Evaluation of the Partnership for Innovation in Education's Case-Based STEM Learning Project

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Executive Summary

The Case-Based STEM Learning Project involves the use of a case method approach to learning in which students are presented with an authentic case challenge and required to actively pursue a solution by applying content knowledge and critical thinking skills. The Case-Based STEM Learning Project was developed by Partnerships for Innovation in Education (PIE) and implemented in collaboration with Smarter Schools and Northern Kentucky University's Center for Applied Infomatics. The development and implementation of the Case-Based STEM Learning Project during the 2013-14 demonstration year was funded by an award from the Straight A Fund, a grant competition established by Ohio's Governor, John Kasich, to seed innovative approaches in education.

Eighteen schools within the Cincinnati Public Schools and Milford Exempted Village Schools districts participated in the Case-Based STEM Learning Project from January – June 2014. The external evaluation of the Case-Based STEM Learning Project was designed to determine the extent to which the Project achieved its stated objectives, as addressed by five evaluation questions: (1) To what extent did students increase their knowledge of the essential elements of a case-based learning project? (2) To what extent did students increase their content knowledge in math or science relative to the academic content standard targeted by the project as determined by their teacher's assessment of learning? (3) To what extent did students perceive their experiences with case-based learning to be satisfactory? (4) To what extent did teachers increase their knowledge of the essential elements of a case-based learning project? (5) To what extent did teachers perceive their experiences with case-based learning to be satisfactory?

Findings from the external evaluation indicate that the students increased their knowledge of the content targeted by the learning objective for the project. Students also increased their knowledge of the case-based learning process. Evidence of student outcomes was obtained by teacher assessment of learning and student self-report. Teachers also reported gains in their knowledge and confidence in using a case-based learning approach. Both students and teachers reported high levels of satisfaction with Case-Based STEM Learning Project. Results from the student survey show variability among the schools with Cincinnati Public Schools' students and having consistently more positive perceptions of the Case-Based STEM Learning Project relative to students in the Milford Exempted Village Schools. Limitations in the evaluation design and procedures noted within the report deserve attention when interpreting the findings.

Evaluation of the Partnership for Innovation in Education's
Case-Based STEM Learning Project

The Case-Based STEM Learning Project involves the use of a case method approach to learning in which students are presented with an authentic case challenge and required to actively pursue a solution by applying content knowledge and critical thinking skills. Case-based learning engages the students in an active, decision-making role while instructors serve as a facilitator and guide. Although the case method approach can be used for instructional in a variety of content areas, the focus of this particular project is on increasing student mastery of content in Science, Technology, Engineering, and Mathematics (STEM).

The Case-Based STEM Learning Project was developed by Partnerships for Innovation in Education (PIE) and piloted as an enrichment program during the 2012-13 school year at Kilgour Elementary School, a Cincinnati Public School. In 2013-14, the Case-Based STEM Learning Project was further developed as a demonstration project among 18 schools within the Cincinnati Public Schools and Milford Exempted Village Schools districts. The Case-Based STEM Learning Project was designed and implemented by PIE, a nonprofit organization, in collaboration with Smarter Schools and Northern Kentucky University's Center for Applied Infomatics. The development and implementation of the Case-Based STEM Learning Project during the 2013-14 demonstration year was funded by a $1.1 million award from the Straight A Fund, a grant competition established by Ohio's Governor, John Kasich, to seed innovative approaches in education to: (a) meet the learning needs of students, (b) reduce the cost of running a school or school district, or (c) drive more dollars to the classroom.

Further development of the Case-Based STEM Learning Project is underway to include a professional development program for math and science educators. The Case-Based STEM Learning Professional Development Program will be designed by the Mayerson Academy in collaboration with PIE, Smarter Schools, and Northern Kentucky University's Center for Applied Infomatics to enhance teachers' capacity to implement a case method approach to increase student learning in STEM content areas.

Purpose of the Evaluation

The external evaluation of the Case-Based STEM Learning Project is designed to determine the extent to which the Project achieved its stated objectives, as addressed by the following evaluation questions:

1. To what extent did students increase their knowledge of the essential elements of a case-based learning project?

2. To what extent did students increase their content knowledge in math or science relative to the academic content standard targeted by the project as determined by their teacher's assessment of learning?

3. To what extent did students perceive their experiences with case-based learning to be satisfactory?

4. To what extent did teachers increase their knowledge of the essential elements of a case-based learning project?

5. To what extent did teachers perceive their experiences with case-based learning to be satisfactory?

Description of Case-Based STEM Learning Project

Participants

The Case-Based STEM Learning Project involved 18 schools in the Greater Cincinnati Area. Twelve elementary and secondary schools from Cincinnati Public Schools and 6 elementary schools in the Milford Exempted Village School district participated in the Project from January – June 2014. Decisions regarding the selection of schools for participation in the Project were made by district administrators. Each of the Cincinnati Public Schools was matched with a business partner to generate a case study. All six of the elementary schools in the Milford Exempted Village School district shared the same partner. A list of the participating schools and their partner is presented in Table 1.

Project Description

Partnerships between the participating schools and local businesses and institutions within the Greater Cincinnati Area were formed by Partnerships for Innovation in Education (PIE). Case studies were developed by PIE. PIE worked with each teacher to design instruction using the case-based learning process. Teachers facilitated student engagement in the Case-Based STEM Learning Projects over the course of 7 weeks (See Table 2). To support student learning and promote the use of 21st Century skills in the classroom, the Case-Based STEM Learning Project also purchased mobile devices (i.e., iPad Air Tablets, Samsung tablets) for the students participating in the Project. Beyond the classroom, many of the partnerships included field-based activities, such as having the fourth grade students from Kilgour School go to The BonBonerie on 5/2/14 to see how bakeries operate or arranging for the fifth grade students from Rothenberg Preparatory Academy go to Music Hall on 5/13/14 to tour the building and consider the acoustic properties of the hall. Following the 7-week classroom-anchored learning

Table 1. Characteristics of the Case-Based Learning Projects

School	Partner	Grade Level Focus	Number of Students
Cincinnati Public Schools			
Academy of Multilingual Immersion Studies (AMIS)	Affordable Language Services	6	24
Aiken New Tech High School	New Tech Network	8	21
Clark Montessori High School	Gorman Heritage Farm	7	55
Gamble Montessori High School	TriHealth	7	50
Hughes STEM High School	Macy's	8	22
Hyde Park School/ Cincinnati Gifted Academy	The BonBonerie	4	34
Kilgour School	Madisono's Gelato	6	86
Pleasant Ridge Montessori	Greater Cincinnati World Affairs Council	4-6	33
Rockdale Academy	Cincinnati Children's Hospital Medical Center	5-6	58
Rothenberg Preparatory Academy	Cincinnati Symphony Orchestra	5	37
Sands Montessori	Cincinnati Art Museum	4-6	50
School of the Creative and Performing Arts (SCPA)	Hamilton County Jobs and Family Services	7-8	13
Milford Exempted Village Schools			
Boyd E. Smith Elementary	3M	6	71
McCormick Elementary	3M	6	66
Meadowview Elementary	3M	6	58
Mulberry Elementary	3M	6	88
Pattison Elementary	3M	6	96
Seipelt Elementary	3M	6	56

Table 2. Case-Based Learning Project Activities and Timeline

Week 1	1. Introduction to Case-Based Project and Pedagogy. 2. Introduction/Orientation to central person, business and/or organization. 3. Review and discuss content flow and deliverables of project. Give students examples of what a case-based discussion would "feel like" (i.e., context review, discussion, rebuttal/argument, new learning developed by students)
Week 2	1. Identify what the central person sees as the decision point or dilemma. 2. Describe the context for this decision point or dilemma: a. Location and purpose of the organization or business b. Relevant business factors c. Goal of the central person
Week 3	3. Understand the Background a. Describe the organization, business, its major products or services, its customers, and its successes and challenges. b. Describe the nature of the industry in which this organization or business operates. Identify the competitors, their major products or services, its customers, and its successes and challenges. 4. Identify the relevant science or math content knowledge that may be applied to this dilemma. Determine the learning objective tied to a state content standard.
Week 4	5. Identify the decision point 6. Generate a list of alternatives available to the central person or business using the STEM concept(s). ***At the end of Week 4, go to* https://www.surveymonkey.com/s/CheckInPart1 *to submit the decision point/central question, hypothesis, and learning objective for your project.***
Week 5	7. Test at least two primary alternatives using the scientific method, SWOT analysis or applied mathematics.
Week 6	8. Recommend a solution to address the dilemma
Week 7	9. Create a student product (e.g., paper, PowerPoint Presentation, 3-min video) using technology to display case-based learning project to the central person or organization/business. (The teacher will be responsible for assessing student learning in this project relative to the stated learning objective). ***After Week 7, go to* https://www.surveymonkey.com/s/CheckInPart2 *to submit the recommended solution and results of the student assessment of learning.***

experience, Northern Kentucky University's Center for Applied Infomatics worked with each school to design an app directly related to the specific project.

Evaluation Method

Evaluation Design

A multiple method, multi-informant descriptive research design was used to gather data using a teacher survey, teacher assessment of student learning, and a student survey. Data collection and analysis to determine formative assessment outcomes followed well established procedures in survey evaluation processes (Dillman, Smyth, & Christian, 2009)

Data Collection Procedures

Teachers were asked to provide descriptive information about their class' case-based STEM learning project on two occasions electronically via a data collection website (SurveyMonkey). For the Check-In: Part I, teachers were asked to describe their project's decision point or dilemma, hypothesis, learning objective and academic content standard, and the instructional strategies used as part of their project. Eighteen teachers (100% response rate among the teachers) completed Check-In Part I between 4/17/14 – 5/26/14. For the Check-In: Part II, teachers were asked to describe the recommended solution generated by the class, identify the method used to assess student learning, describe their students' learning outcome(s), and indicate the number of students participating in the project. Sixteen teachers (88.9% response rate among the teachers) completed Check-In Part II between 5/19/14 – 5/29/14.

A student survey was administered electronically to assess student gains in understanding and satisfaction with the case-based learning process. The survey was completed by 623 students from 13 schools between 5/19/14 - 5/28/14, for a response rate of 72.2% among the participating schools.

A teacher survey was administered to teachers electronically to measure teacher-assessed changes in self-efficacy for implementing the case study method in their classrooms. The survey was completed by 12 teachers between 5/19/14 – 5/29/14. The teacher response rate was 66.7%.

Measures

Case-Based Learning: Student Survey. The *Case-Based Learning: Student Survey* was developed to measure student-assess gains in understanding and satisfaction with the case-based learning process. The instrument was comprised of eight items, seven of which followed a 4-point Likert scale where the possible responses included "Strongly Agree," "Agree," "Not

Sure," "Disagree," and "Strongly Disagree." The final question used a 4-point categorical rating scale format with possible answer choices that included "Excellent," "Good," "Fair," and "Poor."

Case-Based Learning: Teacher Retrospective Self-Assessment. The *Case-Based Learning: Teacher Retrospective Self-Assessment* was designed to measure teacher-assessed changes in self-efficacy for implementing the case study method in their classrooms. The measure was comprised of eight items. For the first six items, the respondent was directed to rate his or her knowledge and skills: (a) prior to the project and (b) following the project. The item structure is a 4-point Likert scale where the possible responses included "Strongly Agree," "Agree," "Disagree," and "Strongly Disagree." The final two items, were designed to measure teacher satisfaction with the case-based learning process. These items were structured using a 5-point Likert scale format where the possible responses included "Strongly Agree," "Agree," "Not sure," "Disagree," and "Strongly Disagree."

