The Green Schools Challenge:
Evidence Based Practices

Evaluation Report

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Executive Summary

This research study aims to understand the influence the Green Schools Challenge has on school staff and students' knowledge of the effects of climate change on human health and the environment, behavioral changes, empowerment and leadership building. This was measured using pre- and post-program surveys as well as focus group questionnaires on students, teachers and parents during the 2015-2016 Green Schools Challenge program cycle. The surveys consisted of 30 questions divided among four categories: knowledge gained, changing behaviors, personal leadership and empowerment, and motivation of science, technology, engineering and math (STEM) careers. This study also establishes a monitoring and evaluation plan, increasing Dream in Green’s capacity to assess the effectiveness of future programming.

The analysis of survey and focus group data indicated that there was an overall net increase in knowledge gained among students, parents and teachers. For questions relating to changing behaviors, parents’ and students’ responses, which were largely positive, showed many similarities. Data also showed that students were more inspired by people who are committed to helping the planet and are also more interested in science than before the program. Students believe more strongly that their actions can impact the community while teachers most strongly agreed that due to the GSC program, students share more knowledge with family and friends on how they can protect the environment. All three stakeholder, that is, parents, teachers and students, identified knowledge and awareness as the most valuable aspect of the GSC with a majority of the participants finding the program to be “very useful”.

Overall, the analysis shows that the GSC has been successful in accomplishing the pre-program goals and has delivered results as outlined in the original plan. In addition, stakeholder feedback has been positive. This positive support will help ensure continued stakeholder support throughout future program cycles. This research project shows that the potential of the GSC can be met, and that the Green Schools Challenge can become more effective, scalable, generalizable, and a model for other communities throughout the country.
1. Introduction

Since 2006, Dream in Green (DIG), a nonprofit environmental education organization, has been implementing the Green Schools Challenge (GSC) program in over 292 unique schools in Miami-Dade and Broward County. The GSC focuses on creating resource-efficient behaviors, increasing school staff and students’ understanding of the challenges of climate change and empowering them to take action to reduce their carbon footprint through solutions that reduce energy, waste, and water use, implementing recycling programs, and learning about alternative-modes of transportation, green buildings and green careers.

The program employs a train-the-trainer model to train school staff to implement the program. The trained staff then train students called the Green Team to conserve energy and water and ensure the school is resource-efficient. Through the creation of hands-on, low to no-cost projects, the Green Teams educate other students and personnel of solutions that help to mitigate the impacts of climate change and other environmental issues on their local environments and community's health. Students also take the ‘environmental sustainability’ message home to encourage sustainable practices amongst parents. Thus, GSC stakeholders, that is teachers, students and parents, play a vital role in program development and evaluation.

The proposed EPA-funded project, Green Schools Challenge: Evidence-based Practices, conducted an in-depth research study and theoretical evaluation to understand the influence the program has on school staff and students' understanding on the effects of climate change on human health and the environment, behavioral changes, empowerment and leadership building and motivation of students to pursue STEM careers. Understanding this influence is crucial to improve the effectiveness of the GSC and continue to lessen the risks associated with climate change. The program is now reaching more than 100 schools a year in Miami-Dade County (MDC), over 10,000 students and 1,000 school staff members in Green Teams. Indirectly, the program reaches more than 100,000 students and 10,000 school staff. This in-depth study uses the Modified General Evaluation (MGE) model developed by Newman and Rios (1994) to make the GSC an evidence-based program.

2. Methodology

Using a MGE model shown in Figure 1 allows for greater understanding, management, and monitoring of the GSC program. Compared with a typical evaluation model, one of the main differences with the MGE model is that it places the stakeholders in the center of a cyclical model, allowing bi-directional flow of information at all stages. Through formative and summative assessments, the evaluation cycle continues while providing feedback to the previous cycle stages. In the GSC feedback and evaluation process, summative assessments, such as post-program surveys, also serve as formative assessments due to the cyclical nature of the program.

