Richmond International Raceway STEM Education Day Program Evaluation
Executive Summary

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March 29, 2014
This executive summary, presented to Dennis Bickmeier and the Richmond International Raceway STEM Education Day Program administrators, is in partial fulfillment of the requirements for Doctor of Education in Educational Leadership.

Virginia Commonwealth University (2014)
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Introduction

The issue facing the educational system in America remains the same: find a better way to educate American’s children if the United States is to compete in the global economy in the future. This issue became prevalent during the Clinton administration and gained momentum throughout the Bush and Obama administrations as it became more and more obvious that the educational system in the United States was not adequately preparing our youth for STEM-related education, degrees, and careers.

As the United States searched for innovative ways to educate its youth through creative and collaborative teaching methods, Richmond International Raceway (RIR) decided to bring its rich background of science, technology, engineering, and math (STEM) disciplines to the classroom. In an effort to increase students’ interest and literacy in STEM, the idea was born to create an educational program dedicated to STEM.

The primary focus was to create a program that would provide a mechanism to connect classroom theory with real-world relevance through motorsports. The goal of the RIR STEM Education Day program was to provide a program that would build interest in STEM, as well as inspire and motivate middle school students to learn and understand STEM through motorsports.

The focus of this evaluation was to determine to what degree the program increased interest and improved understanding of STEM, increased interest in STEM educational and career opportunities, and if there were differences in STEM interest and understanding based on gender and ethnicity.

After-school and community-based events similar to the RIR STEM Education Day program have been effective in helping students make the connection between STEM-related classroom content and the real-world application of STEM education. “These programs present innovative ways to engage students who may be detached and disinterested during the traditional school day” (Afterschool Alliance, n.d.). By making this connection through early exposure to STEM and through exciting hands-on activities, it is anticipated that middle school students’ interest and engagement in STEM-related education will persist throughout their high school and college years.
Historical Context

Even before the acronym STEM was coined by Dr. Judith Ramaley, the topic of STEM had been a hot-button topic among educators and government officials. Previously known as SMET, the former acronym was not as vocally appealing to say as STEM, nor did it carry the underlying important message that the acronym STEM supports. The former term implies that science and math came first or were more important; however, the term STEM suggests a meaningful connection among the components and demonstrates how the math and science disciplines support the other two disciplines of technology and engineering (Chute, 2009).

Richmond, Virginia was already a part of the racing scene as early as 1946 when the Atlantic Rural Exposition Fairgrounds, currently known as the Richmond International Raceway Complex, opened in Henrico County, Virginia. Richmond hosted its first NASCAR race in 1953, since that first NASCAR race, RIR has grown into one of the premier NASCAR racetracks in the United States. RIR’s notoriety, combined with the organization’s commitment to its local community, makes RIR a perfect platform to engage middle school students in STEM, and to get them interested in STEM education and careers. With the growth and the worldwide popularity of the sport, the potential learning opportunities motorsports can provide are virtually limitless.
Evaluation Goal

The goal of this program evaluation was to determine the degree in which the RIR STEM Education Day program increased students’ interest in STEM, improved students’ understanding of STEM, increased students’ interest in STEM educational and career opportunities, and to determine if there were differences in STEM interest and understanding based on gender and ethnicity.

Literature Review & Themes

In a letter to President Barack Obama from the National Science Board, Chairman Steven C. Beering (2009) wrote, “Our national economic prosperity and security require that we remain a world leader in science and technology. Pre-college STEM education is the foundation of that leadership and must be one of our highest priorities as a Nation.”

STEM provides students with science, technology, engineering, and math in sequences that build upon each other and used in real-world applications (Eberle, 2010). Chairman Beering went on to write that “it is essential that we act now to ensure all of our children and American society as a whole can continue to prosper in the 21st century technology-based economy” (Beering, 2009, p. 1).

This literature review examined research on STEM education and programs that effectively promote interest and understanding of middle school students related to STEM. Emerging from the review of literature were three overarching themes: Improving the Appeal of STEM, Female and Minority Students in STEM, and Collaboration Needed.
Improving the Appeal of STEM

To improve the appeal of STEM, literature indicated that course content should connect directly to students’ interest and to what motivated them to learn. If attitudes regarding STEM are to change, teachers must work toward making curriculum and lessons relevant to students. Educators and community leaders can improve the appeal of STEM by making it more understandable, relatable, and appealing to young students.

Female & Minority Students in STEM

Another theme from the literature review addressed females and minorities in STEM. Research stated the underrepresentation of female and minority students in STEM education was a contributing factor to America’s decline as a global leader; therefore, the task for educators in America is to increase female and minority students’ participation in STEM education by providing support and making it a positive experience. It is vital for educational leaders to create and promote an academic environment that welcomes all students to STEM education and not just the academically elite.