Teacher Assessment of Student Learning. Teachers were responsible for identifying a method for assessing student learning that was appropriate to the case-based learning project given the project-specific learning objective(s). A project-based evaluation using teacher observation and student product review (e.g., presentation, written extended responses) was used by nine of the projects (Academy of Multilingual Immersion Studies, Aiken New Tech High School, Boyd E. Smith, Clark Montessori, Mulberry Elementary, Pattison Elementary, Pleasant Ridge Montessori, Sands Montessori, School of the Creative and Performing Arts). Rubrics were used to assess student learning for five of the projects (Gamble Montessori High School, Hughes STEM High School, Hyde Park Elementary/Cincinnati Gifted Academy, Kilgour School, Rothenberg Preparatory Academy, and Rockdale Academy). The *Project Based Learning Engineering Design Team Rubric*, used to assess student learning at Aiken New Tech High School was designed by the Department of Engineering at the University of Pittsburgh and modified to meet the needs of Aiken's Grade 8 students. Gamble Montessori High School also employed a peer evaluation form for group work. Information regarding the teacher assessment of student learning was not provided by three schools.

Evaluation Findings

To what extent did students increase their knowledge of the essential elements of a case-based learning project?

The results of the *Case-Based Learning: Student Survey* indicate that a majority of the students reported gaining knowledge in the use of case-based learning as a result of their class-based project. Six hundred and twenty-three (623) students from 13 schools completed the *Case-Based Learning: Student Survey* from 5/19/14 to 5/28/14. The survey respondents included 186 students enrolled a Cincinnati Public School and 416 students attending a Milford Exempted Village Schools. Twenty-one (21) students did not identify their school. The survey was completed by 306 female students and 300 male students. Seventeen students did not report their gender. The majority of the survey respondents identified their race/ethnicity as White (72.7%). The survey respondents also included student who identified their race/ethnicity as African American/Black (10.3%), Multi-Racial (7.7%), Hispanic (3.4%), and Asian (2.2%). Twenty-three students (3.7%) did not report their race/ethnicity. Among the survey respondents, 92.0% of the students spoke English as their primary language.

Overall, 74.6% of the students reported that they "Strongly Agreed" or "Agreed" with the statement, "I understand how the case-based learning process allowed us to solve the case." The results varied slightly by school among the Cincinnati Public Schools (See Figure 1) and the Milford Exempted Village Schools (See Figure 2), with student agreement to the statement generally slightly higher among students in the Cincinnati Public Schools.

Figure 1. Percentage of Student Agreement to the Statement, "I understand how the case-based learning process allowed us to solve the case": Cincinnati Public Schools

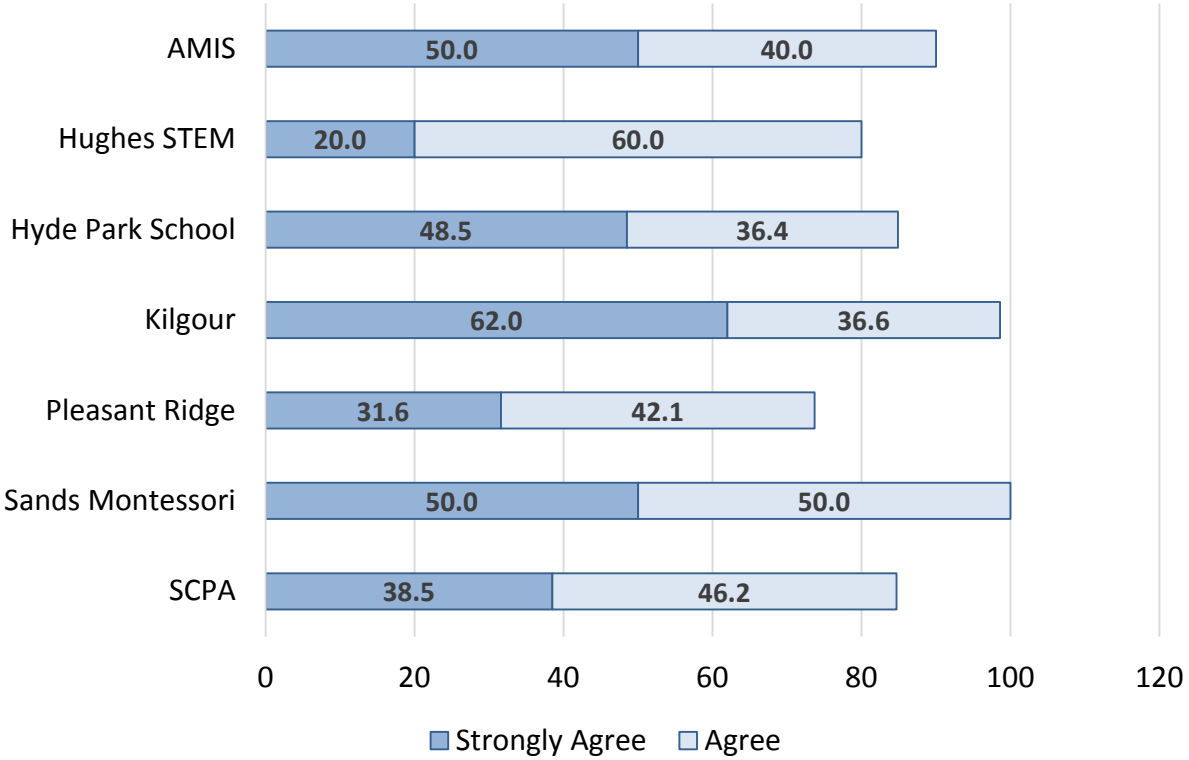
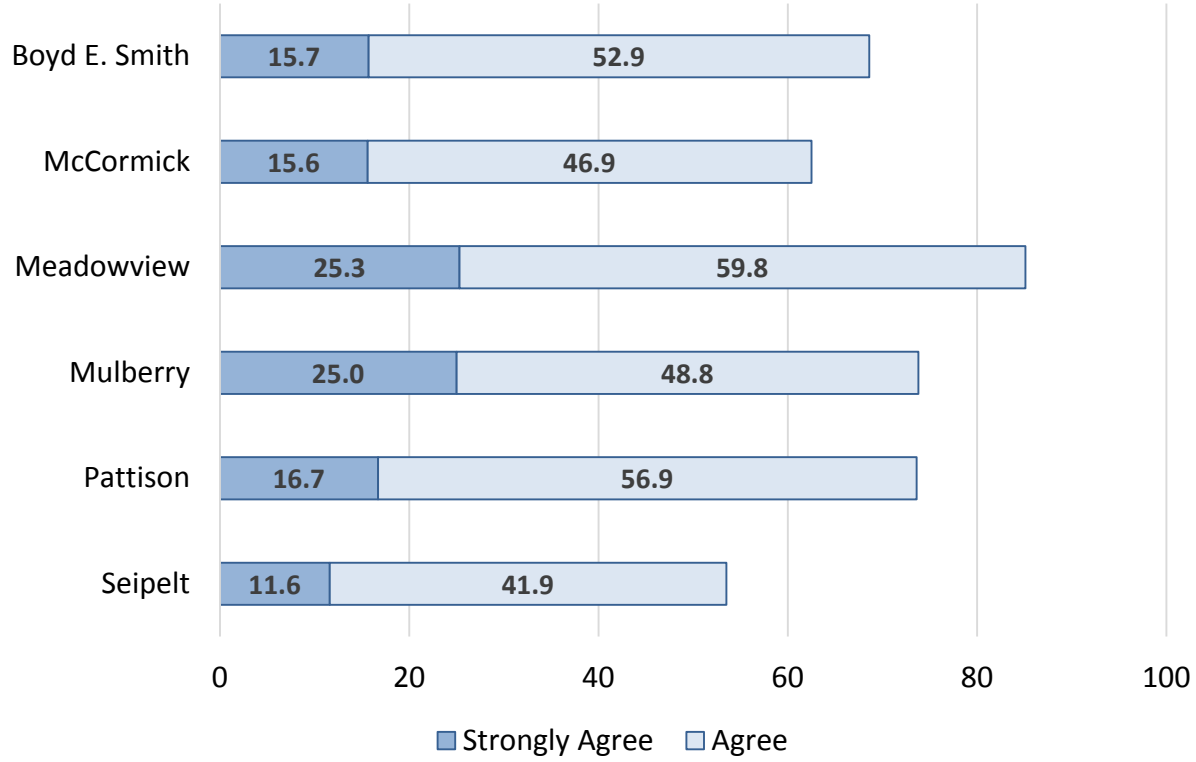


Figure 2. Percentage of Student Agreement to the Statement, "I understand how the case-based learning process allowed us to solve the case": Milford Exempted Village Schools



Overall, 85.7% of the students reported that they “Strongly Agreed” or “Agreed” with the statement, “I contributed to the class’s solution to the case.” The results varied slightly by school among the Cincinnati Public Schools (See Figure 3) and the Milford Exempted Village Schools (See Figure 4).

Figure 3. Percentage of Student Agreement to the Statement, "I contributed to the class's solution to the case": Cincinnati Public Schools

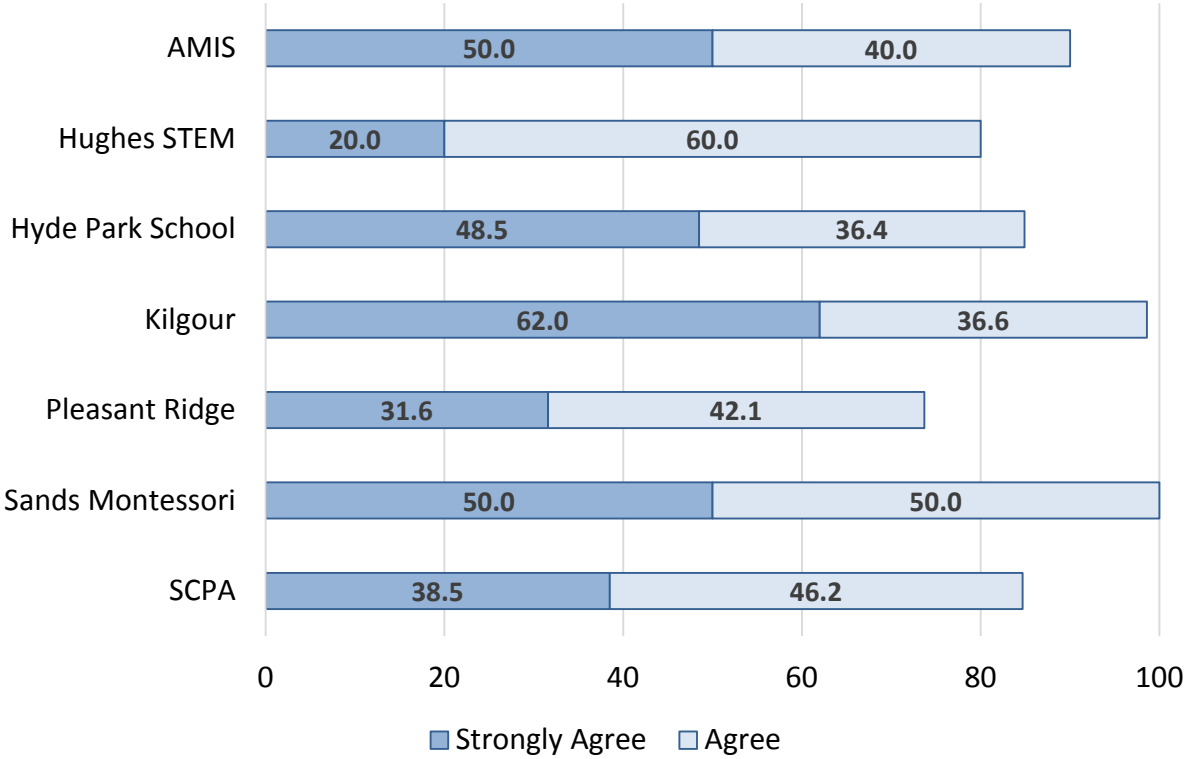
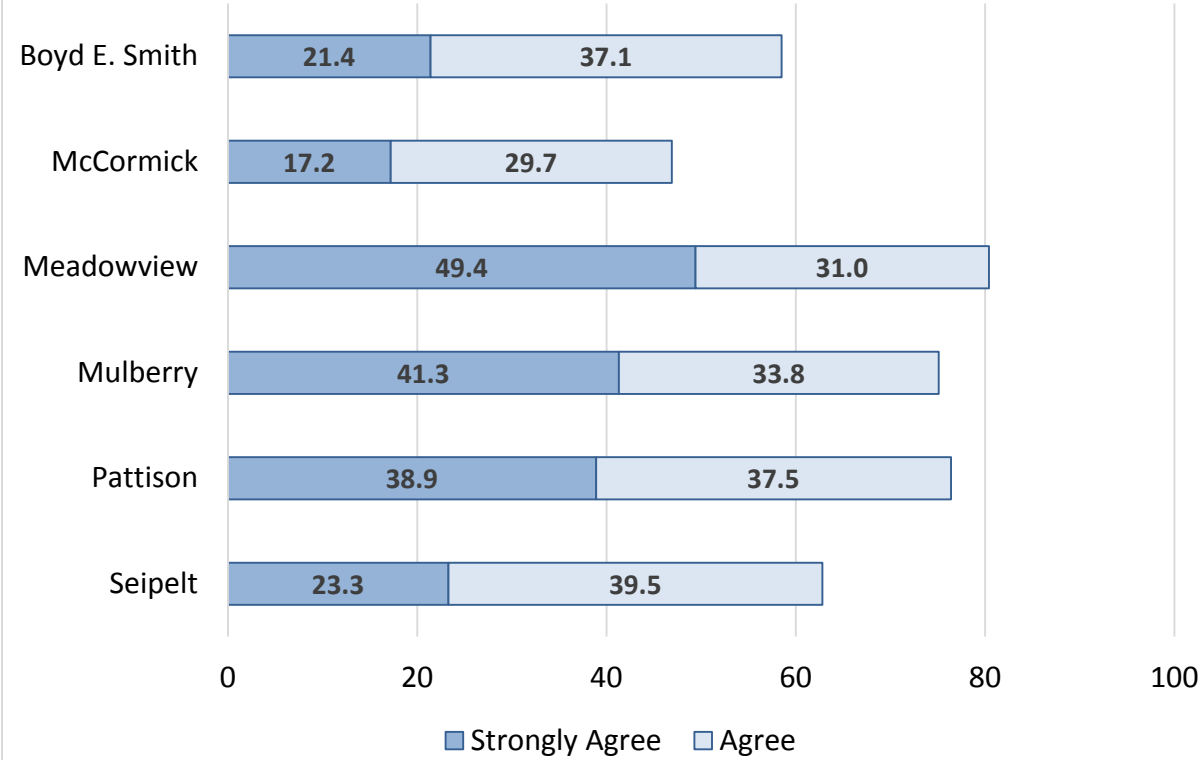


