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Math in Motion


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Math In Motion

TEAM MEMBERS

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Project Sponsor: D'Arcy Mays, Department of Statistical Sciences and Operations Research

PROJECT ABSTRACT

Everything we know about the universe rests on the foundation of mathematics. Somehow, though, the magic of mathematics – the true power of numbers and their beautiful wildness – gets lost in math class. Children, our most magical thinkers, get turned off math in grade school and miss out on a language through which they could learn to read and change the world. VCU Math In Motion will generate a creative, dynamic STEM education initiative within the Richmond community using an innovative curriculum and a customized mobile unit to bring the beauty of math to Richmond region school children in grades 5-9, through partnerships across VCU and within the local school system.

QUEST FOR DISTINCTION

Math In Motion, a mobile tutoring service, in its conception and execution will exemplify Quest Theme IV, Goal B: “Create university-community partnerships with a focus on the key targeted areas of K-12 education (with a focus on middle school), access to health and economic development.” STEM is acknowledged as a national focus in education initiatives. As such, STEM-focused educational initiatives such as this one can tap into a broad existing infrastructure of programs and funding, both inside and outside of VCU. Math In Motion is conceived as a true engagement initiative, relying on concrete information and direction from community partners to guide project planning and implementation and to provide the greatest chance of success.

PROJECT GOALS

The United States ranks 35th in the world, well below the global average, for K-12 mathematics proficiency standards. Nationally, 58% of fourth graders and 65% of 8th graders performed below proficiency level in 2013. Locally, 8 out of 8 Richmond City middle schools and 5 out of 12 Henrico County middle schools received low passing scores. In response to this crisis, and to the national call for STEM-focused education initiatives, VCU Math In Motion will provide the following to Richmond area middle school students:

- Interactive, applied mathematics exercises that generate excitement and engagement by revealing the beauty and omnipresence of math
- Improved student learning outcomes
- Facilitate student access to innovative teaching methods

PROJECT STRATEGIES

Team A arrived at the Math In Motion project through a series of group discussions. Each team member submitted project ideas and interest areas for group discussion. A number of ideas were discussed, seriously considered, and then shelved. A serendipitous lunch conversation with several team members about an idea for a mathematics tutoring project caught the imagination of the team. The division of labor followed the skill sets and interest areas/resources of each team member, under the following categories: curriculum outline; sample activities; delivery models; mobile unit design; funding research; organizational structure; identifying and contacting project partners; presentation plan; final report.

ACTION STEPS

- Meet regularly to discuss and develop project idea, assign action items, follow up/update the team on progress.
- Identify ULIs under which this project could fit.
- Identify and assign action areas – content/curriculum, community partner dialogue, VCU partner dialogue, identify potential funding sources
- Identify and reach out to VCU potential stakeholders
- Identify partner schools/community stakeholders
- Identify potential funding sources
- Develop math demos/sample exercise
- Develop project budget
- Outline project organization and staffing support/structure

OUTCOMES

The outcomes for Math In Motion dovetail with University Level Initiative #4, Community impact: “Contribute to the economic, cultural and civic vitality of the region and the world through collaborative efforts that increasingly define the university as an intellectual, creative and innovative center.” The Math In Motion project offers highly beneficial outcomes for both Richmond K-12 students and to the University itself.

Project deliverables include: an innovative mathematics education curriculum, with accompanying “math kits” to facilitate engaging exercises; a framework for content delivery, specifically the Math In Motion mobile unit; a blueprint for the mobile unit design; the potential for an exportable educational model that could be adapted to other subjects.

The benefits of Math In Motion to Richmond area middle school students include an enhanced love of mathematics and understanding of applied mathematics; improved test scores in mathematics and related areas. For VCU, the project offers recruitment potential; career development for student teachers; introduction to innovative pedagogy for student teachers; and new community engagement partnerships.

SUSTAINABILITY

Team Math In Motion identified several key/potential stakeholders within VCU, including the School of Education; Office of Community Engagement; Office of the Provost, and the Department of Mathematics. Additional collaborators could come from the College of Humanities & Sciences and the School of the Arts, especially programs in Creative Entrepreneurship.

