discussion was met by 85% of the teachers.

Determination: Fidelity Standards for teachers were met.

Construct 2 Level of Fidelity for the Program required 100% participation at the Summer Modeling Institute by attendance or differentiated training and at least 75% of the teachers meeting the STEM Coaching and Leading Challenge Cohorts Discussion thresholds. The thresholds were met in the STEM Coaching and Leading Challenge Cohorts Discussion indicators.

Determination: Fidelity standards were met.

### Construct 3 Administrative Support:

The Level of Fidelity of principal/schools supporting the grant met by 97% of the principals.

Determination: Fidelity Standards for principals/schools were met.

## **APPENDIX.**

The Appendix displays the rating scales for the constructs of the Fidelity of Implementation Report. These tables provide insights to the rating process.

## APPENDIX

**Table 5. Means and Percentages for Indicator 1.1.**

| Indicator   | <i>N</i> | <i>M</i> | Percent Meeting or Exceeding Standards |
|---|----------|----------|--|
| 1. Lesson demonstrated teacher's content knowledge  | 22       | 3.95     | 86.4%                                  |
| 2. Students' prior knowledge and preconceptions were identified by teacher through instruction                | 22       | 3.45     | 59.1%                                  |
| 3. Students participated actively in group based lab investigations   | 22       | 3.64     | 72.7%                                  |
| 4. Task-related student discourse occurred independent of teacher   | 22       | 3.82     | 63.6%                                  |
| 5. Model(s) were represented in multiple ways (verbal, data, graphical, mathematical, diagrammatically, etc.) | 22       | 2.95     | 31.8%                                  |
| 6. Vernier (data gathering) technology was used during lesson to develop model(s)                             | 22       | 3.91     | 63.6%                                  |
| 7. Teacher used GoClass program often during the lesson   | 22       | 1.95     | 13.6%                                  |

Note. *N* refers to the total number of teachers observed during Quarters B, C, and D. The percent meeting or exceeding standards represents the number of participants scoring 4 or 5 points.

**Table 6. Fidelity Score Benchmarks: Indicator 1.1.**

| <b>No Implementation<br/>(0 – 7 points)</b>                     | <b>Partial Implementation<br/>(8 – 14 points)</b> | <b>Inadequate Implementation<br/>(15 – 21 points)</b> | <b>Meets Standards for Implementation<br/>(22 – 28 points)</b> | <b>Exceeds Standards<br/>(29 – 35 points)</b> |
|---|---|---|--|---|
| 1 (4.5%)  | 1 (4.5%)  | 1 (4.5%)  | 16 (72.7%)   | 3 (13.6%)                                     |
| <b>Total Inadequate Fidelity Score<br/>(21 points or below)</b> |   |   | <b>Total Adequate Fidelity Score<br/>(22 points or more)</b>   |   |
| 3 (13.6%)   |   |   | 19 (86.4%)   |   |

Note. *N* = 22.

**Table 7. Means and Percentages for Indicator 1.2.**

| <b>Indicator</b>  | <b><i>N</i></b> | <b><i>M</i></b> | <b>Percent Meeting or Exceeding Standards</b> |
|---|-----------------|-----------------|---|
| 1. STEM Pro engages students in becoming excited about potential STEM fields and/or careers             | 25              | 4.52            | 100.0%  |
| 2. STEM Pro provides opportunities for students to relate to him/her by sharing whole identity          | 25              | 4.44            | 88.0%   |
| 3. Teacher facilitates students in a way that sets students and STEM Pro up for successful interactions | 25              | 3.60            | 60.0%   |
| 4. Students are consistently well behaved and on-task   | 25              | 4.20            | 80.0%   |
| 5. Students are engaged in conversation with STEM Pro as evidenced by active participation              | 25              | 3.48            | 52.0%   |
| 6. Technology functioned in a way that supported STEM Pro, teacher, and student interactions            | 25              | 4.92            | 100%  |

Note. *N* refers to the total number of teachers observed during Quarters B, C, and D. The percent meeting or exceeding standards represents the number of participants scoring 4 or 5 points.