Data collection and extraction is a critical component in the program monitoring and evaluation. Data collection for the GSC occurred at the start of the academic year using pre-program surveys that were provided to the teachers, students and parents. At the end of the academic year, data were collected through focus groups as well as additional post-program surveys.
The pre-program and post-program surveys consisted of 30 questions divided among four different categories: knowledge gained (questions one through 10), changing behaviors (11 through 20), personal leadership and empowerment (21 through 25), and motivation of science, technology, engineering and math (STEM) careers (26 through 30). The post-program surveys also had six supplemental questions that permitted participants to write in answers, allowing for a wider variety of responses about how to improve program components. The following sections discuss these surveys and the associated data.

3. Analysis of Survey Data

The pre-program surveys were completed by 42 teachers, 217 parents, and 265 students. Post-program surveys were completed by 19 teachers, 96 parents, and 112 students. Comparing the pre-program and post-program surveys, the number of surveys completed by teachers decreased 54.8%, 55.8% for parents and 57.8% for the students.

In this analysis, the figure values on the y-axis correspond with the average survey question response. Values that are lower (e.g. one, two, etc.) indicate a greater positive response such as “strongly agree” and “agree”. In the figures that compare pre-program and post-program survey data, it is the difference in average response that is being displayed (e.g., +0.4 or -0.4). Using the knowledge gained category as an example, a value of +0.4 would indicate that the students,
parents or teachers more strongly agreed on average with the question following the completion of the program.

a. Knowledge Gained

This section discusses the impact of the GSC on increasing stakeholder awareness and understanding of climate change effects. Questions one through 10 assess this level of knowledge of environmental issues before and after GSC participation.

- Question 1: Climate change is scientifically proven to be caused by human activities
- Question 2: Carbon dioxide is a greenhouse gas in the atmosphere that traps heat and causes global temperatures to rise
- Question 3: Leaving the lights on when you are not using them is a smart thing to do
- Question 4: Waste reduction and material reuse come before recycling
- Question 5: Walking, biking, carpooling, and using public transport are all better options than driving a car
- Question 6: The buildings we work, live, and play in do not affect our health or the environment
- Question 7: Using renewable energy sources (wind, solar, ocean) can impact positively on climate change
- Question 8: Melting of land ice will cause the sea level to rise
- Question 9: When plastic ends up in a landfill, it breaks down into the soil very quickly
- Question 10: We have an unlimited amount of fresh water on the planet

Participants were able to select values ranging from one through six, corresponding with “strongly agree”, “agree”, “neutral”, “disagree”, “strongly disagree” or “don’t know”. It should be noted that for questions three, six and nine, after the surveys were completed, the data values were inverted to be consistent with the overall survey analysis of lower values being positive indicators. For example, question three reads: “leaving the lights on when you are not using them is a smart thing to do”. For this question, if a value of five (strongly disagree) was selected, it was replaced with a value of one (“strongly agree”). Values two (disagree) and four (agree) were also exchanged while three (neutral) and six (student selects “don’t know”) remained unchanged.
Figure 2 presents the average survey response to the knowledge related questions collected during the post-program survey. Lower values are associated with a greater understanding of environmental issues. Overall, it can be observed that teachers demonstrated the highest level of knowledge followed by parents and then students. With the exception of question nine, the average response for each question ranged between “strongly agree” and “agree” which are represented by values of one and two, respectively. Question nine, which covers the time required for plastic to break down in a landfill, exhibited the greatest similarity in average response among the three participant levels, with values closely grouped around the average response of 3.889. It was also the questions with the highest average value. The standard deviation for the student and parent responses (SD=1.19 and 0.88, respectively) were the lowest for question nine. This indicates that there was the least variation among student as well as parents when compared with the other nine questions. Conversely, question nine had the second highest standard deviation for teachers (SD=1.57) which shows that the variation of survey responses among teachers was greater than the eight other knowledge related questions.
Calculating the change in average survey response for each question has the potential to measure knowledge gained during the GSC program. In Figure 3, positive values are an indicator of knowledge gained. Overall, it can be observed that there is a net positive gain in knowledge.
To gain a better understanding, the data presented in Figure 3 can be sorted by participant level (e.g., parent, student, teacher) to determine the relationship between participant level and knowledge gained. Figure 4 displays these sorted data. It is clear that students had the greatest increase in knowledge following the completion of the GSC program. Average student survey responses increased for all 10 questions, with the greatest gains observed in questions one, four and eight. The teacher and parent survey groups experienced a decrease for a majority of the questions. While the exact reason for this remains unknown, these two groups had initial pre-program survey responses that were low, especially when compared to student responses. Staring with this low pre-program average leaves less room for potential changes. In other words, if the average pre-program values are 1.5 (in between “strongly agree” and “agree”), and the lowest potential value available is 1.0, it would require large quantities of “strongly agree” responses to show a net increase in knowledge gained. In addition to this, the number of surveys completed (i.e., the population size) decreased by approximately 50%. The number of teachers was reduced to 19, parents to 96, and students to 112 participants. This decreased population size also has the potential to affect the results.

