



Dr. Donna Hargens, Superintendent

Program Evaluation 2012-2013

Kentucky Science Center After-School Enrichment Pilot Program

Final Report

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Kentucky Science Center After-School Enrichment Pilot Program

2012-2013 Program Evaluation Report

Background

This evaluation report describes the outcomes from year one of a science enrichment program conducted by the Kentucky Science Center in collaboration with the Jefferson County Public Schools (JCPS). This effort was funded by the JCPS and is aligned with the JCPS Strategic Plan Focus Area *Stakeholder Involvement/Engagement*, Goal 3, *Parents, community, and partners enrich students' educational experiences and support their success and the following strategies:*

- 3.2: Increase the number of out-of-school hours,
- 3.3: Increase the number of community-based opportunities/experiences

Though gains in science proficiency for JCPS elementary students were made on the state assessment in science for 2013, JCPS still lags behind the state in proficiency (i.e., 58.4% vs. 68.5%, respectively). In fact, JCPS has a 5-year trend of lagging behind the state in science proficiency. In 2012, JCPS elementary students gained 1% in proficiency while the state lost .7% in proficiency. This year, the state lost .3% in proficiency while district gained 3.1%. The goal of the KSC pilot after-school enrichment program was to pilot an approach to accelerating growth on the K-PREP science assessment.

Program Design

Five JCPS elementary schools participated in the pilot program: Byck, Cochrane, Foster, Mcferran, and Shelby Traditional. The free and reduced lunch rate for these schools ranges from 83.1% to 92.2% - the average for all JCPS elementary schools is 67%. Table 1 shows that all schools except Mcferran had a lower rate of proficient/distinguished students than the district average for science.

Table 1

Jefferson County Public Schools Kentucky's Unbridled Learning Assessment
2012 Next-Generation Learners (NXGL) Science Achievement

Elementary Schools	Total Students	Novice	Apprentice	Proficient	Distinguished	Achievement Points*
Byck	85	14.1	31.8	34.1	20.0	14.6
Cochran	55	25.5	50.9	21.8	1.8	9.8
Foster Traditional	114	23.7	39.5	28.9	7.9	11.3
Mcferran	115	4.3	33.9	40.9	20.9	17.4
Shelby	102	14.7	42.2	34.3	8.8	12.8
JCPS Elementary	7,316	12.3	32.3	36.3	19.1	15

*The Unbridled Learning Assessment system awards 1 point for each percent of students scoring proficient or distinguished, 1/2 point awarded for each percent of students scoring apprentice, no points for novice students, 1/2 bonus point for distinguished that doesn't overcompensate for novice.

The after-school sessions were conducted on March 7, March 14, March 21, March 28, April 11, and April 18. A culminating event at the KSC for all students enrolled in the schools and their families was held on April 25th. Each session lasted 90 minutes at each school from 4pm to 5:30 pm and was led by a KSC educator. The culminating event lasted from 5-8pm at the KSC and was open to all students and families. Weekly activities were common across all sites but on a six week rotation, meaning that different activities were happening at each site weekly but students had the same set of activities by the final session. Sessions used an inquiry-based framework for instruction and demonstration that provided students to engage in specific scientific and engineering practices using a variety of learning modalities (e.g., kinesthetic, visual). Sessions also included a note booking component. Content addressed: (a) circuits, (b) adaptations, (c) force & motion, (d) states of matter, (e) erosion, and (f) food webs. The JCPS Director of Curriculum Management provided input to the KSC in selecting the content. Additionally, math skills of measurement, conversion, fractions and graphing were incorporated as well as the language arts skills of comprehending informational text, developing conceptual maps, developing arguments and speaking skills were integrated. The culminating event at the KSC provided students with hands-on stations connected to the science content and viewing of the IMAX film *Born to be Wild*.

Evaluation

Session attendance, performance on a science content pre/post assessment, and student responses on a satisfaction survey provided formative evaluation data. Performance on the 2013 K-PREP

assessment in science provided summative data for this initiative. The research questions were as follows:

1. What would the student attendance rate be for an engaging content-based after-school program?
2. Would content knowledge significantly improve by the final after-school session?
3. Will participation in the after-school program lead to better performance on the 2013 K-PREP science assessment?
4. How would students report their satisfaction with the after-school pilot program?

The JCPS evaluator and KSC program staff worked collaboratively in planning and creating the evaluation materials. The KSC educators maintained an attendance log for each session, administered the pre and post-test assessment, and satisfaction survey. The KSC developed and scored the pre and post-test assessment. The evaluator developed and analyzed the satisfaction survey, as well as analyzing the attendance and pre-post test data provided by KSC staff.

Approach

Fourth grade students were selected by each school principal based on former K-PREP performance in reading – students categorized as “high novice”, “apprentice”, or “low proficient” were given priority status for inclusion since reading performance is typically highly correlated with science performance on assessment tests. There were a few requests from principals to deviate from this selection criterion, or to add an extra student, and those requests were honored. Principals gained parent/guardian permission for student participation. Participation was limited to those who had their own transportation since none was provided. Note that reading was selected as a correlate because students are tested for the first time in science at the end of their fourth grade year. Fifty-two students were initially enrolled in the after-school program (two schools selected 11 students). One of those students never attended a session and was never replaced.