Figure 4. Percentage of Student Agreement to the Statement, "I contributed to the class's solution to the case": Milford Exempted Village Schools



Students' recognition of the real world relevance of case-based learning was generally high, but varied considerably by school district. Overall, 76.1% of the students reported that they "Strongly Agreed" or "Agreed" with the statement, "This project related to the real world." The percentage of agreement was much higher among the students in Cincinnati Public Schools (See Figure 5), than the students in Milford Exempted Village Schools (See Figure 6). The results pertaining to students' knowledge of the case-based learning process are presented by grade level (Appendix B), gender (Appendix C), and race/ethnicity (Appendix D).

Figure 5. Percentage of Student Agreement to the Statement, "This project related to the real world": Cincinnati Public Schools

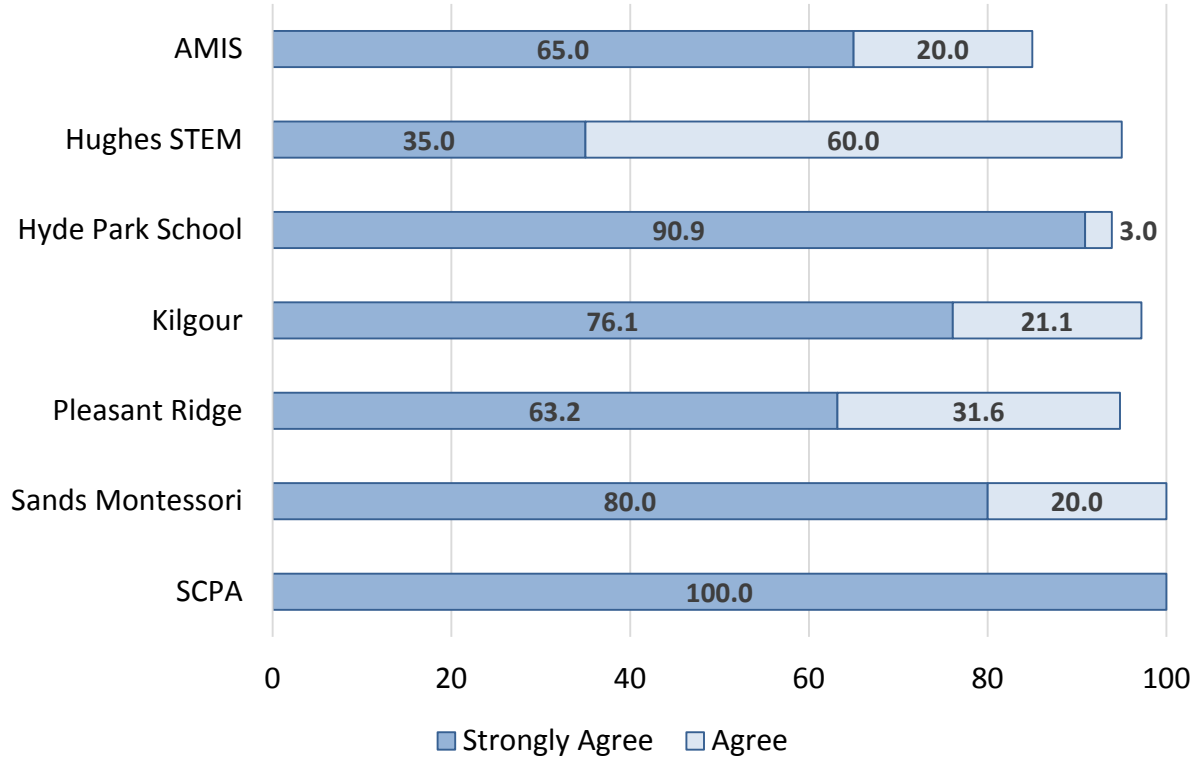
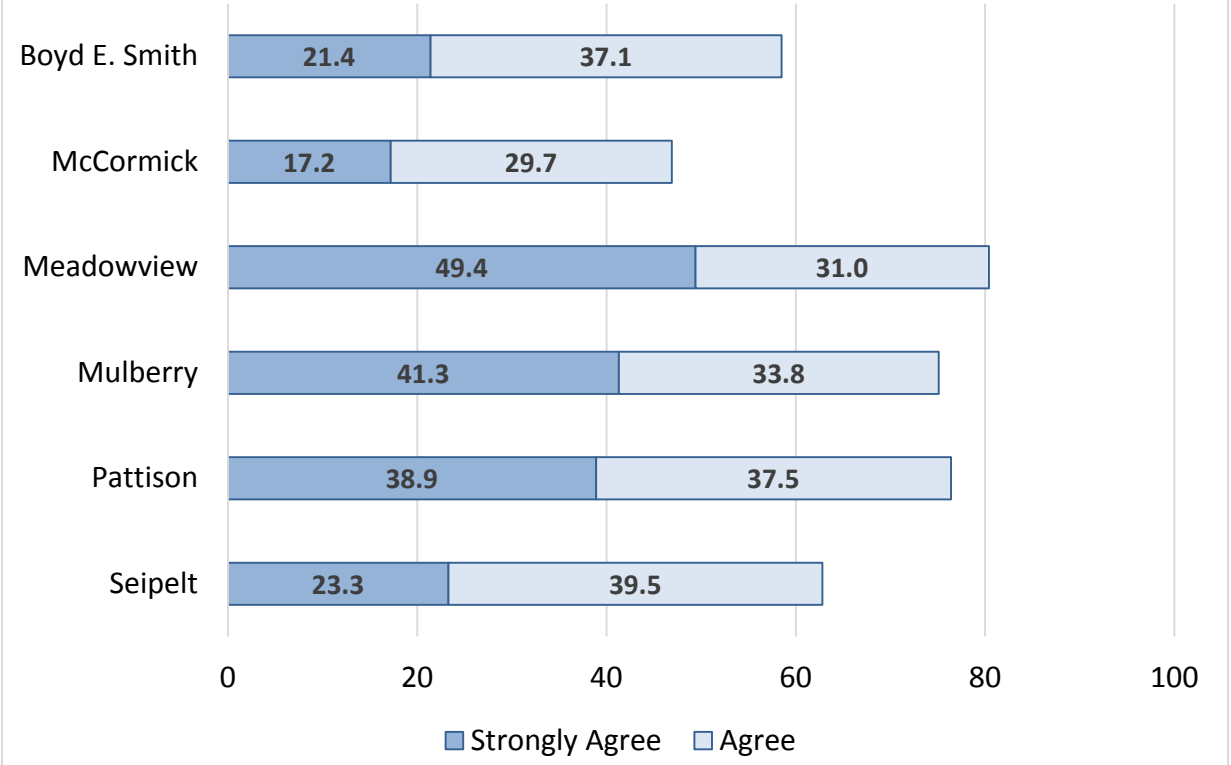


Figure 6. Percentage of Student Agreement to the Statement, "This project related to the real world": Milford Exempted Village Schools



To what extent did students increase their content knowledge in math or science relative to the academic content standard targeted by the project as determined by their teacher's assessment of learning?

Students increased their knowledge and skills in math, science, and related content relative to the academic content standard targeted by the project, according to their teacher's assessment of learning. Teachers in all 12 of the Cincinnati Public Schools reported positive student outcomes (See Appendix H). Ten of the teachers reported a positive student outcome related to mastery of academic content or a combination of mastery (accuracy) and student participation. Two other teachers reported a positive student outcome based on student participation only. Only three of the six teachers from the Milford Exempted Village Schools reported a positive student outcome. Two teachers did not report their students' outcomes and another teacher reported that student learning was not assessed within the case-based learning project. Of the three teachers from Milford Exempted Village Schools that did report

an outcome, two teachers reported a positive student outcome related to mastery of academic content or a combination of mastery and student participation. One teacher reported a positive student outcome based on student participation only.

Teachers' assessment of student learning was supported by students' perceptions of their own learning, based on the *Case-Based Learning: Student Survey*. Overall, 80.1% of the students reported that they "Strongly Agreed" or "Agreed" with the statement, "I learned a lot from this case-based learning project." The percentage of agreement was much higher among the students in Cincinnati Public Schools (See Figure 7), than the students in Milford Exempted Village Schools (See Figure 8).