Collaboration Needed

The need for collaboration is essential to develop a program that would accomplish the goals of RIR and program stakeholders. A strategic collaboration between schools, universities, business, and community partners could enhance students’ educational experiences and foster excellence in K-12 STEM education. Schools can collaborate with universities to improve the quality of content and experiences. By collaborating with schools, these partnerships give students increased opportunities to “learn by doing” through hands-on activities. Furthermore, by collaborating with business and community partners, schools can provide students with real-world hands-on experiences that far exceed the traditional classroom environment. If done properly, learning can be simplified so that students are motivated to probe deeper into STEM topics that interest them on an individual level.
Methodology

This section lists the evaluation questions and describes the evaluation design & methods, participant characteristics, and the quantitative & qualitative data sources.

Evaluation Questions

The following evaluation questions emerged from extended discussions with key program administrators and information gleaned from the review of literature:

1. To what degree did the RIR STEM Education Day program increase middle school students’ interest in STEM education?
2. To what degree did the RIR STEM Education Day program improve students’ understanding of STEM education?
3. To what degree did the RIR STEM Education Day program increase students’ interest in STEM educational opportunities?
4. To what degree did the RIR STEM Education Day program increase students’ interest in STEM-related careers?
5. Are there differences in STEM interest and understanding based on gender and ethnicity regarding the RIR STEM Education Day program?

Evaluation Design & Methods

The evaluation team employed Stake’s (1975) Responsive Evaluation Model, which supports observing how a program works and requires getting to know stakeholders at various levels of the program. The design for this evaluation was mixed-methods. Creswell (2009) described mixed-methods designs as those that include both quantitative and qualitative design elements. Mixed method designs combine both quantitative and qualitative strengths into a single research method. Each method has unique strengths but it is more beneficial to combine these two methods. This point was highlighted by Connelly (2009) who wrote, “the goal of mixed methods research is to draw on the strengths to minimize the weaknesses of both types of research” (p. 31).

Quantitative Data
Student Field Trip Survey

Qualitative Data
Student comments, Focus groups & Teacher feedback
Participant Characteristics

Two groups of participants were involved in this evaluation. They included the students and teachers who participated in the RIR STEM Education Day program. There were approximately 500 eighth-grade students and 12 middle school teachers who participated in the RIR STEM Education Day program. Data revealed that 87.5% of the students were male, 12.5% were female, and of these male and female students, 43% were minorities.

Data Collection

To answer the evaluation questions, a sequential mixed methodology using both quantitative and qualitative data sources were used for this evaluation. The figure shows the quantitative data that consisted of information gleaned from the RIR STEM Education Day field trip survey. The figure also displays the qualitative data, which consisted of student survey comments, student & teacher focus group transcriptions, and teacher feedback.
Findings, Focus Group Themes & Evaluation Questions

This section presents the findings for the evaluation of the RIR STEM Education Day program. These findings highlight information obtained from quantitative and qualitative data sources and form the basis for program recommendations.

The findings revealed that participating students held a favorable opinion of the RIR STEM Education Day program based on the RIR STEM Education Day field trip survey, and student and teacher focus group interviews.

Four themes emerged from the focus group interview transcriptions: Awareness, Making Connections, Role Models, and Time. These themes provided additional insight into what students and teachers perceived to be valuable concerning the RIR STEM Education Day program.

More notably, the themes spoke to the effectiveness of the overall program through the eyes of the participants and were paramount to obtaining a comprehensive evaluation of the program. The four themes also provided evaluators with a starting point in which to answer the evaluation questions.

Program evaluators analyzed each data source in an effort to answer the following five evaluation questions:

1. To what degree did the RIR STEM Education Day program increase middle school students’ interest in STEM education?

2. To what degree did the RIR STEM Education Day program improve students understanding of STEM education?

3. To what degree did the RIR STEM Education Day program increase students’ interest in STEM educational opportunities?

4. To what degree did the RIR STEM Education Day program increase students interest in STEM-related careers?

5. Are there differences in STEM interest and understanding based on gender and ethnicity regarding the RIR STEM Education Day program?
Upon completion of the data analysis, evaluators discovered the program was not only effective at meeting the client’s original goal of creating “Awareness” of STEM, but was also effective at increasing interest & improving understanding of STEM, as well as increasing interest in STEM educational & career opportunities. Additionally, evaluators found that there was a difference in “interest” based on gender and ethnicity; however, no noticeable evidence was found to suggest the program had any effect on “understanding” of STEM.

The findings revealed that students held a favorable opinion of the program based on the quantitative data acquired from the RIR STEM Education Day field trip survey. The survey revealed that 73% of the students indicated an increased interest in STEM and STEM-related educational opportunities, while 84% had an improved understanding of STEM, and 63% had an increased interest in STEM-related career opportunities.

Student and teacher focus groups revealed that there are opportunities to further enhance the program and build on its current success. Recommendations to enhance the program will be discussed in the next section.