b. Changing Behaviors

The ability of the GSC to have an impact on behavioral changes is an important component of the program and was used to measure its effectiveness. Positive changes in behavior are also an
important part of mitigating the impacts of climate change. Questions 11 through 20 of the pre and post surveys given to the students, parents and teachers relate to changing behaviors.

- **Question 11:** I buy items that are environmentally-friendly
- **Question 12:** I turn off the water when I am brushing my teeth or doing the dishes
- **Question 13:** I turn off the lights when I leave the room
- **Question 14:** I recycle at every opportunity
- **Question 15:** I unplug my iPad/cell phone charger/other electronics from the wall when I am done using it
- **Question 16:** I make an effort to walk, bike, or use public transportation rather than taking a car
- **Question 17:** I use a reusable water bottle or water fountain, rather than a single-use plastic bottle
- **Question 18:** I use reusable bags when I go grocery shopping
- **Question 19:** I take showers that are 5-7 minutes long
- **Question 20:** I find a way to reuse and repurpose things instead of throwing them away immediately

Responses range from one through six, corresponding with “always”, “often”, “sometimes”, “rarely”, and “never”. A response of six indicates the participant “doesn’t know”.

Following the completion of the GSC program, teachers exhibited the most positive behaviors for each of the 10 questions as seen in Figure 5. Responses of parents and students show many similarities. With the exception of question 16, elevated responses from parents were associated
with slightly higher, student responses; when students had high positive responses, so did the parents. This data relationship may have the potential to serve as an indicator of the GSC’s ability to extend beyond the classroom.

**Figure 6: Changing Behaviors – Difference of Pre-Survey & Post-Survey**

Observing the difference in pre- and post-program survey responses shows a clear positive impact on behavior of students and teachers as seen in Figure 6. Positive values in this figure indicate greater environmental awareness in the participants’ decisions.

c. **Personal Leadership and Empowerment**

Survey questions 21 through 25 assess the impact the GSC has on building students’ leadership skills and level of empowerment. Large increases in this category among students can potentially yield the added benefit of students encouraging other students and to get involved, similar to the train-the-trainer model used to train teachers at the outset of the program.

- **Question 21:** I believe my actions can impact the community
- **Question 22:** I speak up when I see people littering, leaving lights on, wasting water, etc.
- **Question 23:** I tell all my friends and family about how they can protect the environment
- **Question 24:** I am confident in my ability to solve environmental problems
- **Question 25:** I enjoy taking charge of any situation and leading others

The survey questions for this category are slightly different in the fact that the parents and teachers are answering the questions on behalf of the students. For example, on the parents’
survey, question 21 reads “my child believes their actions can impact the community” and on the teachers’ survey, “my students believe their actions can impact the community”. This allows for an assessment of the students’ leadership and empowerment from three perspectives.

**Figure 7: Personal Leadership & Empowerment – Post-Survey Responses**

Teachers’ assessment of student leadership were the most positive as can be seen in Figure 7. These ranged from “strongly agree” to “agree” (values of one and two). Average responses from parents and students were closer to “agree”, approaching “neutral”; values of 2.0 and 2.5, respectively. Similar to the survey category Changing Behaviors, parents’ responses closely aligned with student responses for all five questions.
The change in pre-program and post-program data shown in Figure 8 demonstrates that there are strong increases in level of agreement for two questions in this category after the GSC. Students believe more strongly that their actions can impact the community as seen in question 21 and in question 23, teachers more strongly agree that due to the GSC program, students share knowledge with family and friends on how they can protect the environment.

d. Motivation of STEM Careers

The GSC has the potential to greatly impact students’ motivation to pursue STEM careers. Increasing students interest in STEM subjects can lead to greater engagement in future GSC program cycles as well as advanced education and careers in STEM fields.