Figure 7. Percentage of Student Agreement to the Statement, "I learned a lot from this case-based learning project": Cincinnati Public Schools

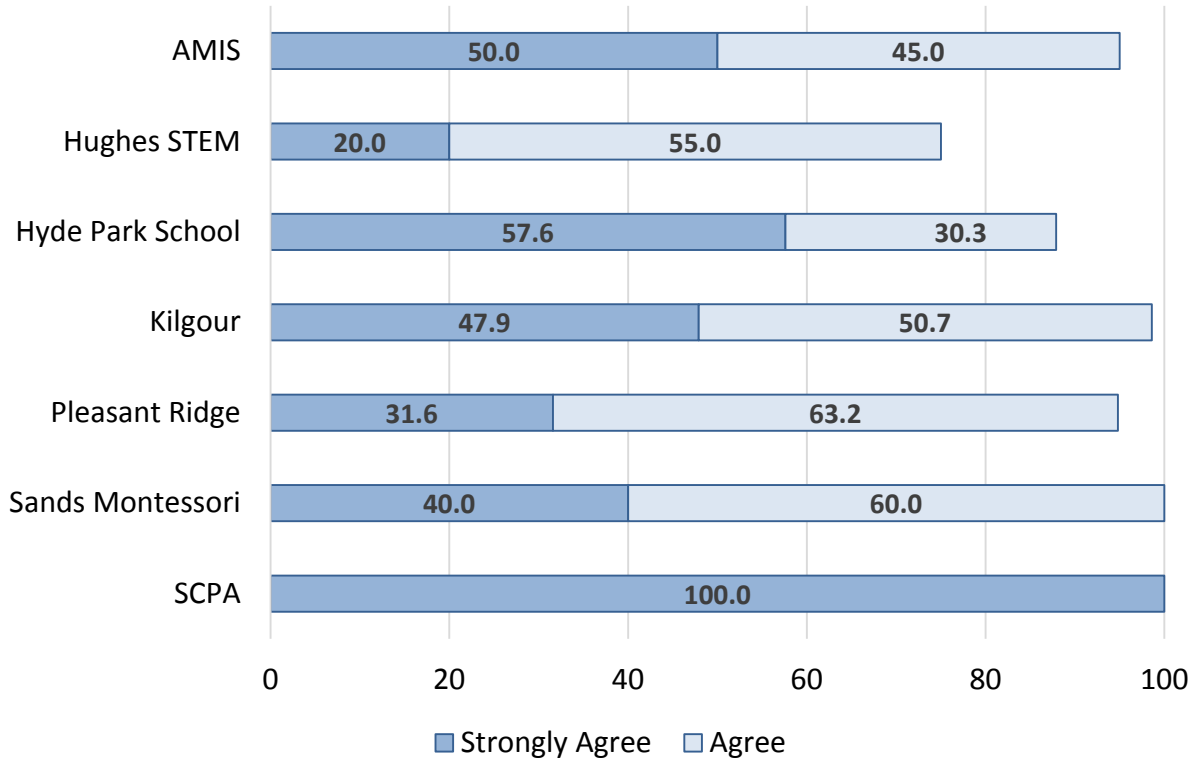
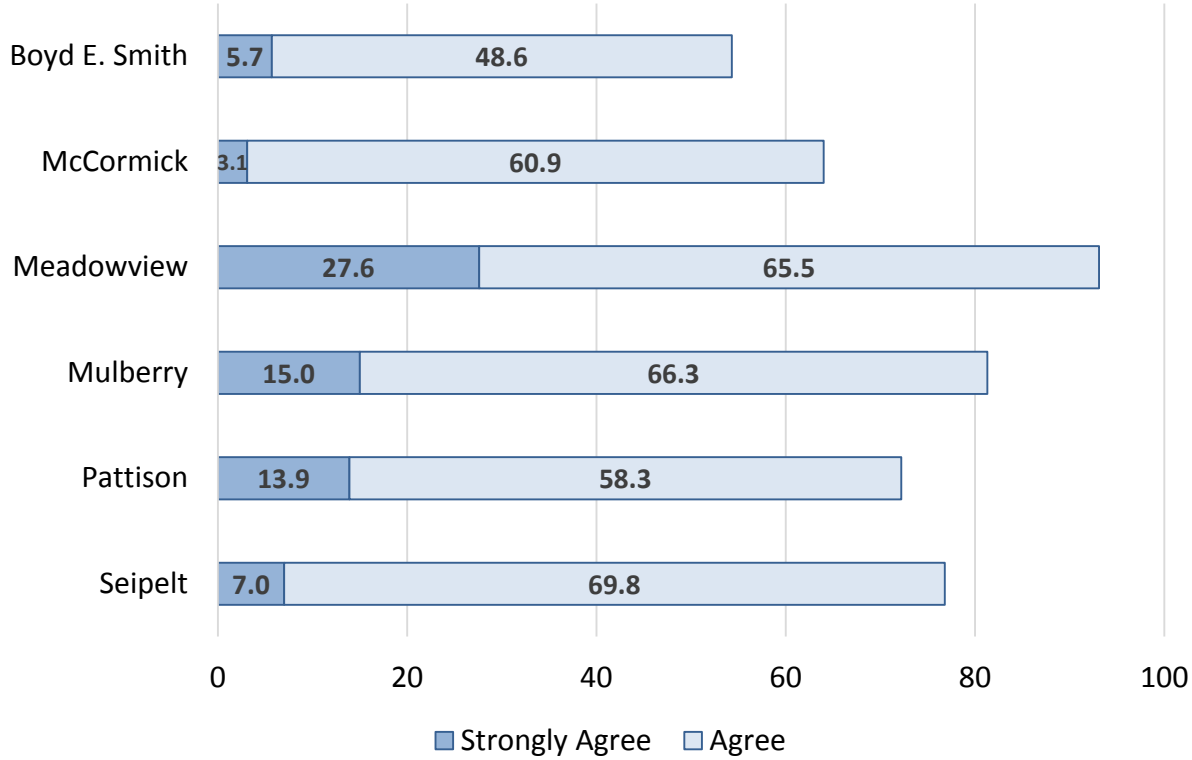


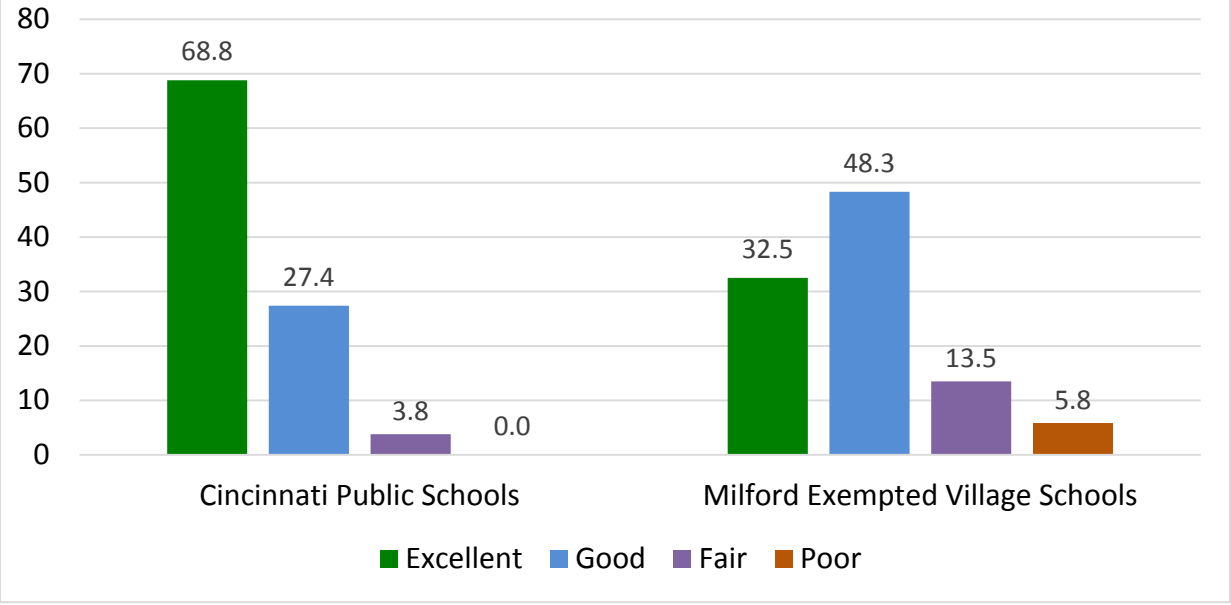
Figure 8. Percentage of Student Agreement to the Statement, "I learned a lot from this case-based learning project": Milford Exempted Village Schools



To what extent did students perceive their experiences with case-based learning to be satisfactory?

Students reported positive perceptions of their experiences with case-based learning, according to the results of the *Case-Based Learning: Student Survey*. There were, however, considerable differences in student perceptions between Cincinnati Public Schools and Milford Exempted Village Schools. Students in Cincinnati Public Schools were far more positive in their appraisal their project overall (See Figure 9).

Figure 9. Students' Overall Rating of their Project



Overall, 67.7% of the students reported that they “Strongly Agreed” or “Agreed” with the statement, “I feel using case studies is an effective way to learn math, science, and related content.” Student agreement varied by school. The percentage of agreement was much higher among the students in Cincinnati Public Schools (See Figure 10), than the students in Milford Exempted Village Schools (See Figure 11).

Figure 10. Percentage of Student Agreement to the Statement, "I feel using case studies is an effective way to learn math, science, and related content": Cincinnati Public Schools

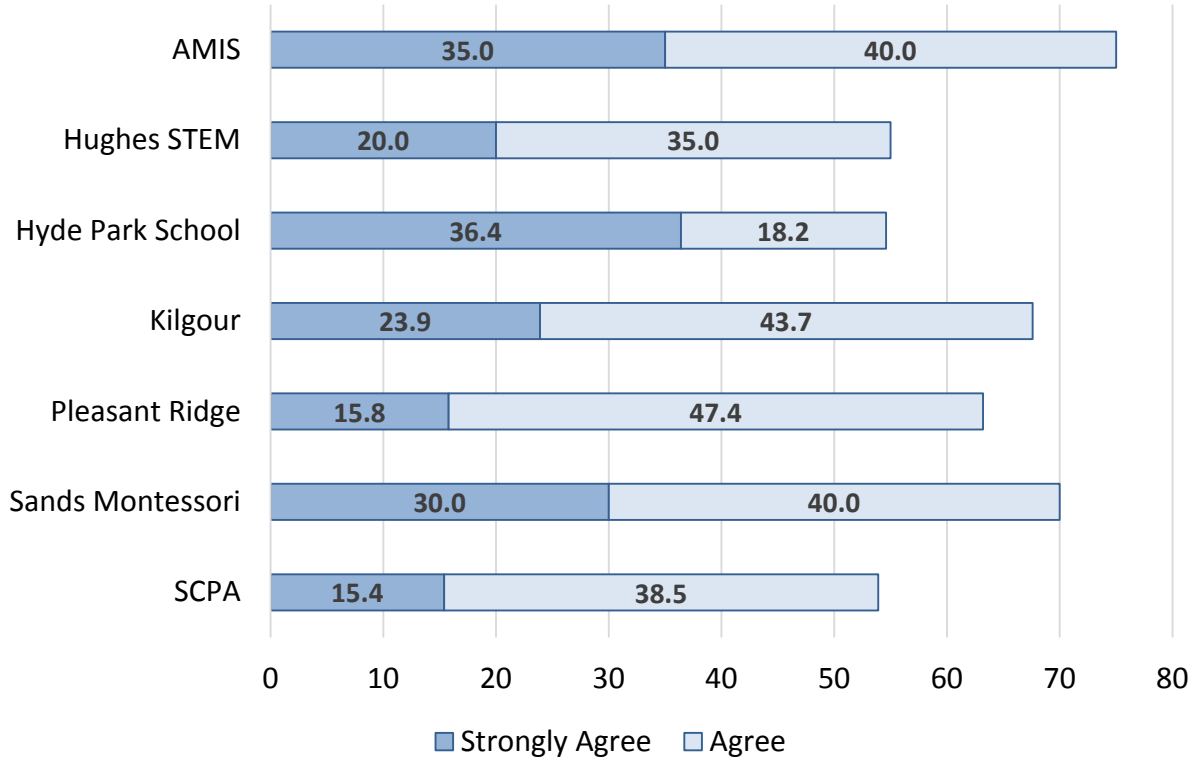
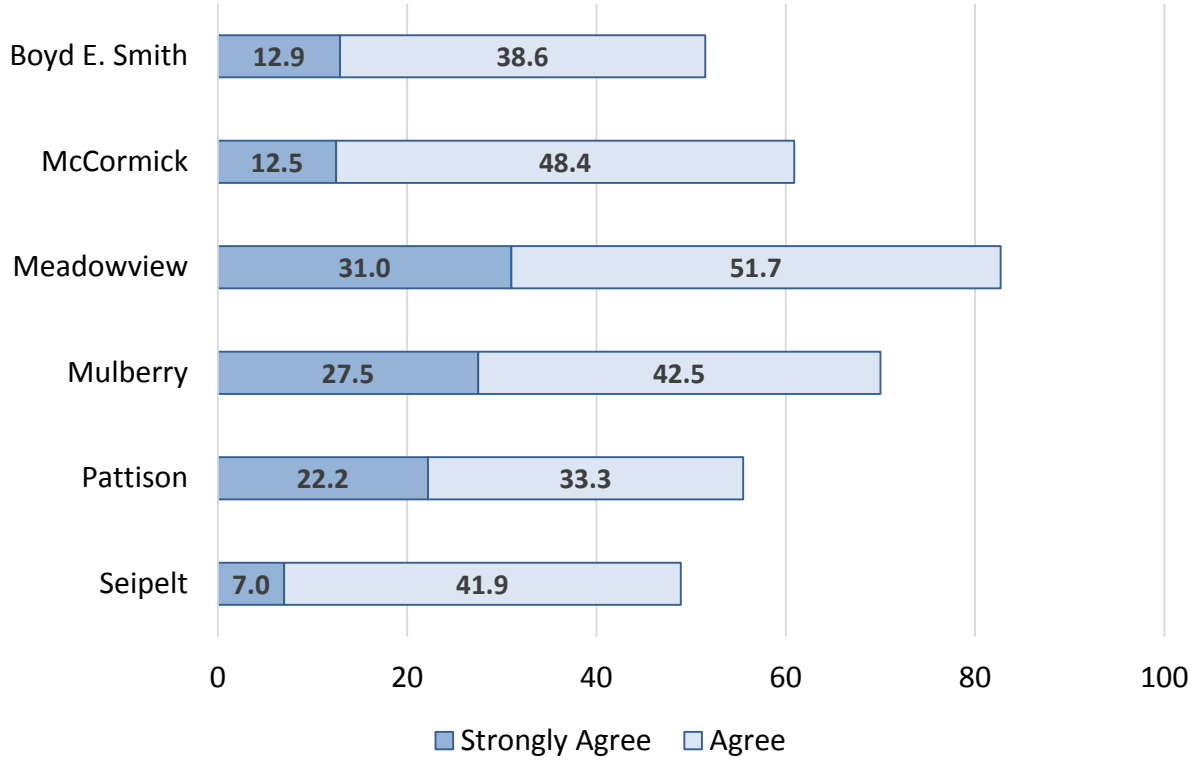