Focus group interviews were conducted eight months after the program, yet most students and teachers were able to recall the specifics of the day and could discuss stations that were meaningful and impactful. This type of recollection demonstrates the significance of the program and the lasting impact it made on many of the students and teachers.

“I absolutely think their awareness increased. I’m glad we got a chance to see the show car because it was the most direct relationship between what we learned in class…it was very, very technical.”
Recommendations

The following recommendations evolved from the “Findings” section of this program evaluation. These recommendations address each evaluation question for the purpose of improving the program’s overall effectiveness. Evaluators propose these recommendations to provide the client with the opportunity to enhance the delivery and subsequent outcome of the RIR STEM Education Day program.

To increase middle school students’ interest in STEM education, the program evaluators recommend that RIR:

- Increase the number of stations with hands-on activities
- Invite non-CTE students to participate

To improve students’ understanding of STEM education, the program evaluators recommend that RIR:

- Provide teachers with pre and post event materials
- Collaborate with key community partners
- Allocate more time at each station

To increase students’ interest in STEM educational opportunities, the program evaluators recommend that RIR:

- Invite 6th and 7th graders

To increase students’ interest in STEM-related careers, the program evaluators recommend that RIR:

- Collaborate with local businesses
- Expose students to career options

Are there differences in STEM interest and understanding based on gender and ethnicity regarding the RIR STEM Education Day program?

- Continue to highlight females & minorities
**STEM Education Day**  
**Focus Group Interview**  
**Vignettes**

“I feel like people learn better when it's hands-on because they can actually see and feel what they are doing and as they are doing it. So they can learn easier and better from doing hands-on and actually doing it rather than having somebody telling them how to do it.”

“There was one student in the class, to augment the power of the event, who was very negative, he was the most negative student I have ever taught in my 30 years of teaching and I found out later on that he went over there [to the Engineering Center].”

“I love what you guys did, I learned so much while I was there. I am so happy I had the opportunity to be there and learn things I never knew.”

“When you go to an event like this [students] start answering some more questions by themselves and you can start challenging their minds” and this program “gives the kids an opportunity to see real-world applications of what we are learning.”

“More touchy-touchy and less talky-talky.”
RIR STEM Education Day Program Evaluation Capstone Team

Ingrid Granberry Grant is a third-year doctoral student at Virginia Commonwealth University. She earned her B.S. degree in Exceptional Student Education from Bethune-Cookman College (1992), M.Ed. Adult Education Administration from Florida A&M University (1995), and Post Graduate Certification in Administration and Supervision K-12 from VCU (2004). Ingrid has worked as an educator for the past 21 years in Florida and Virginia. She is currently the Director of School Improvement for Henrico County Public Schools. Ms. Grant’s prior experience includes serving as a principal, assistant principal and exceptional education teacher on the elementary and middle levels.

Seth Hickerson oversees and implements Fitness programs for the University of Richmond. Additionally, he teaches courses for the wellness graduation requirement, collaborates with national organizations as a host site for fitness certifications, and supervises the Personal Training Department. Seth received his BS in Health/Physical Education K-12 from Indiana State University and MS in Sports Psychology from the University of Tennessee, and is a third-year doctoral student at VCU. He is a certified strength and conditioning specialist (CSCS) from the NSCA and a Personal Trainer through AFAA. Seth is also a veteran of the US Navy (1994-1999) and US Air Force (2002-2008).

Tim Lampe is a third-year doctoral student at Virginia Commonwealth University. He received his B.S. in Education (1986) from Miami University, and his M.S. in Sports Administration (1988) from the University of New Mexico. Tim currently serves as Senior Associate Athletic Director and Adjunct Professor for the Center for Sport Leadership at VCU. Lampe’s passion is community engagement and uses his dual role to build bridges to his community, developing basic well-being, quality of life, and educational opportunities through sport.

William Noel, Sr. is a third-year doctoral student at Virginia Commonwealth University. He received his B.A. (1991) from the UVA & his M.Ed. (2004) from VCU. Will’s career began in 1993 in Caroline and transitioned to Hanover, after earning his M.Ed. Hanover selected him as a representative for the Statewide Communities of Practice for Excellence (S.C.O.P.E), a program for future school leaders. He also worked with the Virginia Advanced Study Strategies program to increase the number of students taking Advanced Placement classes in science, English, and math. He currently serves as the Director of School Safety & Disciplinary Hearing Officer in Hanover County.

Dr. Barbara Driver has served as a teacher and administrator in public school systems in New York and Virginia for over 20 years. In 2002, she was appointed as Director of Special Education and Support Services for Henrico County Schools in Virginia and formally joined the faculty of Virginia Commonwealth University in 2010. Currently, Dr. Driver is working with assistant principals in Virginia to better understand their leadership development needs.

Dr. Barbara Driver
Capstone Chair