



Old Dominion University, Batten College of Engineering & Technology



MarineTech



STEM Preparation through Marine Engineering, Science and Technology Experiences

MarineTech

STEM Careers in Marine Industry

Project Funded by NSF under ITEST



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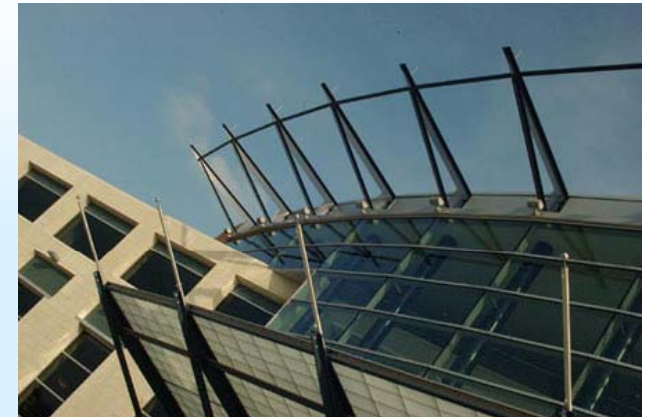


STEM Preparation through Marine Engineering, Science and Technology Experiences

Old Dominion University Norfolk, Virginia

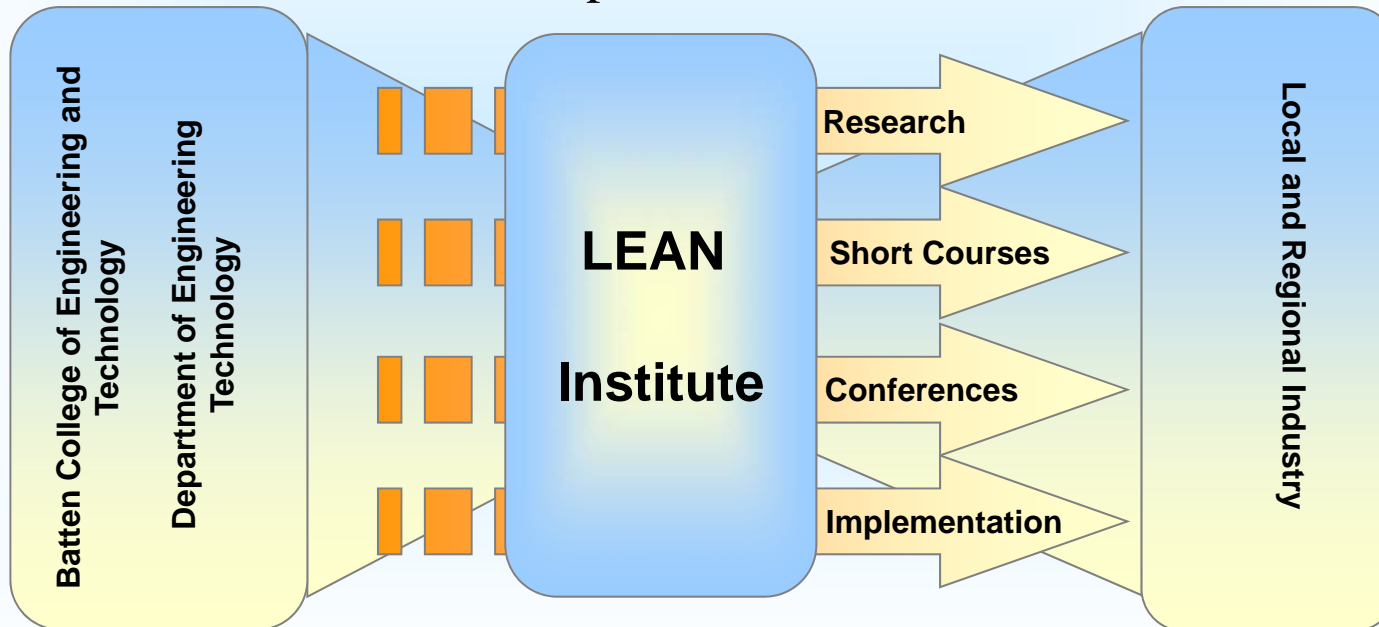
Located in historic Norfolk.

- Founded in 1930 as a division of the College of William and Mary.
- Old Dominion is now one of only 101 public universities with a Carnegie/Doctoral Research-Extensive distinction.
- Approx. 20,000 students
- Proximity to NASA Langley Research Center
- 200 miles south of Washington DC



Lean Institute at ODU is Your Host

Focus on Research, Education & Short Courses, Conferences and Implementation



* Implementation is done with the help of Virginia Applied Technology and Professional Development Center

MarineTech Project Goals

- Increase student awareness about careers in the STEM workforce, specifically in marine engineering and technology.
- To attract students towards marine engineering and technology careers to meet the critical shortage of workforce in this area.
- To train students in the use of information and communications technology tools to work collaboratively on group projects.
- To incorporate project –based pedagogy using Maine kits 1- 4, Sea Perch robotics and ship building for students to connect physical science concepts to marine engineering and technology.