Figure 11. Percentage of Student Agreement to the Statement, "I feel using case studies is an effective way to learn math, science, and related content": Milford Exempted Village Schools



Despite generally positive perceptions of their experiences with case-based learning, students did not consistently report an increased interest in math, science, and/or related content as a result of using a case studies method. Only 46.7% of the students reported that they "Strongly Agreed" or "Agreed" with the statement, "This project made me more interested in math, science, and/or related content." Higher levels of agreement were reported among students in the Cincinnati Public Schools (See Figure 12). In contrast, levels of student agreement were notably low among students in Milford Exempted Village Schools (See Figure 13). The results pertaining to students' satisfaction with the case-based learning project are presented by grade level (Appendix E), gender (Appendix F), and race/ethnicity (Appendix G).

Figure 12. Percentage of Student Agreement to the Statement, "This project made me more interested in math, science, and/or related content": Cincinnati Public Schools

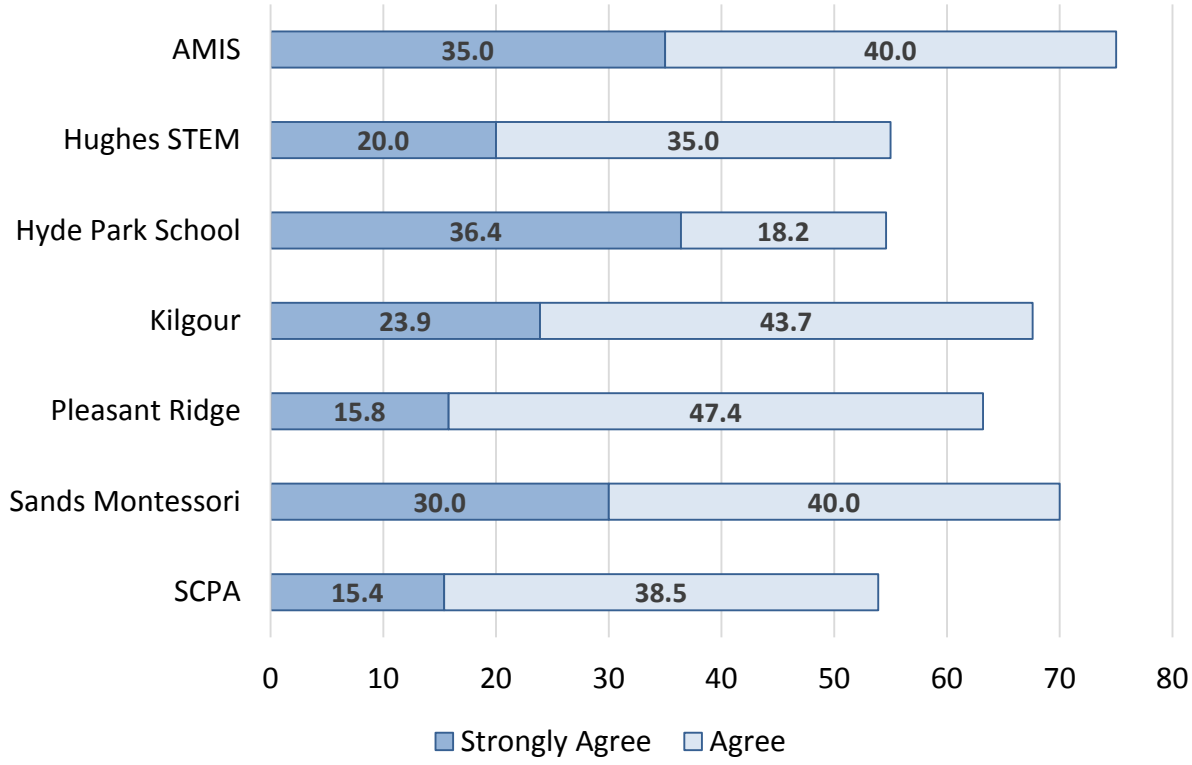
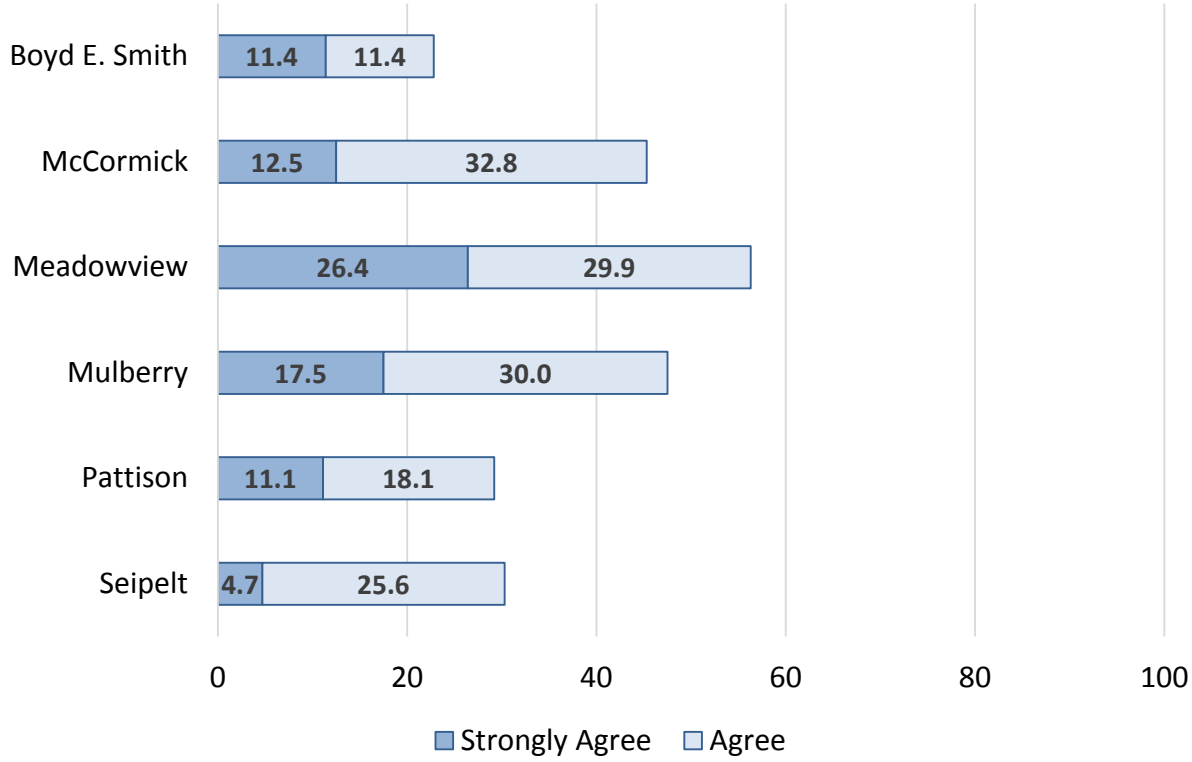


Figure 13. Percentage of Student Agreement to the Statement, "This project made me more interested in math, science, and/or related content": Milford Exempted Village Schools

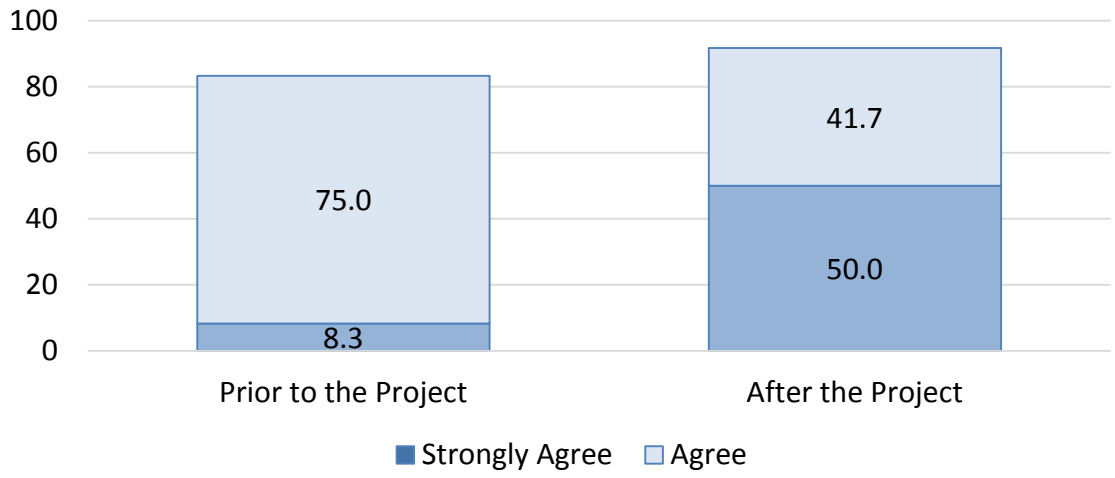


To what extent did teachers increase their knowledge of the essential elements of a case-based learning project?

Teachers reported increases in their knowledge of the essential elements of a case-based learning project, according to the results of the *Case-Based Learning: Teacher Retrospective Self-Assessment*. Twelve teachers completed the *Case-Based Learning: Teacher Retrospective Self-Assessment* between 5/19/14 – 5/29/14. The response rate among teachers was 66.7%.