RESOURCES

The project requires a full time coordinator or director (skilled in grant writing/development), housed within a VCU unit. Additionally, the pool of tutors would be drawn from populations of either graduate students, interns, or service learning students from a number of possible programs, depending on the home unit (Education, Mathematics, etc). Technical needs/requirements are detailed in the project budget, but center on the acquisition and upfit/upkeep of mobile unit.

Identified funding sources include VCU for a portion of operating costs/salary, plus grants from a variety of public/private sources, as well as in-kind donations of equipment and materials. After initial startup costs in the first two years, project budget could remain fairly steady.

RECOMMENDATIONS

As primary next step, Team Math In Motion recommends serious consideration by identified VCU units to determine fit with mission/vision, as well as relevant University initiatives. Team members can meet with stakeholders to determine the suitability of the project for adoption. Provost's Office should be consulted regarding funding for program director, which could be initiated on a part time basis if necessary before shifting to full time. Barriers to success include no university program/unit willing to take on the project; insufficient university funding for program director; complications regarding student involvement; insufficient in-kind support. The project can take place regardless of whether a mobile unit can be acquired/upfitted, as curriculum can be delivered on site using partner schools' facilities.

FINAL PITCH

In sum, VCU Math In Motion offers both an innovative curriculum model for teaching mathematics to middle school students, as well as a unique delivery method that can boost the project's profile in the community. The project serves as a community engagement initiative addressing an imperative need in local middle schools and the need of VCU students for service learning and/or community engaged educational opportunities. The project also offers a recruitment strategy, entrancing local students from a young age with the innovation and breadth of opportunity offered by VCU. Developed with the philosophy of revelation – showing kids the beauty of the world around them through the lens of mathematics – Math In Motion has the potential to revolutionize mathematics education throughout the local community and to become a model for dynamic, progressive pedagogy in other subject areas as well. The need is great; the project will answer when VCU makes it real.

4 out of 3 people
struggle with **math**

Team Members

- ▶ Jose Alcaine
- ▶ Diana Barden
- ▶ Lori Floyd-Miller
- ▶ Blake MacIver
- ▶ Lea Marshall
- ▶ Angela Nelson
- ▶ Thomas Vahdani
- ▶ Tarynn M. Witten

- ▶ Sponsor: D'Arcy Mays

Is There Really A Struggle?

Global Ranking

Organization for Economic Collaboration & Development
(OECD)

- | | | |
|--------------------|--------------------|--------------------------|
| 1. Shanghai-China | 13. Poland | 25. Luxembourg |
| 2. Singapore | 14. Canada | 26. Iceland |
| 3. Chinese Taipei | 15. Finland | 27. Slovak Republic |
| 4. Hong Kong-China | 16. New Zealand | 28. Ireland |
| 5. Korea | 17. Australia | 29. Portugal |
| 6. Liechtenstein | 18. Estonia | 30. Denmark |
| 7. Macao-China | 19. Austria | 31. Italy |
| 8. Japan | 20. Slovenia | 32. Norway |
| 9. Switzerland | 21. Viet Nam | 33. Israel |
| 10. Belgium | 22. France | 34. Hungary |
| 11. Netherlands | 23. Czech Republic | 35. United States |
| 12. Germany | 24. United Kingdom | |

National Ranking

In 2013, students performed **BELOW** proficiency level in mathematics.

4th Grade
58%
below

8th Grade
65%
below

Local Rankings

Richmond City
8 out of 8 received low passing scores

Chesterfield County
1 out of 12 received low passing scores

Hanover County
0 received low passing scores

Henrico County
5 out of 12 received low passing scores

So what is the problem?

Sadly, math is no longer fun ...
oh, and it's not cool either!

... the magic of mathematics -
the true power of numbers
and their beautiful wildness -
gets lost in math classes.

How can we make a difference?

What is *Math in Motion*?

Math in Motion

VCU *Math In Motion* will generate a creative and dynamic STEM education initiative within the Richmond community using an innovative curriculum and a customized mobile unit to bring the beauty of math to school children in grades 5-9.