Program Highlights

- MarineTech covers 3 geographical areas:
Hampton Roads ,Central Virginia, South Virginia
- 40 Teachers and 80 students from middle and high school will participate in this 3 year program.
- Marine Tech also features carefully constructed evaluation component that will examine the impact of this project based learning approach on student knowledge, instructional practices and student career interests.



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For Teachers

- Two day professional development summer workshops.
- Online training(10 hrs every semester), classroom visits and support from ITTIP.
- Each participating teacher will receive:
 - 1 Sea Perch Robot Kit
 - 4 Marine Kits and
 - Associated curriculum
 - **\$1800 stipend for 3 years**
 - **2 Graduate Credits**



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For Students

- Saturday Academies
(64 hrs during school year, 4 Saturdays/Semester)
- Summer Academies(80hrs/summer)
- Counseling Services.
- Field Trips to Shipyards and Marine Museums
- **\$1200 stipend for 3 years.**

Expectations from Students

- Saturday Academy (4 Saturdays / Semester for 3 years)
- Summer Academy (2 week long Workshop each Summer)
- Active Participation in Classroom Implementation of Marine Kits and Sea Perch
- Active Participation in Field Trips
- Active Participation in Sea Perch and Human Powered Container Ship Competition

YEAR 1-Spring 4 Saturdays	YEAR 1- Fall 4 Saturdays	YEAR 2-Spring 4 Saturdays	YEAR 2-Fall 4 Saturdays	YEAR 3-Spring 4 Saturdays
<ul style="list-style-type: none"> • Shipyards and marine industry terminology I • Shipbuilding production processes (hands-on) • Field trip to Marine Science Museum • Use of IT in shipping related and other careers I 	<ul style="list-style-type: none"> • Shipyards and marine industry terminology II • Shipyards operations / shipyard IT/Advanced Concepts • Field trip to Marine Science Museum • Use of IT in shipping related and other careers II/Career exploration 	<ul style="list-style-type: none"> • Introduction to Sea Perch /ROV • Shipbuilding production process(hands-on) • Field trip to Marine Museum • Web page design I / Career exploration 	<ul style="list-style-type: none"> • Introduction to ROV/ROV operation and applications • Web page design II • Field trip to Marine Science Museum • Web page design III/Career Exploration 	<ul style="list-style-type: none"> • Introduction to ship design/CAD/simulation • Activity shipbuilding production process (hands-on) • Field trip to Marine Science Museum • Web page design project / Career Exploration

STEM Preparation through Marine Engineering, Science and Technology Experiences

March 14	March 21	April 18	April 25
<p>Shipyards & Marine Industry Terminology I</p> <ul style="list-style-type: none"> • Speakers from Marine Industry (NGNN, Colonna's, BAE, Apprentice School) (4 hrs) 	<p>Shipbuilding Production Processes (Hands-on)</p> <ul style="list-style-type: none"> • Peninsula Higher Education Center 	<p>Field Trips to Marine Museum</p> <p>Group-1:</p> <p>Hampton Roads - HR</p> <p>Group-2:</p> <p>Central Virginia - CV</p> <p>Group-3:</p> <p>South Side Virginia –SS</p>	<p>Career Counseling By Dr. Nina Brown</p> <p>9:00 AM - 12:PM (3 hrs)</p> <ul style="list-style-type: none"> • 3 gradate student in SS & CV • Career Exploration • Games, Competition, raffles
LUNCH	LUNCH		LUNCH
<p>Use of IT in Marine Industry by Prof Deborah Chen (3 hrs)</p> <ul style="list-style-type: none"> • 21st century skills • CS basics-Activities using Computer Science Unplugged • Discussion of Assignment before Fall 	<p>Counseling Sessions by Dr. Nina Brown</p>	<p>Mariner's Museum</p> <p>Marine Science Museum</p>	<p>Math & Science Exploration By Dr. Sueanne Mckinney Dr. Daniel Dickerson 1:00PM - 4:00PM (3 hrs)</p>



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Saturday Academies

Oct 17	Oct 24	Oct 31	Nov 14
Information Technology (Video Conferencing)	Nauticus, Norfolk (Field Trip)	Science (Video Conferencing)	Marine Career Industry Speakers –Instructional Module on Environmental Issues in Ship Building (Video Conferencing)
Lunch Break			
Information Technology (Video Conferencing)	Nauticus, Norfolk (Field Trip)	Math (Video Conferencing)	Counseling (Live)
Survey		Survey	Survey



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Fall 2009 Saturday Academies



Two-week Summer Academies for Students

In 2008 We covered,

- **Marine Kits –**

MK1- Shipyard Operations MK2 - ship Construction

MK3 - Ship Stability MK4 - Ship Disaster Investigation

- **Instructional Modules -**

IM1 – Shipbuilding History IM2 – Ship and Offshore Structures

IM3 – Hull Design IM4 – Ship Operations

- **Other Activities:** Fieldtrips to shipyards and Museums.