**Table 8. Fidelity Score Benchmarks: Indicator 1.2**

| <b>No Implementation<br/>(0 – 3 points)</b>                     | <b>Unacceptable Implementation<br/>(4 – 6 points)</b> | <b>Partial Implementation<br/>(7 – 10 points)</b> | <b>Meets Standards for Implementation<br/>(11 – 25 points)</b> | <b>Exceeds Standards<br/>(26 – 30 points)</b> |
|---|---|---|--|---|
| 0 (0.0%)  | 0 (0.0%)  | 0 (0.0%)  | 12 (48.0%)   | 13 (52.0%)                                    |
| <b>Total Inadequate Fidelity Score<br/>(10 points or below)</b> |   |   | <b>Total Adequate Fidelity Score<br/>(11 points or more)</b>   |   |
| 0 (0.0%)  |   |   | 25 (100.0%)  |   |

Note. *N* = 25.

**Table 9. Means and Percentages for Indicator 1.3**

| <b>Indicator</b>   | <b><i>N</i></b> | <b><i>M</i></b> | <b>Percent Meeting or Exceeding Standards</b> |
|--|-----------------|-----------------|---|
| 1. STEM professional is able to provide assistance in the development of the Engineering Challenge by acting as consultant to individualized classroom needs                         | 14              | 1.21            | 7.1%  |
| 2. STEM professional is able to provide assistance in the implementation of the Engineering Challenge by acting as consultant to individualized classroom needs                      | 14              | 1.21            | 7.1%  |
| 3. Students and teachers create an engineering challenge that is specific to the needs of their school; students perceive that the identified challenge was determined by themselves | 14              | 3.86            | 71.4%   |
| 4. PCK Expert is able to mediate conversation between STEM Pro, classrooms, and teachers   | 14              | 4.71            | 92.9%   |
| 5. Students are consistently well behaved and on-task during all interactions with the STEM Pro  | 14              | 4.00            | 78.6%   |
| 6. The IVL technology functions in a way that supports STEM Pro, PCK Expert, teachers, and student interactions  | 14              | 4.93            | 100.0%  |

Note. *N* refers to the total number of teachers observed during Quarters C, and D. The percent meeting or exceeding standards represents the number of participants scoring 4 or 5 points.

**Table 10. Fidelity Score Benchmarks: Indicator 1.3**

| <b>No Implementation<br/>(0 – 5 points)</b>                     | <b>Unacceptable Implementation<br/>(6 – 10 points)</b> | <b>Partial Implementation<br/>(11 – 14 points)</b> | <b>Meets Standards for Implementation<br/>(15 – 26 points)</b> | <b>Exceeds Standards<br/>(27 – 30 points)</b> |
|---|--|--|--|---|
| 0 (0.0%)  | 1 (6.25%)  | 0 (0.0%)   | 13 (93.75%)  | 0 (0.0%)                                      |
| <b>Total Inadequate Fidelity Score<br/>(14 points or below)</b> |  |  | <b>Total Adequate Fidelity Score<br/>(15 points or more)</b>   |   |
| 1 (7.1%)  |  |  | 13 (92.9%)   |   |

Note.  $N = 14$ .

**Table 11. Means and Percentages for Indicator 1.4**

| <b>Indicator</b>  | <b><math>N</math></b> | <b><math>M</math></b> | <b>Percent Meeting or Exceeding Standards</b> |
|---|-----------------------|-----------------------|---|
| 1. Teachers managed class behavior and interactions effectively to advance student learning | 26                    | 3.62                  | 53.8%   |
| 2. Students demonstrated excitement and enthusiasm while engaging                           | 26                    | 3.62                  | 61.5%   |
| 3. Meeting content was relevant and integrated with class curriculum                        | 26                    | 3.77                  | 69.2%   |
| 4. Student conversations between classrooms occurred via the IVL technology                 | 26                    | 3.58                  | 53.8%   |
| 5. The IVL technology functioned to support class meeting                                   | 26                    | 3.73                  | 53.8%   |

Note.  $N$  refers to the total number of teacher pairs observed during Quarters B, C, and D. The percent meeting or exceeding standards represents the number of participants scoring 4 or 5 points.