Survey questions 26 through 30 related to STEM career motivation.

- Question 26: I am interested in working in a field related to the environment
- Question 27: I am inspired by people who are committed to helping the planet
- Question 28: I am more interested in science than last year
- Question 29: I am interested in working with technology, or as a scientist, mathematician, or engineer
- Question 30: I am interested in technologies that provide environmental solutions

Similar to the personal leadership and empowerment questions, teachers and parents are responding based on their perception of the students’ interest in STEM careers. For example, question 26 would read “my child expresses interest in wanting to work in a field related to the environment” for the parents’ survey and on the teachers’ survey, “my students express interest in wanting to work in a field related to the environment”.
Figure 9 shows the effectiveness of the GSC program to inspire students to choose STEM careers. On average, question 28 is most strongly agreed with, indicating that the students are more interested in science than the previous year. Following this increased interest in science, there is an increased inspiration by people who are committed to helping the planet. While the questions relating more directly to STEM careers did not rank as high, it is a positive sign that students are taking a greater interest in science and are also being inspired by those who are committed to helping the planet. This can serve as a strong foundation for the GSC in future years.
The change in student responses over the year aligns with the post-program survey data shown in Figure 9. In Figure 10, the two questions that students less strongly agreed with after the completion of the GSC program were those that involved working in an environmental field or working in a STEM career. It can be seen that the teachers’ responses increased for four out of five questions, with the greatest increase observed for question 26: “My students are interested in working in a field related to the environment”. This is interesting due to the fact that this same question, when answered by the students before and after the GSC, experienced the greatest decrease out of all the STEM career questions. It can be expected that as educators, teachers would have a good sense of the students’ engagement relating to STEM topics and interest in STEM careers. These teachers would likely be able to more accurately quantify their students’ level of motivation towards STEM careers.

**e. Supplemental Survey Questions**

The survey provided at the completion of the GSC program had six supplemental questions to gather additional information from the parents, students and teachers. Questions two, three and four allowed participants to write in a response while questions one and five had answers to choose from. Question six provided an option for participants to provide “other comments”.

![Figure 10: Motivation of STEM Careers – Difference of Pre-Survey & Post-Survey](image-url)
Participants had the option to choose one of the four levels of program usefulness: “very useful”, “somewhat useful”, not very useful”, and “not useful”. It can be seen in Figure 11 that almost 60% of GSC participants found the program to be “very useful”. This overall support for the GSC is important and has the potential to help ensure continued success.
Looking at supplemental question two, participants had the opportunity to write about aspects of the GSC that they found to be most valuable. It is clearly seen in Figure 12 that all three groups identified knowledge and awareness as the most valuable aspect of the GSC. Student responses were more evenly distributed, with none of the individual topics having greater than 30%.
Supplemental question three asked the parents, students and teachers how the GSC could be improved. Results are somewhat evenly distributed with the exception of the teachers. Half of the teachers that participated in the GSC stated that the “program structure” could use improvement. Taking these data into account in future cycles of the GSC will help ensure continued stakeholder support.
Supplemental question four asked participants if the environmental knowledge they gained over the last year motivated them to lead a more sustainable life at home. If it did, the question asked in what way their lives were more sustainable. Survey responses were analyzed and main topics were extracted. A breakdown of these topics extractions and percent occurrence can be seen in Figure 14. Parent responses did not exceed 20.0% in any one category while student and teacher responses had multiple topics that were more often extracted.
Question five consists of two parts. From a list of ten topics and ten skills, participants are asked to choose the top three most important lessons and skills learned from the GSC over the previous year. Figure 15 shows the distribution of topics selected, separated by participant level. Among the most selected were: “The three R’s, Reduce, Reuse, Recycle” as well as “Saving Energy”.

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Figure 16: Most Important Skills Learned from the Green Schools Challenge

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![Figure 16: Most Important Skills Learned from the Green Schools Challenge](image-url)
It can be seen in Figure 16 that “Critical Thinking/Problem Solving” was the most often selected skill, especially among teachers. “Creativity/Innovation” can be observed to be a key skill among the different participant levels. In total, the majority of the skills selected ranged between 10 percent and 15 percent.