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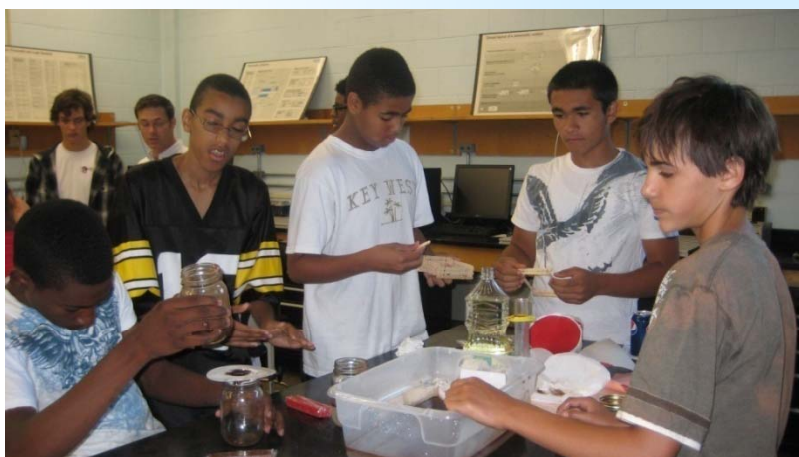


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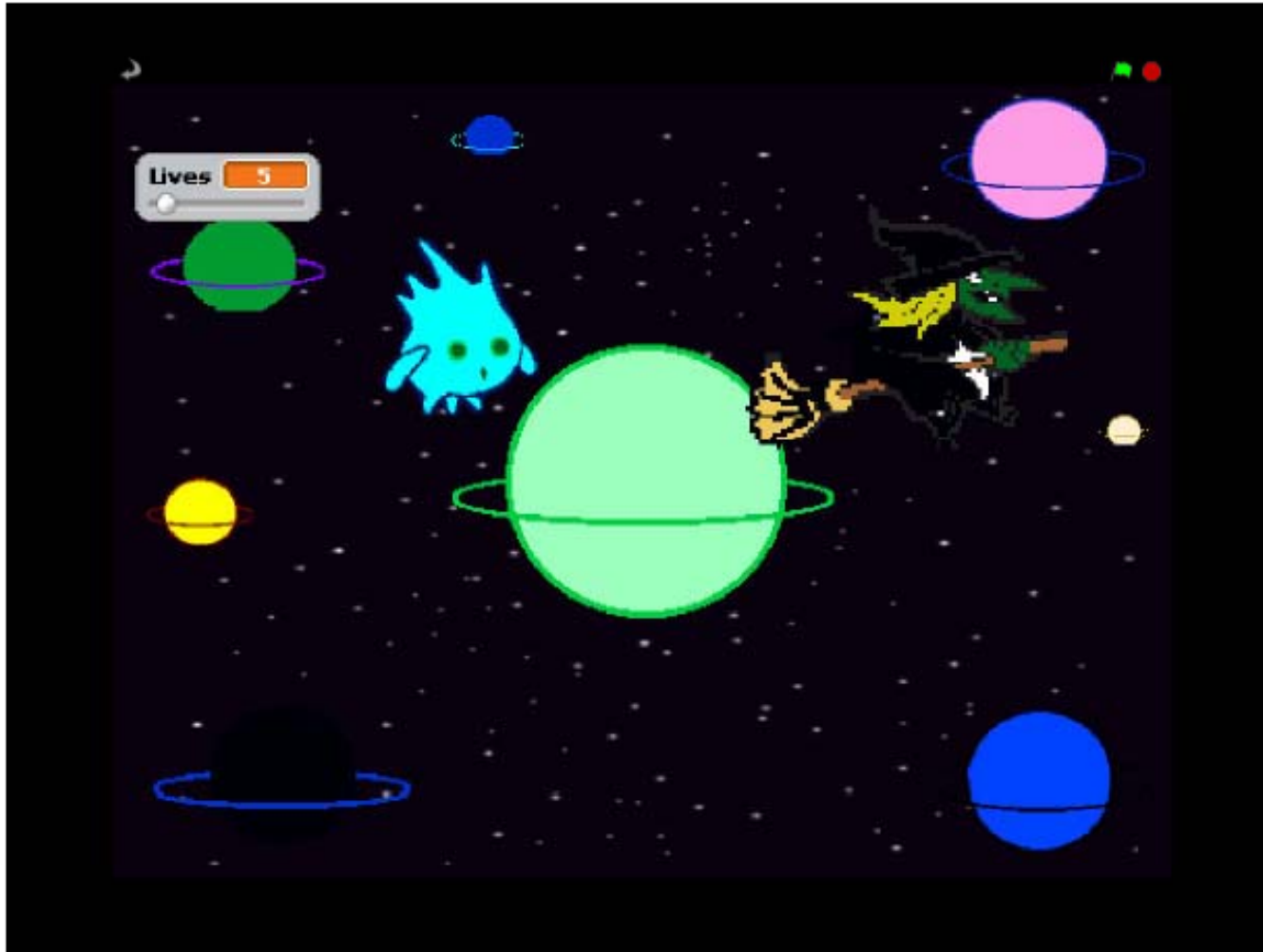
Summer Workshops 2009