The content pre-test was administered at the beginning of Session 1 with the post-test and survey administered at the end of Session 6. Attendance was taken during each session. All formative data was analyzed using descriptive statistics. The summative component of the evaluation will compare the pilot group to a comparable control group on outcomes for the K-PREP science assessment while controlling for confounding variables such as differences in socio-economic status or reading ability.

Results

Attendance

After-School Sessions. The overall rate of attendance for the after-school sessions for all schools was 77.72%. This equates to 363.75 total hours of enrichment for the 51 students who attended at least one session. Attendance varied by session date as shown below:

- Session 1: 94.2%
- Session 2: 78.9%

- Session 3: 74.1%
- Session 4: 73.1%
- Session 5: 73.1%
- Session 6: 73.1%

Attendance also varied by school with overall attendance for each school as follows:

- Byck: 59.2%
- Cochran: 81.8%
- Foster Traditional: 76.7%
- Mcferran: 88.6%
- Shelby Traditional 80.8%

Figure 1 shows the attendance rate for each school by session. Anecdotal reports to the evaluator described some students being “double booked” for activities toward the end of the KSC program and being pulled from the program to attend something else. This may account for the drop in attendance at some schools. Attendance at the Byck location declined markedly after the second session and fell to 40% during the final three sessions.

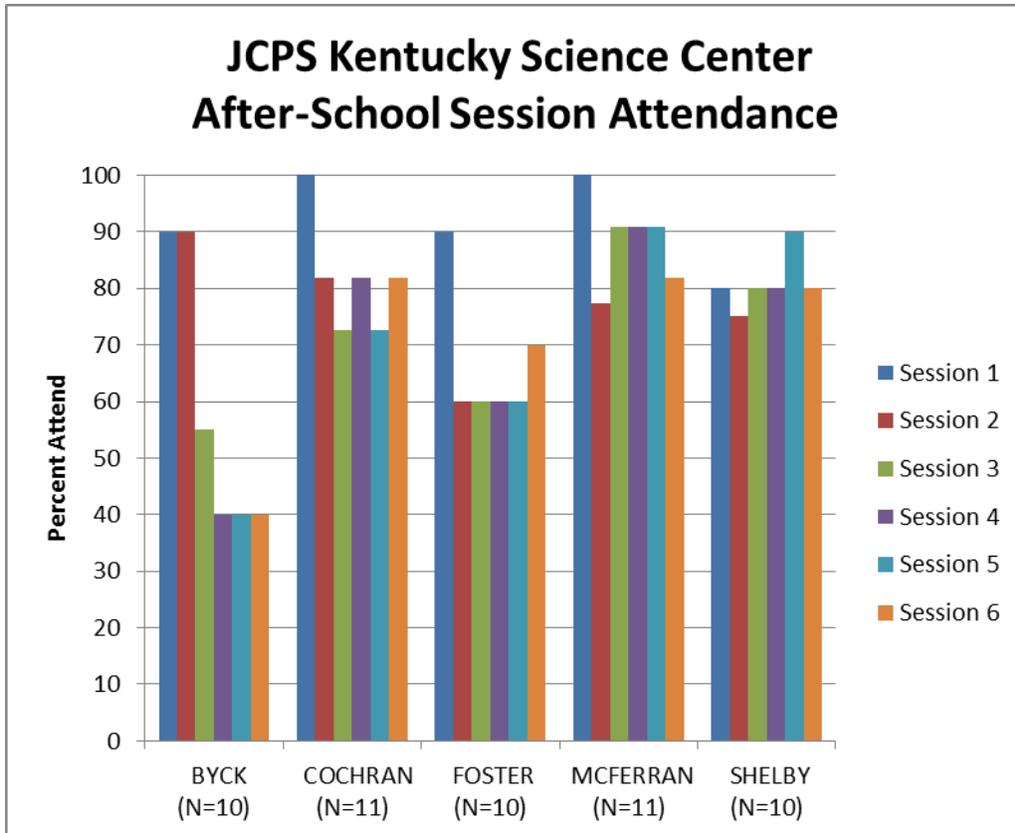


Figure 1. After-school session attendance data.

Family Night. Attendance at the Kentucky Science Center varied by location. A total of 77 people attended the event (73 school attendees and 4 JCPS Central Office attendees).