Quest II and IV

A fun way to deliver *Math in Motion*



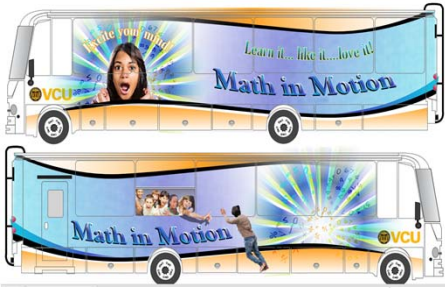
No, it won't look like this . . .

Exterior of the *Math in Motion* Mobile Unit

Graphic design image will depict colorful and fun scenes of youth in action along with different math imagery.



And here are the sides ...



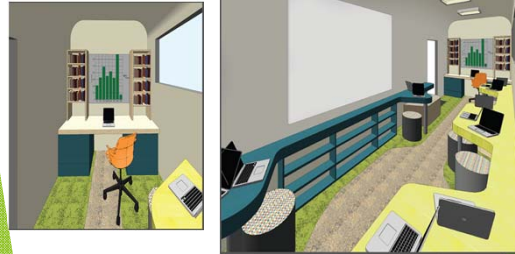
Like the outside? You are going to love the inside!

- Storage space - vertical storage (bookcases) and cabinet storage
- Teacher space - work station and chair
- Student learning space - should be fun and functional with multiple options for teaching/learning (individual, small group, large group) and smart board
- Colors - create combination of colors that would create energy, fun, and positive image about Math



Front to Back

Teacher area and group area



Organization and Operation of *Math in Motion*

Coordinator of *Math in Motion*
Mobile Unit
Curriculum kits
Interns
Volunteers
Graduate assistantships
Service learning students

So we have a mobile unit....

Take Home Message

"If I were not a physicist, I would probably be a musician. I often think in music. I live my daydreams in music. I see my life in terms of music... I get most joy in life out of my violin." - Albert Einstein, 1929

Some potential curriculum application areas

There are many fun things that we can do with math. Some examples are (but the list is endless)

Application Area	Mathematics Area
Seashells	Angles
Flowers	Euclidean Geometry and Spirals (Fibonacci series)
Fish	Excuse the pun but ... scaling
Shorelines	Fractals
Clouds	Fractals
Architecture	The golden rectangle
Insect population growth	Exponential growth
Today → Music	Fractions, Powers and Roots

Some Mathematics Behind Music

You've seen how mathematics can be used to create music. However, much of music is also mathematical in nature. For example, musical scales are defined by fractions and powers of two and roots of two.

How can this be?

Classroom Exercise

Musical scales, rubber bands and why women's voices are higher than men's voices

From the Cradle to VCU!

If we get them excited and they see what we are doing, we increase the likelihood that they will want to come to VCU to study.

So what will this cost?

	Budget Year 1	Budget Year 2	Budget Year 3
Program director (include FB)	\$50,000	\$ 51,000	\$52,020
Driver (hourly)		\$ 4,800	\$ 4,800
Volunteers	\$ 0	\$ 0	\$ 0
Curriculum/kits	\$ 4,000	\$ 4,000	\$ 4,000
Supplies/materials	\$ 2,500	\$ 1,500	\$ 1,500
Netbook (15)		\$ 7,500	
Smartboard		\$ 7,000	
Furnishings		\$ 40,000	
Vehicle purchase (used)		\$390,000	
Interior/exterior fitout		\$ 50,000	
Maintenance of vehicle		\$ 12,000	\$ 12,000
Technology		\$ 20,000	\$ 2,400
Insurance (12 months)		\$ 3,600	\$ 3,600
Total	\$56,500	\$591,400	\$80,920

Potential Funding Sources

VCU Opportunities

Quest Innovation Fund
Community Engagement Grants
Presidential Research Quest Fund

External Funding Opportunities

Virginia Department of Education, Mathematics & Science Partnership Program
NSF Advancing Informal STEM Learning (AISL) NSF 14-555
NSF Discovery Research K-12 (DRK-12), NSF 13-601
Altria - Success360 program
Dominion - K-12 Educational Partnership
Genworth
Capital One
Markel
Community Foundation

Thank you

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Grace E. Harris Leadership Institute

Questions?