Student Work posted on Website



Bird Kicker Game, by Paul Aelhart



Alien Game, by Kristine Currie

Two-week Summer Academies for Students

In 2010 We will be covering

- **Instructional Modules -**

IM1 – Force and Motion

IM2 – Oceanography

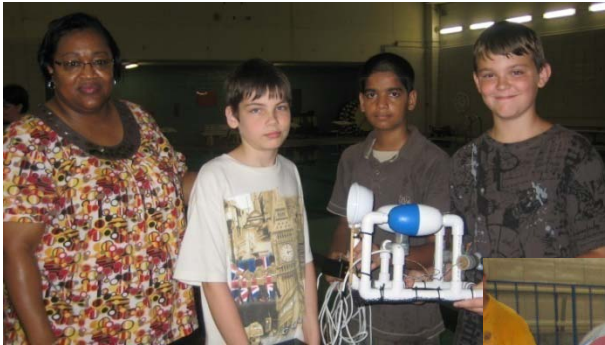
IM3 – Submarines

IM4 – Deep Sea Salvage

- **Sea Perch Robot** – Design and build underwater robot and participate in a competition. Learn about engineering and science behind underwater robots.

Summer 2009





Sea Perch Competition Summer 2009



Hampton Roads Schools
June 27th





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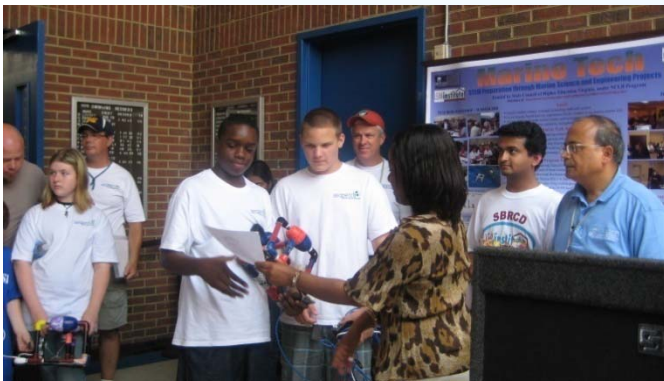


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Sea Perch Competition - Summer 2009



PORTSMOUTH
July 11th



Prize
Distribution





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Tentative Dates for 2010 Activities

Spring 2010 Saturday Academies	March 13, and March 27, 2010 April 17, and April 24, 2010
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Summer Academies 2 weeks	June 21 – June 26 June 28– July 2
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Fall 2010 Saturday Academies	Oct. 9 and Oct 16, 2010 Nov. 6 and Nov 13, 2010
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Program for Spring 2010 Saturday Academies

Saturday Academies			
March 13	March 27	April 17	April 24
Field Trip Mid Atlantic Maritime Academy (MAMA)	Marine Career Industry Speakers (Video - conferencing)	Math (Video Conferencing) Doctoral Students to Assist	Information Technology (Video Conferencing)
Lunch Break			
Field Trip VA Aquarium	Career Counseling (Live) Videoconferencing for last 1 hour	Science (Video Conferencing) Doctoral Students to Assist	Information Technology (Video Conferencing)
Survey		Survey	Survey

Program for Spring 2010 Summer Academies

SUMMER WORKSHOPS				
June 21	June 22	June 23	June 24	June 25
Student Summer Workshop IM 1	Student Summer Workshop IM2	Student Workshop Sea Perch	Student Workshop Sea Perch	Field Trip APM Terminal
		Teacher Workshop Sea Perch	Teacher Workshop Sea Perch + ITTIP	
June 28	June 29	June 30	July 1	July 2
Student Summer Workshop IT	Student Summer Workshop Science / Math	Teacher Counseling	Student Summer Workshop IM 4	Field Trip
		IM 3 Student Counseling		



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MarineTech Website




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[Home](#)[Goals](#)[AY Activities](#)[Summer Activities](#)[Contact Us](#)




2006/01/08

Program Summary:


1. 60 Math, Science and Technology Education teachers and 60 students
2. One week long professional development workshop during the Summer.
3. Classroom Implementation of instructional resources, building marine kits and Sea Perch underwater robot and human powered container ship for competition




FRANK BATTEN
COLLEGE OF
ENGINEERING
& TECHNOLOGY
UNIVERSITY




PARTNERS




ITTIP
Institute for Teaching Through
Technology and Innovative Practices



ONR
Office of Naval Research
Revolutionary Research... Relevant Results



NSU
NORFOLK STATE UNIVERSITY





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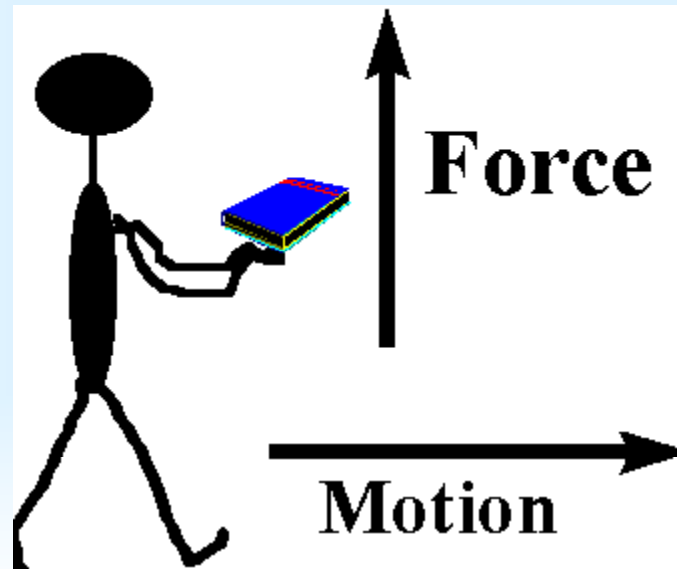
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STEM Preparation through Marine Engineering, Science and Technology Experiences