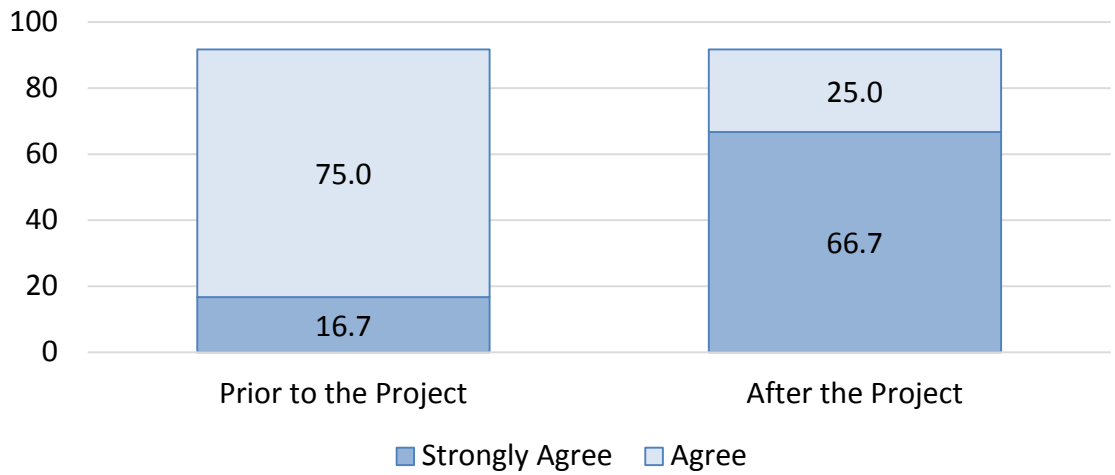
Although 83.3% of the teachers reported having prior knowledge of how to guide their students to develop solutions to real world problems presented as a case, their level of agreement increased considerably from prior to the project, where only 8.3% strongly agreed with the statement, to project completion where 50.0% strongly agreed with the statement (See Figure 14).

Figure 14. Percentage of Teacher Agreement to the Statement, "I know how to guide students to develop solutions to real world problems presented as a case."



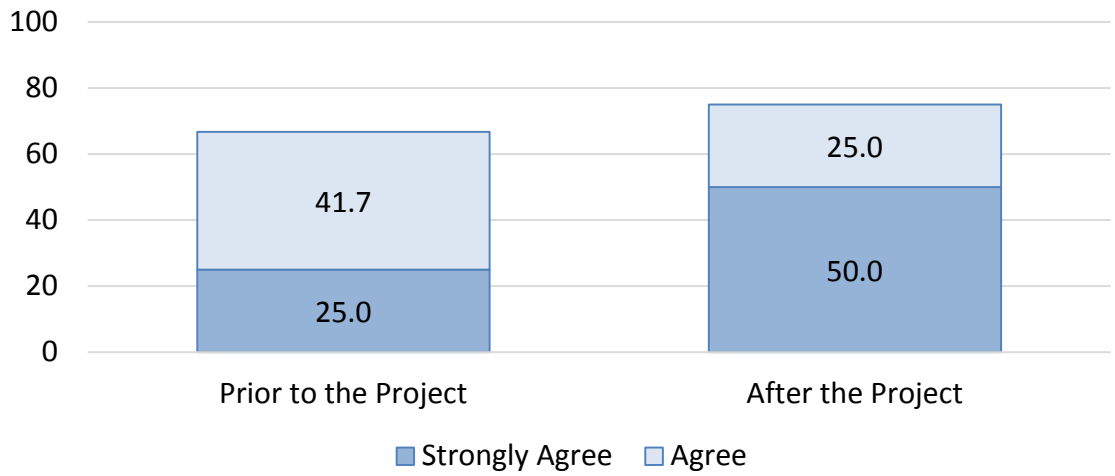
Likewise, 91.7% of the teachers reported having prior knowledge of how to help student define the Problem, Questions to be Researched, and Methods within a case-based learning process, their level of agreement increased considerably from prior to the project, where only 16.7% strongly agreed with the statement, to project completion where 66.7% strongly agreed with the statement (See Figure 15).

Figure 15. Percentage of Teacher Agreement to the Statement, "I know how to help students define the Problem, Questions to be Researched, and Methods within a case-based learning process."



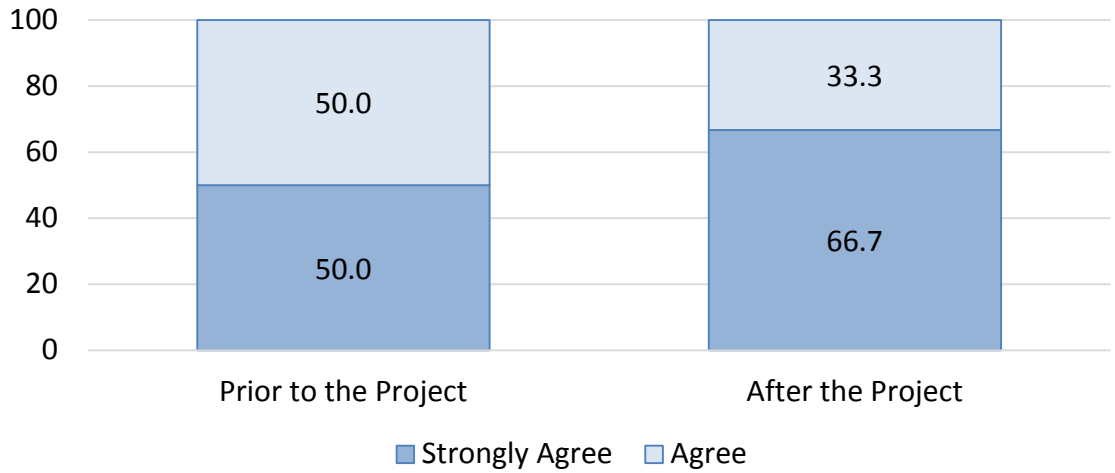
Although the majority (66.7%) of the teachers reported having prior knowledge of how to teach math, science, and/or related content using a case-based learning approach, their level of agreement increased considerably from prior to the project, where only 25.0% strongly agreed with the statement, to project completion where 50.0% strongly agreed with the statement (See Figure 16).

Figure 16. Percentage of Teacher Agreement to the Statement, "I know how to teach math, science, and/or related content using a case-based learning approach."



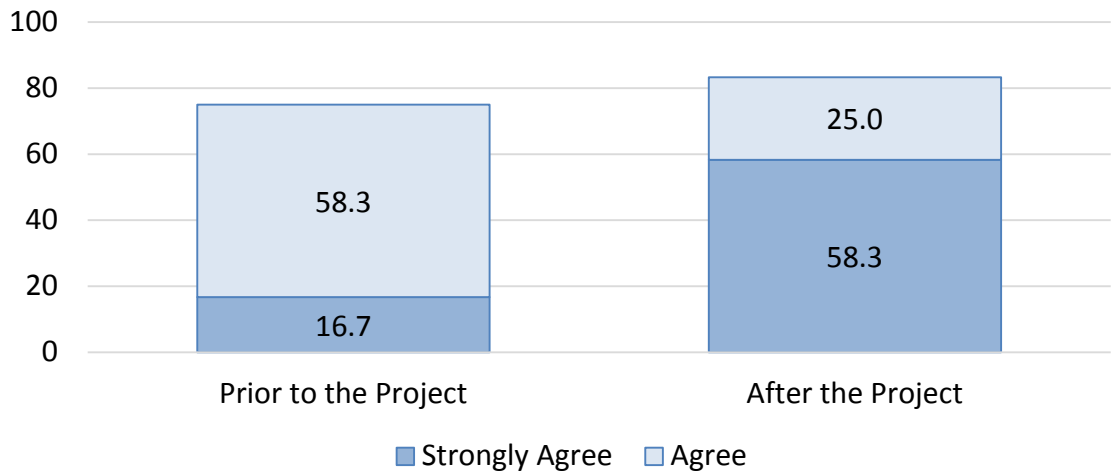
All of the teachers (100%) reported having prior knowledge of how to engage students in applying math, science, and/or related content to the work in which they live. The teachers' level of agreement with this statement increased slightly from prior to the project, where 50.0% strongly agreed, to project completion where 66.7% strongly agreed (See Figure 17).

Figure 17. Percentage of Teacher Agreement to the Statement, "I know how to engage students in applying math, science, and/or related content to the work in which they live."



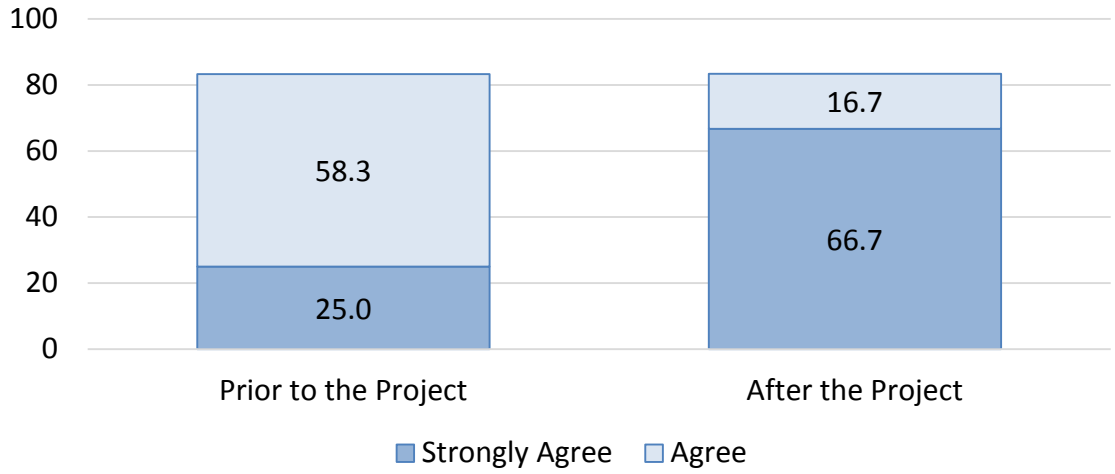
In addition to increasing their knowledge of the case-based learning process, teachers also self-assessed increases in their confidence or self-efficacy in using case studies for instruction. Although 75.0% of the teachers reported being confident in his or her ability to use case-based learning pedagogy in other areas of content prior to the project, their level of agreement increased from prior to the project, where only 16.7% strongly agreed with the statement, to project completion where 58.3% strongly agreed with the statement (See Figure 18).

Figure 18. Percentage of Teacher Agreement to the Statement, "I am confident in my ability to use case-based learning pedagogy in other areas of content that I teach."



The percentage of teachers that reported being confident in his or her ability to connect the real-world applications of math, science, and/or related content to STEM careers remained the same overall from prior to the project to project completion. The teachers' level of agreement, however, increased sharply from prior to the project, where only 25.0% strongly agreed with the statement, to project completion where 66.7% strongly agreed with the statement (See Figure 19).

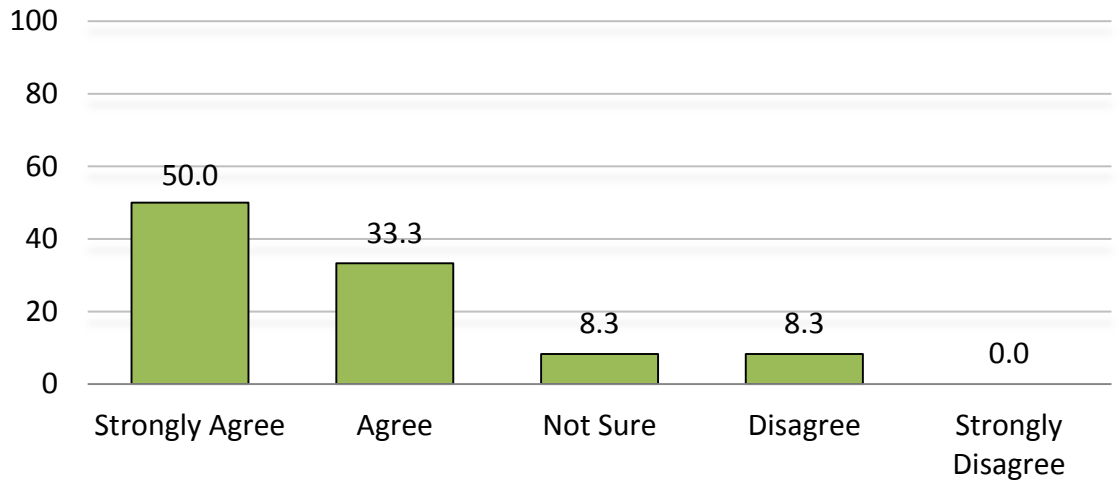
Figure 19. Percentage of Teacher Agreement to the Statement, "I am confident in my ability to connect the real-world applications of math, science, and/or related content to STEM careers."