Considering that the event was open to all students and families enrolled at each school, attendance was light with 22 attendees who were from the schools but not directly involved in the program (see below):

- Byck: 9 attendees (2 KSC participants, 7 KSC family members)
- Cochran: 25 attendees (4 KSC participants, 9 KSC family members, 12 others)
- Foster Traditional: 14 attendees (2 KSC participants, 7 KSC family members, 5 other)
- Mcferran: 15 attendees (2 KSC participants, 8 KSC family members, 5 other)
- Shelby Traditional: 10 attendees (4 KSC participants, 6 KSC family members)

Content Knowledge

Pre-Post Assessment. Students completed a pre-test (N=47) and post-test (N=30) on the content provided during the after-school sessions. Unfortunately, there was a large discrepancy in the number of students who had both a pre and post-test score, so analysis of knowledge gains was limited. Looking at the change from pre to post-test overall, there was a gain on the post-test for every test item (see Figure 2). The largest gain was for the item “What state of matter is Liquid Nitrogen?” where 29.8% of students answered the question correctly on the pre-test, compared to 73.3% answering the question correctly on the post-test. A sizeable pre-test (34% correct) to post-test (76.7% correct) gain was also made on the item requiring students to organize a series of organisms in the food chain. The data seem to indicate that students were still struggling with the concepts of behavioral and structural adaptations by the end of the pilot program. The overall percent correct for the pre-test was 37.2% and the overall percent correct for the post-test was 60%, a sizeable gain but a failing grade using conventional grading standards.

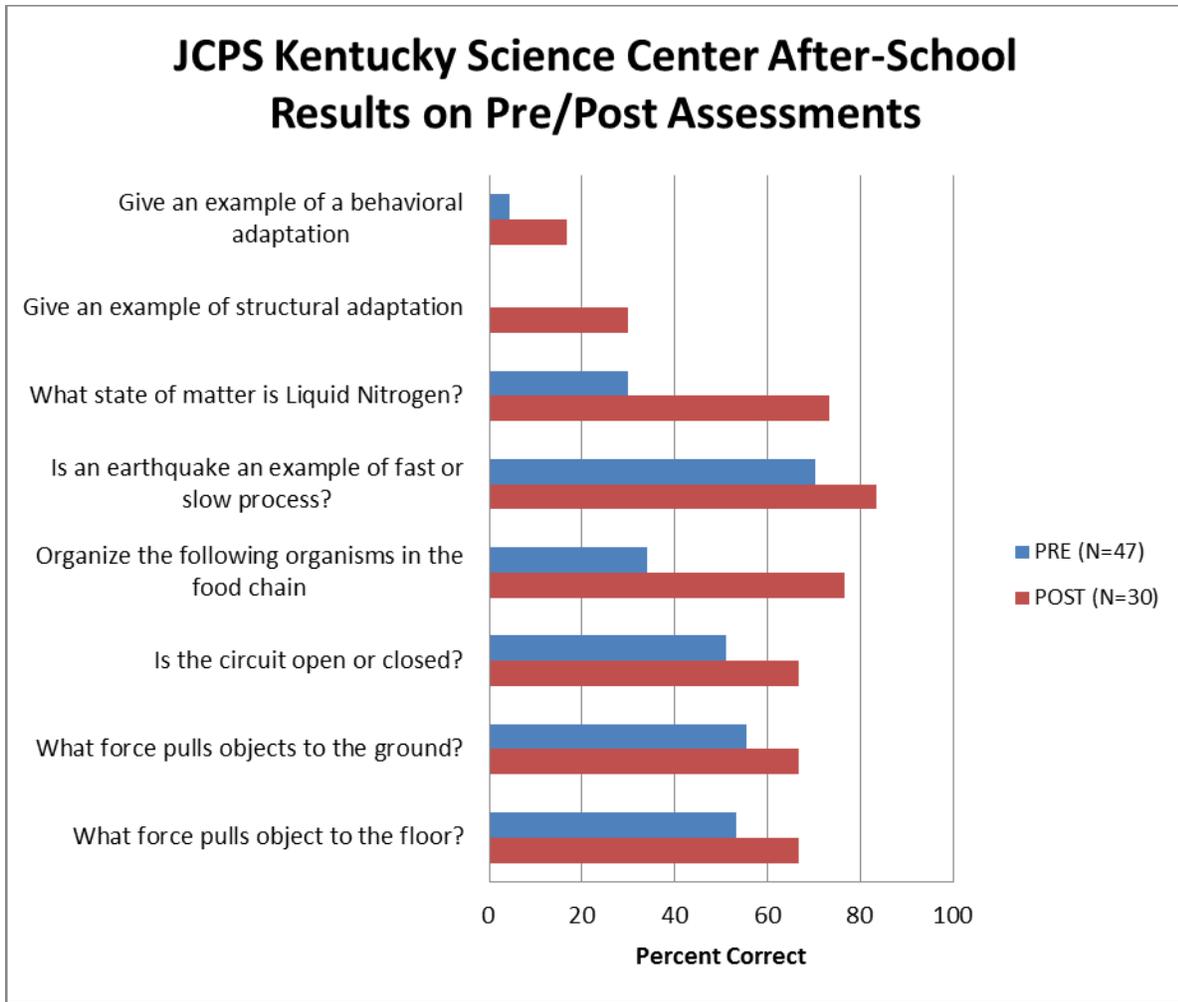


Figure 2. Pre/Post Test Assessments on science content.

K-PREP Results

2013 K-PREP data was analyzed for the 52 KSC after-school students. A control group (N=52) matched on reading performance category on the 2012 K-PREP assessment (100%), lunch status (92.3%), and school location (86.5%) was constructed. Independent t tests were conducted to examine differences between the KSC and control groups on 2013 K-PREP scale scores in reading, math, and science. Chi-Square tests (χ^2) were also conducted on performance category scores for reading, math, and science.