Instructional Modules for 2010

Force and Motion





Contents

1. Force and motion
2. Balanced and Unbalanced forces
3. Types of forces
4. Types of Friction.
5. Tension force
6. Hooke's law
7. Gravity
8. Mass and weight
9. Newton's first law
10. Newton's Second law
11. Newton's third law
12. Momentum

Summary

Force and motion module that studies forces and how they affect motion.

Secondly the most common forces that affect motion are identified and analyzed in some detail how these forces combine to produce an overall effect on the motion of an object.



Hands on Activities

1. **Coefficient of Friction:** To find the coefficient of static, kinetic friction for different Surfaces.
2. **Hooke's law:** To verify Hooke's law (Relationship between force and deflection)
3. **Projectile Motion:** To study projectile motion
4. **Acceleration:** what does it mean to accelerate (using Pasco material)

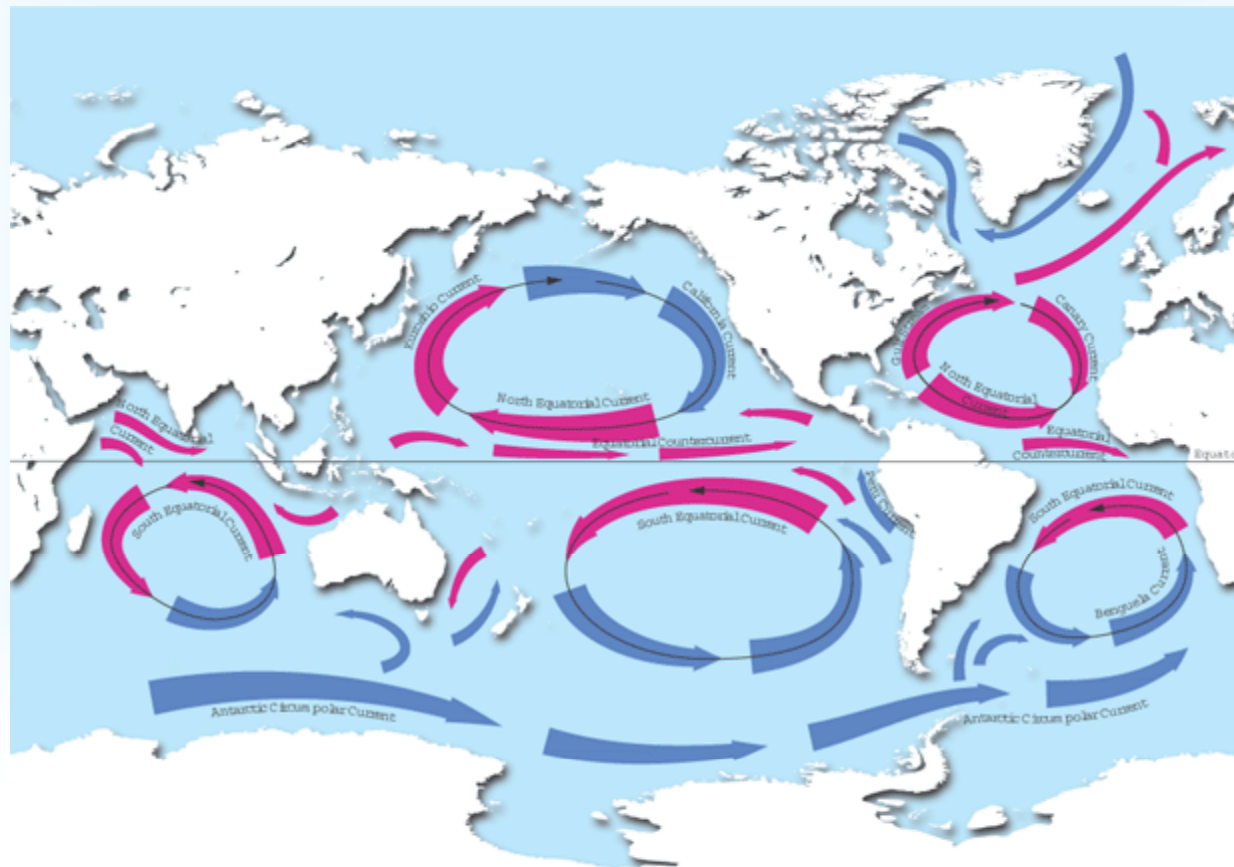


Class Exercises

- 1. Newton's second law:**(Quantitative problems on force, acceleration, mass)
- 2.Gravity:**To find gravity of different Planets and effect of gravity on weight.
- 3.Newtons third law:**(Complete the table by writing the reaction for each action)
- 4.Force and Motion:** Crossword puzzles on forces and motion
Match the following on force and motion



Oceanography



Summary

- The module gives a detailed description of oceanic currents and factors which causes it such as Tides , Coriolis Effect, Winds, Differences in water density,
- Study about different types of currents in ocean and about wave characteristics, Sofar channel, and Seafloor topography in detail.