To what extent did teachers perceive their experiences with case-based learning to be satisfactory?

Teacher satisfaction was generally high among the 12 teachers who completed the *Case-Based Learning: Teacher Retrospective Self-Assessment*. The majority (83.3%) of teacher participants strongly agreed or agreed that a case study was an effective way to teach math, science, and related content (See Figure 20).

Figure 20. Percentage of Teacher Agreement to the Statement, "I feel using a case study is an effective way to teach math, science, and related content."



Limitations of the Evaluation Design and Procedures

There are a couple of limitations of the evaluation design and procedures that warrant attention when interpreting the findings from this evaluation. The first limitation was the lack of consistent alignment between the instructional content standard targeted, the learning objective, the instructional activities, and the student assessment of learning across projects. To ensure case-based learning projects have the desired impact on student learning, teachers will need more planning time, guidance, and input on the most effective way to meet the designated learning objective using a case-based learning approach. Given that the primary measure of student learning relied on teacher assessment, the assessments of student learning should focus on the mastery of content knowledge, and not be based solely on project participation.

The second limitation of the evaluation pertains to teacher and student survey response rates. Although adequate for analysis, only 66.7% of the teachers completed the *Case-Based*

Learning: Teacher Retrospective Self-Assessment and only 72.2% of the schools was represented in the data from the *Case-Based Learning: Student Survey*. Consequently, the generally positive findings from the teacher and student surveys reflects only the experiences of the teachers and students who responded. The degree to which the teachers and students who did not respond to the survey shared these generally positive perceptions is unknown.

The final limitation of the evaluation was the evaluation design itself, which was descriptive and therefore limited to addressing preliminary questions about the Project's activities and outcomes. As such, this evaluation did not examine the cost-effectiveness of obtaining desired student learning outcomes using a standardized measure of math and/or science achievement relative to other less expensive experiential learning initiatives. Future evaluations should explore the sustainability of the case-based learning approach following the initial year of implementation.

Conclusions

Findings from the external evaluation indicate that the students increased their knowledge of the content targeted by the learning objective for the project. Students also increased their knowledge of the case-based learning process. Results from the student survey show variability among the schools with Cincinnati Public Schools' students and having consistently more positive perceptions of the Case-Based STEM Learning Project's impact on learning relative to students in the Milford Exempted Village Schools. Evidence of student outcomes was obtained by teacher assessment of learning and student self-report. Teachers also reported gains in their knowledge and confidence in using a case-based learning approach. Both students and teachers reported high levels of satisfaction with Case-Based STEM Learning Project, although the students in Cincinnati Public Schools were more positive in their appraisal than were the students in Milford Exempted Village Schools. Limitations in the evaluation design and procedures noted within the report deserve attention when interpreting the findings.

Appendix A

Case Study Decision Point or Dilemma for Each Case-Based STEM Learning Project

Cincinnati Public Schools

School	Partner	Decision Point or Dilemma
Academy of Multilingual Immersion Studies	Affordable Language Services	How many interpreters does Cincinnati need? How can we help Affordable Language Services?
Aiken New Tech High School	New Tech Network	How does an artist create the illusion of three-dimensionality on a flat wall?
Clark Montessori High School	Gorman Heritage Farm	How do we bring awareness to Community Supported Agriculture and Gorman Heritage Farm?
Gamble Montessori High School	TriHealth	Can we figure out if the benefits of using UV cleaning could outweigh the drawbacks?
Hughes STEM High School	Macy's	Create an app that can enhance the customer experience at a Macy's department store
Hyde Park School/ Cincinnati Gifted Academy	The BonBonerie	How can the Bonbonerie create cakes that would appeal to kids?
Kilgour School	Madisono's Gelato	We are developing a new gelato flavor.
Pleasant Ridge Montessori	Greater Cincinnati World Affairs Council	Will Brazil be ready for the 2016 Summer Olympics?
Rockdale Academy	Cincinnati Children's Hospital Medical Center	Designing a Balanced 10 day Meal Plan and a 10 day Fitness plan for students
Rothenberg Preparatory Academy	Cincinnati Symphony Orchestra	How does sound influence an ecosystem? How do we bring a younger audience to Cincinnati Pops Orchestra?
Sands Montessori	Cincinnati Art Museum	How can we, as an exhibition team, help curators at the Cincinnati Art Museum develop and design an educational exhibition that will share the history of the

		Queen City in a limited gallery space?
School of the Creative and Performing Arts (SCPA)	Hamilton County Jobs and Family Services	What type of program can HCJFS put into place that will provide aged-out foster child an official commitment from an adult to act as a parental figure?

Milford Exempted Village Schools

School	Partner	Decision Point or Dilemma	Learning Objective(s)
Boyd E. Smith Elementary	3M	How can 3M determine the best materials to use for transferring moisture away from the body and moving that moisture through the material from the body to the supporting fabric?	
McCormick Elementary			
Meadowview Elementary			
Mulberry Elementary			
Pattison Elementary			
Seipelt Elementary			

Appendix B

Percentage of Students Reporting "Strongly Agree" or "Agree" to Items Regarding Understanding the Case-Based Learning Process by Grade Level

Cincinnati Public Schools	**Grade Level**			
	4	5	6	8
I understand how the case-based learning process allowed us to solve the case.	68.4%	92.9%	90.7%	73.9%
I contributed to the class's solution to the case.	86.8%	78.6%	95.9%	82.6%
This project related to the real world.	94.7%	92.9%	94.8%	95.7%
Number of Students	*38*	*14*	*97*	*23*
Milford Exempted Village Schools	**Grade Level**			
	4	5	6	8
I understand how the case-based learning process allowed us to solve the case.	-	-	71.4%	-
I contributed to the class's solution to the case.	-	-	84.4%	-
This project related to the real world.	-	-	68.0%	-
Number of Students			*416*	

Appendix C

Percentage of Students Reporting "Strongly Agree" or "Agree" to Items Regarding Understanding the Case-Based Learning Process by Student Gender

Cincinnati Public Schools	**Gender**	
	Female	Male
I understand how the case-based learning process allowed us to solve the case.	84.6%	79.3%
I contributed to the class's solution to the case.	92.3%	86.6%
This project related to the real world.	96.2%	93.9%
Number of Students	*104*	*82*
Milford Exempted Village Schools	**Grade Level**	
	Female	Male
I understand how the case-based learning process allowed us to solve the case.	74.4%	69.0%
I contributed to the class's solution to the case.	85.9%	82.9%
This project related to the real world.	67.8%	68.5%
Number of Students	*199*	*216*

Appendix D

Percentage of Students Reporting "Strongly Agree" or "Agree" to Items Regarding Understanding the Case-Based Learning Process by Student Race/Ethnicity

Cincinnati Public Schools	**Race/Ethnicity**			
	Black	Hispanic	Multi-racial	White
I understand how the case-based learning process allowed us to solve the case.	80.0%	80.0%	73.7%	85.6%
I contributed to the class's solution to the case.	87.3%	80.0%	78.9%	94.4%
This project related to the real world.	96.4%	80.0%	84.2%	98.9%
Number of Students	*55*	*15*	*19*	*90*
Milford Exempted Village Schools	**Race/Ethnicity**			
	Black	Hispanic	Multi-racial	White
I understand how the case-based learning process allowed us to solve the case.	-	-	75.0%	71.7%
I contributed to the class's solution to the case.	-	-	89.3%	84.5%
This project related to the real world.	-	-	67.9%	67.6%
Number of Students			*28*	*361*

Note: The results were not reported in instances where the number of students in a subgroup were fewer than 10.

Appendix E

Percentage of Students Reporting “Strongly Agree” or “Agree” to Items Pertaining to Satisfaction with the Case-Based Learning Project by Grade Level

Cincinnati Public Schools	**Grade Level**			
	4	5	6	8
I feel using case studies is an effective way to learn math, science, and related content.	71.1%	71.4%	83.5%	69.6%
This project made me more interested in math, science, and/or related content.	52.6%	92.9%	68.0%	56.5%
Number of Students	*38*	*14*	*97*	*23*
Milford Exempted Village Schools	**Grade Level**			
	4	5	6	8
I feel using case studies is an effective way to learn math, science, and related content.	-	-	63.5%	-
This project made me more interested in math, science, and/or related content.	-	-	39.9%	-
Number of Students			*416*	

Appendix F

Percentage of Students Reporting “Strongly Agree” or “Agree” to Items Pertaining to Satisfaction with the Case-Based Learning Project by Student Gender

Cincinnati Public Schools	**Gender**	
	Female	Male
I feel using case studies is an effective way to learn math, science, and related content.	83.7%	70.7%
This project made me more interested in math, science, and/or related content.	68.3%	57.3%
Number of Students	*104*	*82*
Milford Exempted Village Schools	**Grade Level**	
	Female	Male
I feel using case studies is an effective way to learn math, science, and related content.	66.3%	60.6%
This project made me more interested in math, science, and/or related content.	37.7%	42.1%
Number of Students	*199*	*216*

Appendix G

Percentage of Students Reporting "Strongly Agree" or "Agree" to Items Pertaining to Satisfaction with the Case-Based Learning Project by Student Race/Ethnicity

Cincinnati Public Schools	**Race/Ethnicity**			
	Black	Hispanic	Multi-racial	White
I feel using case studies is an effective way to learn math, science, and related content.	70.9%	66.7%	89.5%	82.2%
This project made me more interested in math, science, and/or related content.	61.8%	66.7%	42.1%	67.8%
Number of Students	*55*	*15*	*19*	*90*
Milford Exempted Village Schools	**Race/Ethnicity**			
	Black	Hispanic	Multi-racial	White
I feel using case studies is an effective way to learn math, science, and related content.	-	-	53.6%	64.3%
This project made me more interested in math, science, and/or related content.	-	-	32.1%	39.9%
Number of Students			*28*	*361*

Note: The results were not reported in instances where the number of students in a subgroup were fewer than 10.

Appendix H

Learning Objective, Content Standard, and Student Outcome for Each Case-Based STEM Learning Project

Cincinnati Public Schools

School	Partner	Learning Objective/Content Standard	Student Outcome
Academy of Multilingual Immersion Studies	Affordable Language Services	Integrate information presented in different media to develop a coherent understanding of a topic or issue. Produce clear and coherent writing. Use technology to produce and publish writing and interact and collaborate with others. Introduce a topic by including graphics, formatting, and multimedia.	67% passed the entire test. 100% passed their section of the test.
Aiken New Tech High School	New Tech Network	**S. Inquiry B:** Analyze and interpret data from scientific investigations using appropriate mathematical skills in order to draw valid conclusions. **S. & Technology A:** Give examples of how technological advances, influenced by scientific knowledge, affect the quality of life. Design and conduct scientific investigations. Formulate and revise explanations and models using logic and evidence (critical thinking). Recognize and analyze explanations and models.	On a scale of 1-3 using the *Project Based Learning Engineering Design Team Rubric,* 13% of the students received a rating of 3, 83% of the students received a performance rubric rating of 2, and 5% of the students received a rating of 1.
Clark Montessori High School	Gorman Heritage Farm	Students will understand the difference between organic and non-organic vegetables, regarding size, shape, quality, quantity, color, texture, and taste. Students will identify biotic and abiotic factors for growing vegetables on a rooftop garden. Students will determine the environmental conditions necessary for the organism's survival. • **8th Grade LS.1.1.b** Changes in environmental conditions can affect how beneficial a trait will be for the survival and reproductive success of an organism or an entire species. • **7th Grade LS.1.2.a** Biomes are regional ecosystems characterized by distinct types of organisms that have developed under specific soil and climatic conditions. • **7th Grade LS.1.2** In any particular biome, the number, growth, and survival of organisms and populations depend on e biotic and abiotic	The class received a rubric rating of 3 on a scale of 1-4 for the project. A 4 was defined as: Information is very organized with well-constructed paragraphs and subheadings. Notes are recorded and organized in an extremely neat and orderly fashion. Information clearly relates to the main topic. It includes several supporting details and/or examples.