Table 2 shows the outcomes for 2013 scale score comparisons. Significant differences between the KSC and control group 2013 scale scores were found for reading, $t(102) = 2.51, p=.014$ (two-tailed), $d=.49$ and science, $t(102) = 2.92, p=.004$ (two-tailed), $d=.573$. The average 2013 reading scale score for the KSC group was 208.23 (SD=21.3) compared to 198.67 (SD=17.43) for the control group. It is important to view these findings in light of the fact that the KSC group’s reading scale score for 2013 was essentially unchanged from 2012 (M=208.63) while the control group’s reading scale score for 2013 was 8.21 points lower than the scale score for 2012 (M=206.88). Thus the KSC group showed a significant advantage for 2013 reading scale scores

but the overall outcomes show that the KSC group maintained their reading levels from the previous year while the control group lost ground. Reading scale scores for the KSC group were also higher than the overall district scores (M=203.53, SD=28.89). Reading and math scale scores are used to calculate K-PREP percentile growth by converting scores and awarding points for scores demonstrating typical or high growth for their academic peers. The KSC group showed a significant growth advantage for reading (M=.62, SD =.49) when compared to the control group, (M=.37, SD = .49); t test (102) = 2.61 (SD=.1), p=.01, d=.51.

The average 2013 science scale score for the KSC group was 215.85 (SD=15.5) compared to 207.4 (SD=13.95) for the control group; with the KSC group showing a significant advantage for 2013 science. Unfortunately, there are no 3rd grade science scores for the KSC and control groups to support a similar comparison made for reading. A scale score of 216.88 was classified as proficient for JCPS using the K-PREP cut-off scores for 2013. Clearly, the KSC group scores were much closer to this benchmark, outscoring the control group and JCPS 4th grade.

The math scale score t test (102) = 1.97, p = .052, approached significance with an average scale score for the KSC group of 206.62 (SD = 18.37) compared to 200.71 (SD = 11.44) for the control group. Again, both the KSC and control groups scored lower on their math scale scores in 2013 with the KSC group scoring 2.57 points lower (SD=17.0) and the control group scoring 3.79 points lower (SD=18.37).

Table 2

2013 K-PREP Reading, Science, and Math Scale Scores for KSC After-School Program Participants

2013 K-PREP SCALE SCORES			
READING*	<i>N</i>	<i>MEAN</i>	<i>STD. DEV</i>
KSC	52	208.23	21.3
Control	52	198.67	17.43
JCPS 4 th Grade	7407	203.53	28.89
SCIENCE**			
	<i>N</i>	<i>MEAN</i>	<i>STD. DEV</i>
KSC	52	215.85	15.5
Control	52	207.40	13.95
JCPS 4 th Grade	7407	211.14	27.74
MATH***			
	<i>N</i>	<i>MEAN</i>	<i>STD. DEV</i>
KSC	52	206.62	18.37
Control	52	200.71	11.44
JCPS 4 th Grade	7407	204.17	27.63

Significant difference between KSC and control group, *pvalue = .014; **pvalue=.004; ***pvalue=.052 (approached significance)

Scale scores are used to calculate K-PREP achievement by converting scores to performance categories for each content area (i.e., novice, apprentice, proficient, and distinguished). In

general, schools are only awarded points for scores are in the range of apprentice, proficient, or distinguished. Points are more heavily weighted for proficient and distinguished scores. The analysis on science performance categories showed a significant difference for the KSC and control groups, $X^2(3, N=104), p=.004$. Table 2 shows that for science, the KSC group had far fewer novices than the control group (3.8% vs. 13.5%) and substantially more proficient/distinguished students (65.4% vs. 38.5%). The KSC group also outperformed the district in having fewer novices and more proficient /distinguished scoring students. The proficient/distinguished rate for the 2013 state elementary in science was 68.5%. The KSC group outperformed the state in every performance category except distinguished (see Table 3).

Table 3

2013 K-PREP Reading, Science, and Math Performance Category Distributions for KSC After-School Program Participants

2013 K-PREP PERFORMANCE CATEGORY DISTRIBUTIONS					
READING	<i>N</i>	<i>NOVICE</i>	<i>APPRENTICE</i>	<i>PROFICIENT</i>	<i>DISTINGUISHED</i>
KSC	52	28.8%	25%	25%	21.2%
Control	52	48.1%	26.9%	19.2 %	5.8%
JCPS GRADE 4	7,259	34.3%	21.6%	28.6.%	15.8%
State GRADE 4	50,360	26.9%	24.4%	33.1%	15.6%
SCIENCE*	<i>N</i>	<i>NOVICE</i>	<i>APPRENTICE</i>	<i>PROFICIENT</i>	<i>DISTINGUISHED</i>
KSC	52	3.8%	30.8%	44.2%	21.2%
Control	52	13.5%	48.1%	32.7%	5.8%
JCPS GRADE 4	7,259	12.8%	28.8%	36.5%	21.8%
State GRADE 4	50,360	7.5%	24.1%	40.8%	27.7%
MATH	<i>N</i>	<i>NOVICE</i>	<i>APPRENTICE</i>	<i>PROFICIENT</i>	<i>DISTINGUISHED</i>
KSC	52	26.9%	32.7%	34.6%	5.8%
Control	52	28.8%	42.3%	28.8%	0%
JCPS GRADE 4	7,259	26.4%	31.8%	30.0%	11.8%
State GRADE 4	50,360	23.2%	32.9%	31.8%	12.2%