4. Focus Group Data Extraction Process

Focus groups were conducted with parents, students and teachers on separate occasions at the completion of the program. A grounded theory approach was used for the analysis of these data. Recordings from the focus groups were transcribed, reviewed and then broken down using a coded system to create “concepts”. These concepts are collections of codes, or similar content, that allow for the data to be sorted and grouped. Once the concepts have been identified, broad groups of these concepts are formed to create “categories” or “themes”. These themes come together to form a theory.

a. Focus Group Data

Figure 17: Main Themes Extracted from Focus Groups

The main themes extracted from the focus groups are presented in Figure 17. They are displayed as a percent occurrence within each participant level. Identifying the frequency of the major themes being extracted allows for the quantitative comparison among data.
b. Main Themes Identified by Focus Groups

The major themes identified from the focus groups, in order of most often occurring to least are behavioral changes, leadership skills/empowerment, knowledge gained, message brought home, and motivation of STEM careers. The student focus group yielded the highest percentages in knowledge gained topics and behavioral changes. This was different for the teachers, where the greatest percent was observed in a single category, personal leadership and empowerment. Focus groups with the parents yielded the greatest frequency of the behavioral change and personal leadership and empowerment themes.

5. Monitoring & Evaluation (M&E) Framework

Monitoring and evaluation plays the important role of ensuring that a program is achieving its overall goals. The monitoring component is a long-term process that utilizes the collection of data to measure progress. The evaluation component determines whether or not the GSC has reached its established goals, and if the program delivered results in accordance with the original plan. Developing a strong M&E framework will help determine if changes are required in future program cycles. In addition, M&E is an important means of assessment, ultimately allowing for program results to be communicated to the wide variety of stakeholders involved. This can lead to increases in both the number of program stakeholders as well as the level of stakeholder engagement. It is for these reasons that the development of a M&E framework is essential. The recommended M&E plan provided in this analysis should serve as a foundation, growing throughout future program cycles. A strong M&E plan will also help ensure that if necessary, changes are made allowing for continued program success. Table 1 provides a M&E plan which assesses overall program impact.
<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>DEFINITION</th>
<th>BASELINE</th>
<th>TARGET</th>
<th>DATA SOURCE</th>
<th>FREQUENCY</th>
<th>RESPONSIBLE</th>
<th>REPORTING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal</strong></td>
<td>Number of teachers, parents and students enrolled</td>
<td>Number of participants completing post-program surveys</td>
<td>Teacher: 19 Parent: 96 Student: 112</td>
<td>50% growth Teacher: 28.5 Parent: 144 Student: 168</td>
<td>Quantity of surveys completed.</td>
<td>After completion of GSC program.</td>
<td>Program Manager</td>
</tr>
<tr>
<td><strong>Goal</strong></td>
<td>Number of enrolled schools</td>
<td>Quantity of schools with participating teachers, parents and students</td>
<td>44 Schools</td>
<td>10% growth 49 schools</td>
<td>Counting number of enrolled schools</td>
<td>Annually, at start of program</td>
<td>Program Manager</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td>Similarities in “Behavior Changes” between parents and children.</td>
<td>Calculating the difference between pre and post survey responses – comparing student &amp; parent values</td>
<td>Average GSC survey value: 1.61 (parents) -1.36 (student) 0.25</td>
<td>Less than 0.25 point difference.</td>
<td>Behavior Changes questions on pre-program and post-program surveys.</td>
<td>Before and after academic year.</td>
<td>Program Manager</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td>Families incorporating the GSC principles</td>
<td>Percent of parents that list “none” when asked about the GSC leading to more sustainable life at home.</td>
<td>12.7%</td>
<td>Under 10%</td>
<td>Post-program survey, supplemental question 4.</td>
<td>After completion of GSC program.</td>
<td>Program Manager</td>
</tr>
</tbody>
</table>
The data collected during this study helped shape the goals, outcomes and outputs in the GSC’s M&E plan. This framework identifies and defines indicators, establishes baseline and target data along with recommended measurement frequencies, and categorizes the responsible professionals and reporting methods.