Hands-on Activities

- CORIOLIS EFFECT : To simulate the Coriolis Effect by drawing a "straight" line on a rotating disc.
- WIND-DRIVEN OCEAN CIRCULATION (Gyre Circulation Patterns): To describe the typical gyre circulation pattern found in each of major ocean due to the movement of wind
- HOW DENSITY EFFECTS WATER CURRENTS IN OCEAN: How the water movement due to density causes currents
- AIR CURRENTS: To learn and understand convection air currents.



Class Exercises

- Composition of Ocean Water: To learn about the different percentage of salts present in ocean water
- Coriolis Effect : To learn and understand Coriolis Effect
- Tidal Ranges Compared To Moon Phases: To Understand how tides occur compared to Moon Phases
- Wave Characteristics: To learn how to calculate Wave speed using length and period
- Sofar Channel: To learn and understand how fast sound travels in ocean and the factors that effect the sound speed.



Submarines



Summary

- This module gives a detailed description on history of submarines, types, parts, working of submarine and dangers on submarine
- Study about different principles applied to make the submarine work like buoyancy, Boyle's Law, effect of water pressure on the submarine with the help of hands on activities, class exercises and check on learning

Hands-on Activities

- Ketchup Submarine – small activity to discuss how the submarine submerges and rises because of the pressure.
- Archimedes Principle Activity – Observe how the object's weight changes when submerged in water.
- SONAR Hands On- To trace the submarine located at the bottom of the sea floor.
- Build a Submarine Model – Build the model with the help of the items



Deep Sea Salvage



Summary

Shipwrecks are salvaged world wide for accident investigation, antique exploration and some other purposes. It is a million dollar industry that uses sophisticated navigation procedures, deep sea diving procedures and equipment and most cutting edge technology.

Deep Sea Salvation modules introduces students to the general procedure of salvation. It also teaches students basic concepts in navigation e.g. latitude, longitude, bearings etc. Hydrostatic pressure, underwater navigation using SONAR are also discussed in this module.



Hands-on Activities

Various interactive hands-on activities are used to teach practical applications of basic concepts

1. **Treasure Hunt** – Learn about Latitudes and Longitudes and locate various shipwrecks around the world using Google maps to find out sunken treasures
2. **SOS** – Learn about compass and bearing angles to locate the ship calling for help
3. **Around the World in 30 minutes** – Locate various ports around the globe using coordinates and bearings and calculate distance between them



Hands-on Activities – Contd..

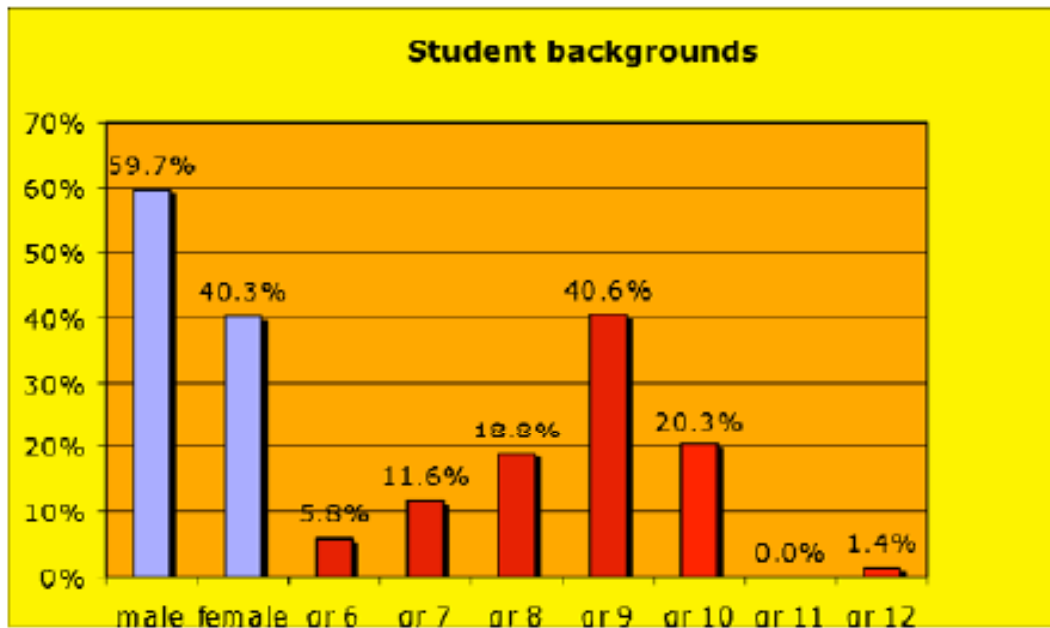
4. **Deep Dive**– Use your scratch programming skills to simulate an underwater glider diving to the wreck, docking and coming back to the surface again
5. **Underwater Glider** – Build an underwater glider working on the density variation principle (WIP)