**Table 12. Fidelity Score Benchmarks: Indicator 1.4**

| <b>No Implementation<br/>(0 – 3 points)</b>                    | <b>Unacceptable Implementation<br/>(4 – 6 points)</b> | <b>Partial Implementation<br/>(7 – 8 points)</b> | <b>Meets Standards for Implementation<br/>(9 – 22 points)</b> | <b>Exceeds Standards<br/>(23 – 25 points)</b> |
|--|---|--|---|---|
| 0 (0.0%)   | 0 (0.0%)  | 0 (0.0%)   | 23 (88.5%)  | 3 (11.5%)                                     |
| <b>Total Inadequate Fidelity Score<br/>(8 points or below)</b> |   |  | <b>Total Adequate Fidelity Score<br/>(9 points or more)</b>   |   |
| 0 (0.0%)   |   |  | 26 (100.0%)   |   |

Note. *N* = 26.

**Table 13. Fidelity Score Benchmark: Indicator 2.2**

| <b>Nonuse/Basic Orientation<br/>(1 point)</b>                  | <b>Mechanical Use<br/>(2 points)</b> | <b>Routine Use<br/>(3 points)</b> | <b>Refinement<br/>(4 points)</b>                            | <b>Integration/Renewal<br/>(5 points)</b> |
|--|--------------------------------------|-----------------------------------|---|---|
| 0 (0.0%)   | 1 (5.0%)                             | 2 (10.0%)                         | 11 (55.0%)  | 6 (30.0%)                                 |
| <b>Total Inadequate Fidelity Score<br/>(3 points or below)</b> |                                      |                                   | <b>Total Adequate Fidelity Score<br/>(4 points or more)</b> |   |
| 3 (15.0%)  |                                      |                                   | 17 (85.0%)  |   |

Note. *N* = 20.

**Table 14. Fidelity Score Benchmark: Indicator 2.3**

| <b>Nonuse/Basic Orientation (1 point)</b>                  | <b>Mechanical Use (2 points)</b> | <b>Routine Use (3 points)</b> | <b>Refinement (4 points)</b>                            | <b>Integration/Renewal (5 points)</b> |
|--|----------------------------------|-------------------------------|---|---------------------------------------|
| 0 (0.0%)   | 2 (10.0%)                        | 1 (5.0%)                      | 6 (30.0%)   | 11 (55.0%)                            |
| <b>Total Inadequate Fidelity Score (3 points or below)</b> |                                  |                               | <b>Total Adequate Fidelity Score (4 points or more)</b> |                                       |
| 3 (15.0%)  |                                  |                               | 17 (85.0%)  |                                       |

Note.  $N = 20$ .

**Table 15. Means and Percentages for Indicator 3.1**

| <b>Indicator</b>   | <b><math>N</math></b> | <b><math>M</math></b> | <b>Percent Meeting or Exceeding Standards</b> |
|--|-----------------------|-----------------------|---|
| 1. Overall school environment  | 16                    | 4.16                  | 100.0%  |
| 2. Resources are available to support ESI                                  | 16                    | 4.38                  | 100.0%  |
| 3. Principal / central office participates in ESI activities               | 16                    | 4.25                  | 100.0%  |
| 4. Establish time for ESI teachers to collaborate with other teachers      | 16                    | 4.16                  | 90.63%  |
| 5. Expand STEM curriculum and instruction                                  | 16                    | 4.03                  | 90.63%  |
| 6. Additional credit based on exceptional performance in one or more areas | 16                    | 1.38                  | 0.0%  |

Note.  $N$  refers to the total number of observations conducted. The percent meeting or exceeding standards represents the number of participants scoring 4 or 5 points. Each of the 16 principals was assessed on two occasions.

**Table 16. Fidelity Score Benchmark: Indicator 3.1**

| <b>No Implementation<br/>(1 – 6 points)</b>                     | <b>Low Implementation<br/>(7 – 13 points)</b> | <b>Moderate Implementation<br/>(14 – 19 points)</b> | <b>Meets Standards for Implementation<br/>(20 – 25 points)</b> | <b>Exceeds Standards<br/>(26 – 30 points)</b> |
|---|---|---|--|---|
| 0 (0.0%)  | 0 (0.0%)                                      | 1 (0.0%)  | 27 (93.75%)  | 4 (0.0%)                                      |
| <b>Total Inadequate Fidelity Score<br/>(19 points or below)</b> |   |   | <b>Total Adequate Fidelity Score<br/>(20 points or more)</b>   |   |
| 1 (3.13%)   |   |   | 31 (96.9%)   |   |

Note. *N* = 16 principals assessed on two occasions