*Significant difference between KSC and control group, $pvalue = .004$

Effect sizes measure the magnitude of a treatment effect. Cohen's d is a common statistic used to calculate effect size. Effect sizes are typically classified as small (.2), medium (.5), and large (.8). All effect sizes for the KSC ranged from .49 to .57. Another way to look at these effect sizes is as the average percentile standing of the average treated participant relative to the average untreated participant. For example, the effect sizes reported for the pilot study can be considered to be somewhere between the 68th and 72nd percentile of the control group.

Finally, while not a part of the formal analysis, a comparison of the KSC group for each school is compared to that school's overall distribution of performance scores for science. Three of the five (i.e., Byck, Foster, and McFerran) KSC locations had negative gains in the %proficient/distinguished students in science for 2013. Byck, had the lowest gains in

%proficient/distinguished students for science (i.e., -23.4%) in the district (refer to Table 1 for more 2012 data). Table 4 shows that while the school, overall, had a novice rate of 34.7% in science, the Byck KSC group had 0 novices. Foster was the only KSC school with novices in the KSC group. In every case, the KSC groups outperformed their school as a whole in proficient/distinguished rates for science.

Table 4

2013 K-PREP performance category distributions for KSC location and by overall school

2013 K-PREP PERFORMANCE CATEGORY DISTRIBUTIONS FOR KSC SCHOOL GROUP AND BY OVERALL SCHOOL (in parenthesis)					
SCIENCE*	N	NOVICE	APPRENTICE	PROFICIENT	DISTINGUISHED
KSC	52	3.8%	30.8%	44.2%	21.2%
BYCK	10 (101)	0 (34.7%)	40 (34.7%)	50 (21.8%)	10 (8.9%)
COCHRAN	11 (79)	0 (24.1%)	0 (41.8)	36.3% (24.1)	63.6% (10.1)
FOSTER	10 (93)	20% (25.8%)	50% (46.2%)	30% (25.8%)	0% (2.2)
MCFERRAN	11 (113)	0 (8.8%)	36.4% (38.1%)	45.5% (35.4%)	18.2% (17.7%)
SHELBY	10 (110)	0 (13.6%)	30% (36.4%)	60% (36.4%)	10% (13.6%)

Program Satisfaction

All students attending the last session (N=33) completed a survey which contained the following questions:

1. How interesting were the sessions overall?
2. How many opportunities did you have to actively participate in the sessions?
3. How many opportunities did you have to ask questions in the sessions?
4. Would you recommend this program to a friend?
5. Please tell us two of your favorite things about this program (open-ended item).
6. Please tell us how we can improve the program for next time (open-ended item).

Unfortunately, schools varied by location in terms of the number of student who completed the survey: (a) Byck (N=4), (b) Cochran (N=8), (c) Foster Traditional (N=5), (d) Mcferran (N=9), and (e) Shelby Traditional (N=7). The low number of surveys from Byck and Foster make it difficult to compare responses between sites. Responses from the student survey were overwhelmingly positive. The data in Figure 3 show that nearly 97% of the students responded agreed that they found the sessions to be either very “Interesting” (33.3%) or “Extremely Interesting” (63.6%).