Class Exercises

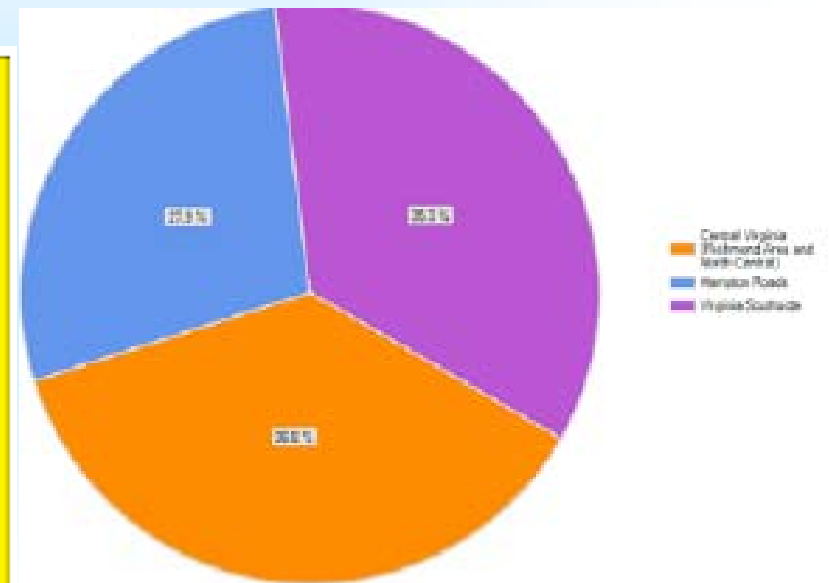
1. **Hydrostatic Pressure** – Learn to calculate increase in hydrostatic pressure with increase in depth. Plot a pressure profile for your simulated dive in scratch
2. **Underwater Navigation (SONAR)** – Learn the principles behind SONAR and solve a case study