Program indicators such as the number of participants, schools, etc., serve to quantify program aspects. The data associated with these indicators allow for the GSC to measure the progress of achieving its goals. As observed in Table 1, program goals are more easily quantifiable while program outcomes and outputs require the use of summative assessments and data analysis.

6. Discussion

Large quantities of quantitative and qualitative data were collected from the different program assessments. Assessing each of the main program components provided different results. Analyzing the collected data is important for future program cycles as well as the successful development of the M&E plan.

Overall, there was a net increase in knowledge gained among all participants as a result of the implementation of the 2015-2016 GSC program, with students experiencing the largest gain. Of the 10 questions relating to changing behaviors, the program’s teachers exhibited the most positive change. Also interesting is that the responses of parents and students showed many similarities for the questions related to changing behaviors. The highest average responses from parents were associated with even higher average responses from their children in all cases except one. This may have the potential to serve as an indicator of the GSC’s ability to extend beyond the classroom, since this data relationship is a quantifiable link between students, parents, and the GSC. For this reason, measuring the relationship between parent and child survey responses has been incorporated into the program’s M&E plan as shown in Table 1. A comparison of pre- and post-program survey data indicated that following the completion of the program, there was a clear positive impact on students’ and teachers’ behaviors.

After reviewing the data associated with the personal leadership and empowerment questions, it was observed that teachers’ assessment of students was the most positive; ranking higher than students’ self-assessment and parents’ assessment of their children. This was also true for the data collected during the teachers’ focus group. Parent and student survey responses were closely aligned, similar to the questions pertaining to behavioral changes. Students were found to believe more strongly that their actions can impact the community while teachers most strongly agreed that due to the GSC program, students share more knowledge with family and friends on how they can protect the environment. Students were more inspired by people who are committed to helping the planet and are also more interested in science than the previous year. These observed increases can serve as a strong foundation for the GSC in future years. All three participant levels identified knowledge and awareness as the most valuable aspect of the GSC with a majority of the participants finding the program to be “very useful”.

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7. Conclusion

Data collected from the program’s assessments can be used to ensure continued success of the M&E plan. Using these data, the GSC’s M&E framework should continue to be developed and grow throughout future program cycles. Each of the M&E indicators has specific baseline and target values which should be reviewed following program evaluations and, if necessary, revised. Incorporating new indicators over time and updating values of existing indicators will allow for continued growth of the M&E plan, helping to ensure that the program goals continue to be met.

The M&E plan presented in Table 1 lists the number of participants as a program indicator. One of the recurring topics extracted during the various stakeholder assessments was the potential to increase the number of teachers participating in the program. In one case, teachers discussed how many other teachers were available but not participating. It was stated that the lack of participation among some teachers was likely due to their limited knowledge of the program. To increase teacher participation, it is recommended that coordination with the schools take place to allow the GSC to be introduced to all teachers at the start of the year. This would have the potential to increase the number of teachers involved, expanding the program within the school.

Stakeholders also identified the fact that differences exist among the participating schools. These differences may have the potential to affect program outcomes. In one case, a teacher spoke of how implementing the program in a private school posed unique challenges. To help identify these areas, it is recommended that the collected data be compared between schools in future analyses. This will allow for schools, or certain participant levels within those schools, who are either over or underperforming to be identified. Once identified, these results should be incorporated into the M&E plan.

Data collection and extraction is a critical component of the program’s M&E plan. With the large amount of qualitative and quantitative data resulting from the GSC, it is clear that the best method of understanding, managing and monitoring the GSC is through the use of a Modified General Evaluation model. By placing the stakeholders in the center of the MGE model, which is the defining aspect of the model, there is a bi-directional flow of data at all stages. With the nature of the program and its stakeholders, this better allows for effective program monitoring and evaluation.

After careful analysis, it can be concluded that the GSC has been successful in accomplishing the pre-program goals and has delivered results as outlined in the original plan. Participant feedback has been largely positive which will help ensure continued stakeholder support throughout future program cycles. There remains great potential for the GSC. Integrating a strong M&E plan through the use of the MGE model will help meet this potential.