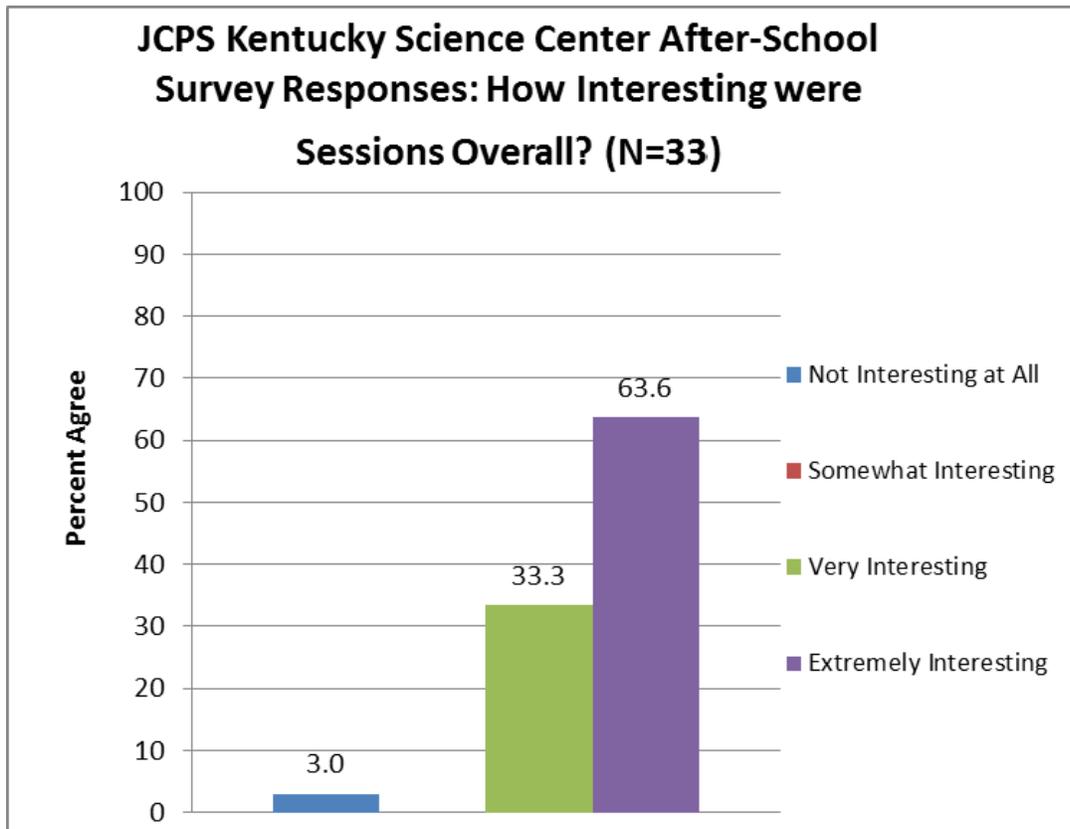


Figure 3. Student ratings of session interest level.

Most students indicated that they had ample opportunities to ask questions during the sessions with 75.7% of students reporting they had either “Lots of Opportunities” or “Constant Opportunities” to ask questions while 24.2% of students reported they had either “Some Opportunities” or “No Opportunities” to ask questions (see Figure 4).

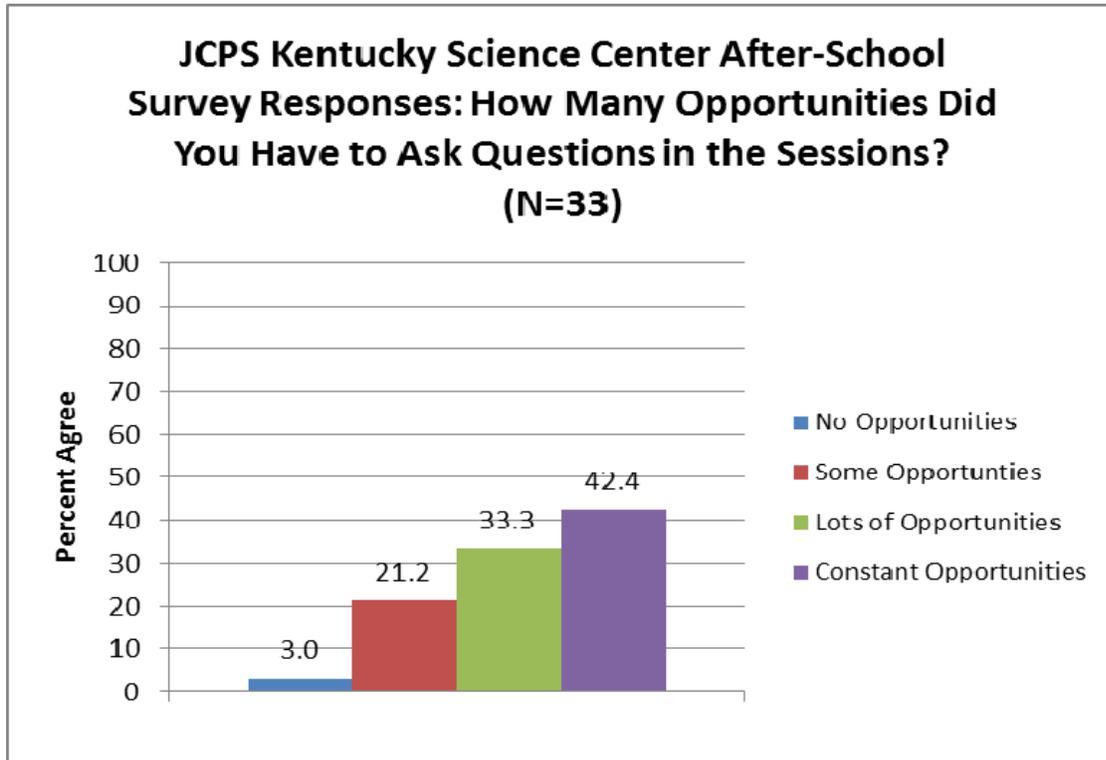


Figure 4. Student ratings of opportunities to ask questions during sessions.

Figure 5 shows that 79.8% of students agreed that there were either “Lots of Opportunities” or “Constant Opportunities” to ask questions; no one reported “No Opportunities” to ask questions.