		factors	Diagrams and illustrations are neat, accurate and add to the reader's understanding of the topic. A 3 was defined as: Information is organized with well-constructed paragraphs. Notes are recorded legibly and are somewhat organized. Information clearly relates to the main topic. It provides 1-2 supporting details and/or examples. Diagrams and illustrations are accurate and add to the reader's understanding of the topic. A 2 was defined as: Information is organized, but paragraphs are not well-constructed. Notes are recorded. Information clearly relates to the main topic. No details and/or examples are given. Diagrams and illustrations are neat and accurate and sometimes add to the reader's understanding of the topic.
Gamble Montessori High School		• Use technology including iPads and Mac Books to research hospital cleaning procedures, the importance of keeping disease/illness contained within a hospital, the use of UV cleaning in hospital rooms. • Use appropriate mathematics, tools and techniques to gather data and information; • Analyze and interpret data; • Develop descriptions, models, explanations and predictions; • Think critically and logically to connect evidence and explanations; • Recognize and analyze alternative explanations and predictions; and	Through the presentation, questioning, and interviewing, students were able to accurately meet 3/4 of the standards in science and 2.5/4 in mathematics. Percentage wise, the students were performing at level or above

		Communicate scientific procedures and explanations.	75-85%.
Hughes STEM High School	Macy's	*Goal:* The students will design a mobile application to fit the specifications of the Macy's Intersession management team Documentation (Case Notebook): project planning sheet, criteria/constraints chart, picture of brainstorming session results, rough mock up, final wireframe, presentation to Macy's Intersession management team App design that best meets the management team criteria will be developed in conjunction with NKU informatics *Actions:* (Engineering Design Process) Identify the problem. Identify the client needs for the app. Identify Criteria and Constraints. Create a chart listing the criteria and constraints of the app project. Brainstorm Possible Solutions. Conduct a brainstorming session. Generate Ideas. List solution ideas from brainstorming session. Explore Possibilities. Identify the possible objects of the final app (the possibilities). Select an Approach. Select objects to use in the design (the choice). Create a rough mock-up of user interface (UI). Build a Model or Prototype design a wireframe depicting the UI with objects (the product). Present wireframe to management team.	90% of the students earned an 80% and higher on the assessment. The assessment included participation and project completion.
Hyde Park School/ Cincinnati Gifted Academy	The BonBonerie	*Math:* Data analysis and probability as well as conversions related to measurement. *Science*: Technology. *Language Arts:* Speaking and Listening: 1. Engage effectively in a range of collaborative discussions with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly. 2. Paraphrase portions of a text, or information presented in a diverse media and formats including visually, quantitatively, and orally. 4. Report on a topic or text, using appropriate facts and relevant, descriptive details to support main ideas or themes, speak clearly at an understandable pace. *Writing Standards*: Research to build and present knowledge: 7. Conduct short research projects that build knowledge through investigation of different aspects of a topic. 9. Draw evidence from literary or informational texts to support analysis,	Students will use mean, median and mode to analyze a data set: 98% Mastery.

		refection, and research. *Social Studies*: Economics 22. Tables and charts help people to understand information and issues. Tables organize information in columns and rows. Charts organize information in a variety of visual formats (pictures, diagrams, graphs). 23. Entrepreneurs in Ohio and the US organize productive resources and take risks to make a profit and compete with other producers. MATH Use the four operations with whole numbers to solve problems. **CCSS.Math.Content.4.OA.A.1** Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. **CCSS.Math.Content.4.OA.A.2** Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison. **CCSS.Math.Content.4.OA.A.3** Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. Solve problems involving measurement and conversion of measurements. **CCSS.Math.Content.4.MD.A**.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. Represent and interpret data. **CCSS.Math.Content.4.MD.B.4** Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots. For example, from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection. Develop understanding of statistical variability.	

		CCSS.Math.Content.6.SP.A.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages. **CCSS.Math.Content.6.SP.A.2** Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. **CCSS.Math.Content.6.SP.A.3** Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number. Summarize and describe distributions. **CCSS.Math.Content.6.SP.B.4** Display numerical data in plots on a number line, including dot plots, histograms, and box plots. **CCSS.Math.Content.6.SP.B.5** Summarize numerical data sets in relation to their context, such as by: **CCSS.Math.Content.6.SP.B.5.**a Reporting the number of observations. **CCSS.Math.Content.6.SP.B.5.b** Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. **CCSS.Math.Content.6.SP.B.5.c** Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. **CCSS.Math.Content.6.SP.B.5.d** Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered. **Science Inquiry and Application:** •Observe and ask questions about the natural environment; •Plan and conduct simple investigations; •Employ simple equipment and tools to gather data and extend the senses; •Use appropriate mathematics with data to construct reasonable explanations; •Communicate about observations, investigations and explanations; and •Review and ask questions about the observations and explanations of others. Designing *Technological/ Engineering Solutions using Science Concepts 21st Century Skills:* 21st century skills are integral to the science	

		standards and curriculum development revision documents. They are an essential part of the model curriculum component through the incorporation and integration of scientific inquiry, science skills and process and technological and engineering design. As enumerated by **Am. Sub. H.B. 1,** these skills include: creativity and innovation; critical thinking, problem solving and communication; information, media and technological literacy; personal management, productivity, accountability, leadership and responsibility; and interdisciplinary, project-based, real-world learning opportunities *Technological Design*: Technological design is a problem or project based way of applying creativity, science, engineering and mathematics to meet a human need or want. Modern science is an integrated endeavor. Technological design integrates learning by using science, technology, engineering and mathematics and fosters 21st Century Skills. *Technology and Engineering*: Technology modifies the natural world through innovative processes, systems, structures and devices to extend human abilities. Engineering is design under constraint that develops and applies technology to satisfy human needs and wants. Technology and engineering, coupled with the knowledge and methods derived from science and mathematics, profoundly influence the quality of life.	
Kilgour School	Madisono's Gelato	**6.SL.1.** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. **6.SL.1b**. Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed. **CCRA.W.4**. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **6.W.1**. Write arguments to support claims with clear reasons and relevant evidence. **6.RP.3c**. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent. **6-8.WHST.8**. Gather relevant information from multiple print and digital	Week 1 - No assessment Week 2 - 8.8/10 Week 3 - 9.1/10 Week 4 - 9.3/10 Week 5 - 9.5/10 Week 6 - 9.6/10 Week 7 - 9.7/10

		sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. **6.SP.1.** Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages. **6.SP.5.** Summarize numerical data sets in relation to their context, such as by: (a) Reporting the number of observations, (b) Describing the nature of the attribute under investigation, including how it was measured and its units of measurement, (c) Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/ or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered, (d) Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered. **6.SL.2** Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study. **6.SL.5** Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information. **6.SL.4** Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation. **CCRA.SL.1** Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.	
Pleasant Ridge	Greater Cincinnati	Students research four groups: Economics, Environmental, Political and Cultural. Within these groups, students will identify and answer questions	Mean rubric of 3.50 for the three PowerPoint

Montessori	World Affairs Council	related to the current political and financial status of Brazil, as well the history and requirements of the Olympic Games. **CCSS ELA-Literacy.RL.5** (Literary Text): 1.Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. **CCSS.ELA – Literacy.RI.5** (Informational Text) 5.Compare and contrast the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in two or more texts. Measurement and Data **4.MD A**. Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.	presentations
Rockdale Academy	Cincinnati Children's Hospital Medical Center	Students will learn to identify good nutritional habits as well as identify alternative fitness activities.	80% of students completed the project with 85% accuracy of information.
Rothenberg Preparatory Academy	Cincinnati Symphony Orchestra	*Objectives*: Students will be able to: 1. Conduct and draw conclusions from an experiment using the scientific method. 2. Students will be able to create tables and graphs of their data and draw conclusions from it. 3. Students will be able to interpret data and graphs and applying it to the design of their game application. 4. Students will be able describe how sound waves can influence an ecosystem. *Standards*: **Life Sciences: C.** Compare changes in an organism's ecosystem/habitat that affect its survival. **Scientific Ways of Knowing: B.** Describe the different types of investigations and use results and data from investigations to provide the evidence to support explanations and conclusions. **Scientific Ways of Knowing: C**. Explain the importance of keeping records of observations and investigations that are accurate and understandable. **Math: Standard: PFA:BM.F:** Models problems with physical materials and visual representations and use models, graphs and tables to draw	Overall rubric rating was a 14 out of 16.

		conclusion.	
Sands Montessori	Cincinnati Art Museum	21st century skills are integral to the science standards and curriculum development revision documents. They are an essential part of the model curriculum component through the incorporation and integration of scientific inquiry, science skills and process and technological and engineering design. As enumerated by **Am. Sub. H.B. 1,** these skills include: creativity and innovation; critical thinking, problem solving and communication; information, media and technological literacy; personal management, productivity, accountability, leadership and responsibility; and interdisciplinary, project-based, real-world learning opportunities.	1. 100% of students were able to successfully utilize the iPad technology. 2. 100% of students participated in at least one aspect of model design/ construction. 3. 98% of students attended the informational seminars offered by the Cincinnati Art Museum. 4. 82% of students contributed written or online input for the app design.
School of the Creative and Performing Arts (SCPA)	Hamilton County Jobs and Family Services	1. To engage in a case study 2. To investigate HCJFS operations with regard to foster care 3. To use technology to research permanency pacts 4. To collect and analyze data about foster children 5. To collect and analyze data regarding life for former foster children as adults 6. To become informed of corporations who support programs for children and/or foster children 7. To produce or design the production of a commercial using technology 8. To create the design for an app	1. 100% of the students were observed engaging in internet research. 2. 100% of the students were observed generating ideas and formulating decisions about an aged out young adult permanency pact program. 3. 100% of the students were observed generating ideas about an app to create awareness about aged out young adults. 4. 100% of the students were observed sharing ideas during discussions throughout the ten week program.

School	Partner	Learning Objective/Content Standard	Student Outcome
Boyd E. Smith Elementary	3M	The learning objective for this project is for the students to help 3M determine the best fabric to use in medical products, braces, etc. They are researching, working with the fabrics themselves, analyzing data and presenting that data digitally. **ELA-Literacy.RST.6-8.1**. Determine the central ideas or conclusions of a text: provide an accurate summary of the text distinct from prior knowledge or opinions. **ELA-Literacy.RST.6-8.8.** Distinguish among facts, reasoned judgment based on research findings, and speculation of text. **ELA-Literacy.SL.6.1**. Engage effectively in a range of collaborative discussion (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. **ELA-Literacy.SL.6.1.C**. Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion. **ELA-Literacy.W.6**. Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate. **ELA.-Literacy.RST.6-8.7**. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., flowchart, diagram, model, graph or table). **ODE - Science Inquiry and Application**: Identify questions that can be answered through scientific investigations. **ODE - Science Inquiry and Application:** Use appropriate mathematical, tools, and techniques to gather data and information. **ODE - Science Inquiry and Application:** Analyze and interpret data in order to think critically and logically to connect evidence and explanations. **ODE - Science Inquiry and Application:** Communicate scientific procedures and explanations. **Math.Content.6.SP.A.2**. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.	The class received and average rating of 3 on their presentation slides which is defined by presenting the most of the data in a clear easy to understand manner. There are photos that document the process during the experiments. Some observations are described on the slide.
McCormick Elementary			*Learning outcome not reported.*
Meadowview Elementary			*Learning outcome not reported.*
Mulberry Elementary			Students followed the scientific method, used math for findings and created presentations with 100% participation
Pattison Elementary			Given a rubric scale of 1-5, the average rating was 4. Evaluations were written by students based on "real life problem solving", group presentation, and group work,
Seipelt Elementary			*No assessment conducted.*

		Math. Content.6.SP.A.3. Recognize that a measure of center for a numerical data set summarizes all of its values with a single number. **Math.Content.6.SP.B.5**. Summarize numerical data sets in relation to their context, such as by: Reporting the number of observations.	