Figure 6 shows that 97% of students responded either “Probably Yes” or “Definitely Yes” that they would recommend the program to a friend. No one responded “Definitely No” to the question.

Figure 7 shows a Wordle graphic of the question asking students to list their favorite two things about the program. Wordle displays responses scaled to reflect the frequency of responses. The most common favorites of students were the experiments; they particularly liked the experiment which featured liquid nitrogen. Many of the words suggest “active participation” such as “participating” and “learning”, and “seeing”.

Figure 8 shows a Wordle graphic of the question asking students for suggestions for program improvement. Many of the student comments indicated they did not feel any changes were necessary. The words “perfect”, “awesome”, and “change nothing” were used by several students. There were some comments that indicated behavior may have been an issue at times –

“stop talking”, “stop laughing”, and “not talking” are suggestions offered by students. Several students also requested “less writing”, “less math” but wanted “more experiments”.

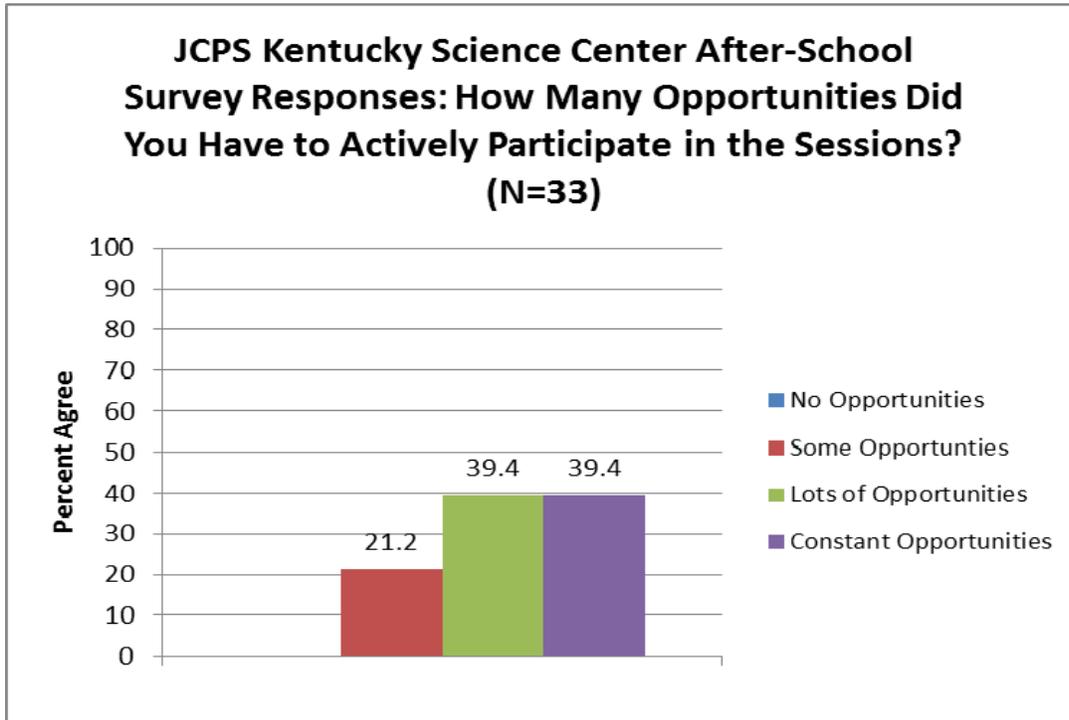


Figure 5. Student ratings of opportunities for active participation.

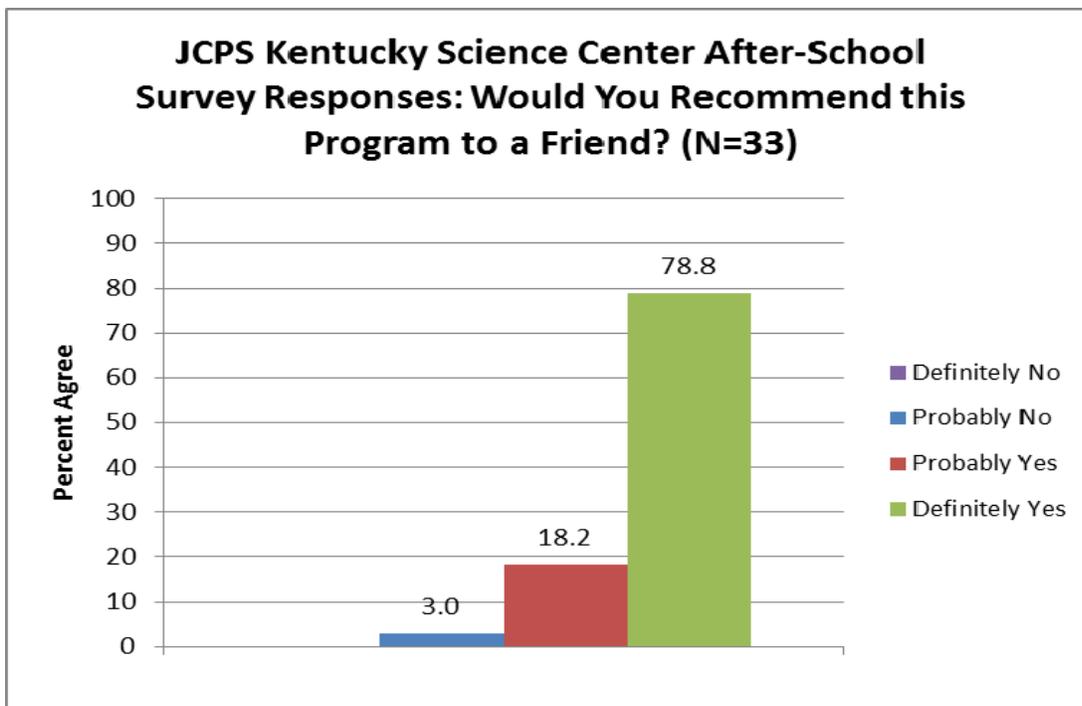


Figure 6. Student ratings of recommending program to a friend.

Cost

The Kentucky Science Center offered JCPS a 40% discount for the pilot program. The total, discounted price was \$7,200. The full price would have been \$13,600 with \$1600 for the Family Science Night. The discounted price breaks out the following way:

- \$ 240 per site per 90 minute block, up to 20 children (\$1440 per school or \$7200 total).
- Family Science Night, minimum 200 people (free of charge).

The cost per student was \$141.18 with the discounted pricing. Full pricing would have resulted in a cost per student of \$266.67. The KSC pricing indicated a capacity of up to 20 children which would greatly reduce the cost per child; however, both JCPS and the KSC agreed that a 20:1 student to teacher ratio would not have supported the type of inquiry-based, participatory experienced desired for the students. The discounted cost per hour for each student was \$15.69.

Conclusions

The evaluation of this program sought to answer the following questions:

1. What would the student attendance rate be for an engaging content-based after-school program?
2. Would content knowledge significantly improve by the final after-school session?
3. Will participation in the after-school program lead to better performance on the 2013 K-PREP science assessment?
4. How would students report their satisfaction with the after-school pilot program?

Student attendance did vary by location and decreased at all locations by the final sessions. Anecdotal reports from KSC leaders indicated that some students were “double booked” for afternoon activities and were pulled out of the session to attend something else. Other students stopped showing up for sessions and the exact reason for their absence is unknown.

Content knowledge increased on all items from pre to post assessment. It appears that students did learn content over the sessions; however, they still showed a lack of understanding for the concepts of structural and behavioral adaptations.

All analyses indicated that the KSC students performed significantly better on the 2013 K-PREP assessment in reading and science than their control group. K-PREP analyses indicated a significant advantage for the KSC group in reading and science scale scores, reading growth, and science performance category scores. The effect sizes for these differences indicate that the afterschool program provided meaningful impact.

Overall, students were very satisfied with the pilot program. They seemed very keen on the inquiry-based approach and especially liked hands-on activities. Some students did not like the writing and math components but those complaints did not seem to prevent the majority of students from saying they would recommend the program to a friend. Some comments indicated issues with behavior during the sessions. Three of the five locations had either a teacher remain

unofficially in the classroom or a principal who “popped” into the classroom regularly. It was reported by KSC personnel that the presence of the extra adults helped with the management of student behavior.

The main conclusion of this evaluation is that the KSC program should be replicated and expanded to another group of challenged elementary schools. Since students who participated in the KSC program tended to outperform their school, one option might be to expand the program to more students within the original five schools. Specific recommendations to sustain program impact and make improvements are offered below.

Recommendations

1. Continue priority selection of students based on K-PREP reading scores (high novice through low proficient).
2. Ensure that students selected for participation are available and committed to completing the entire program. Perhaps provide an incentive for program completion such as a coupon to dress-down or an extra recess.
3. Cultivate parent engagement by hosting a “Parent-Open House” to kick-off the program and provide valuable program information. Send home a parent information sheet after each session that summarizes that session’s learning objectives and gives tips on ways that parents can engage their children in discussing or further exploring that content.
4. Have school principal contact the parents of students who miss more than one session and provide timely assistance when behavior issues are raised as a concern.
5. Offer the after-school sessions earlier in the spring so that learning needs can be shared with the teacher of record and hopefully addressed before the K-PREP assessment.
6. Consider ways to incentivize a 4th grade teacher to provide “back-up” support during KSC session.
7. Do not increase the 10:1 KSC student/teacher ratio until at least one more year of data has been collected and student behavior issues have been solved.
8. Collaborate with the district’s science specialist in future endeavors to ensure that the program addresses common student misunderstandings and aligns with the Next Generation Science Standards.
9. Continue providing core content aligned language arts and math instruction as major program components.
10. Consider adding an informal “check for learning” at the end of each session. Learning needs from the former session would be addressed before the next content is begun.
11. Take steps to increase participation at “Family Nights”. Suggestions include providing transportation, raffling a KSC membership to attendees, providing a light dinner, and/or offering a “Science Fair” format where families are invited to see their child actively demonstrating an important science concept.