Year 1 Results

Student Backgrounds



Area-wise Student Distribution

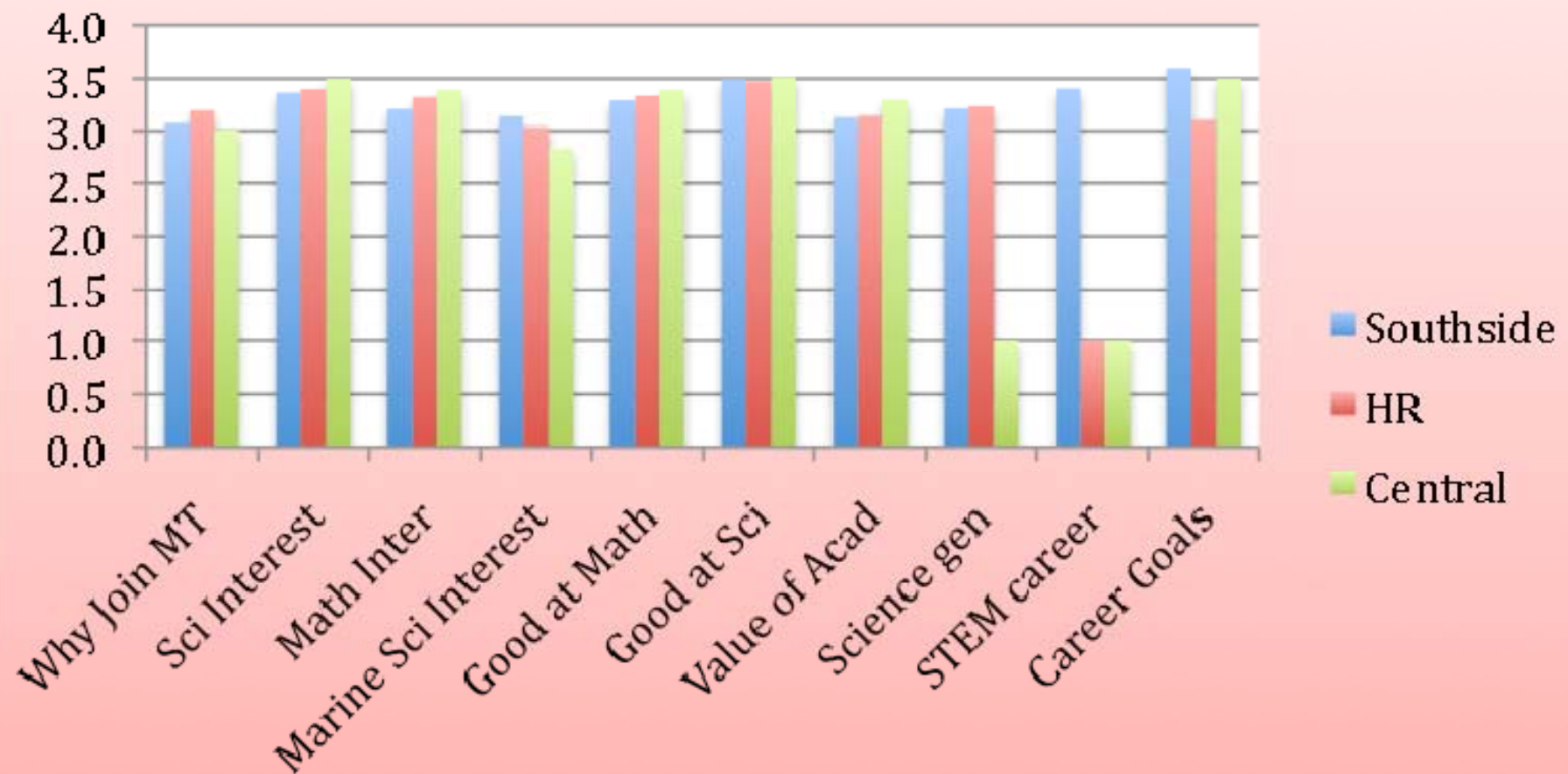


Hampton Roads 27.9 %

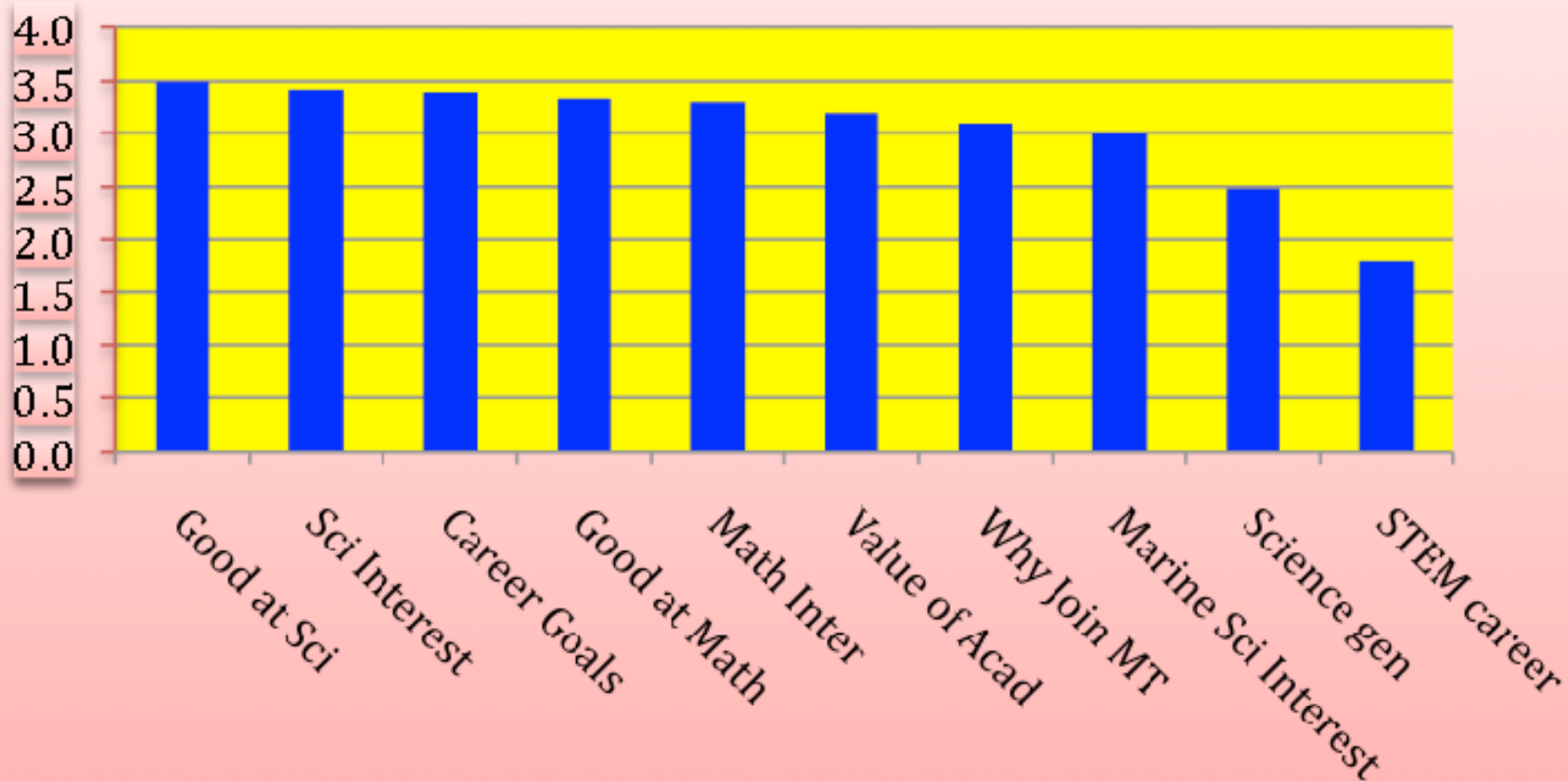
Central Virginia 35.3 %

Southside Virginia 36.8%

Student dispositions (pre), by site



Student dispositions (pre), sorted



Results of Survey - Examples

I would like to listen to scientists talk about their jobs

58% agree or strongly agree.

comment: more than half seem interested in the workplace roles for scientists

Engineering and Science magazines and stories are interesting

88% agree or strongly agree.

comment: interest in learning about the science fields; magazines and stories are typically read during voluntary or non-committed time, indicating a genuine interest. This is a very high response to this item compared to other projects the evaluation team is conducting.

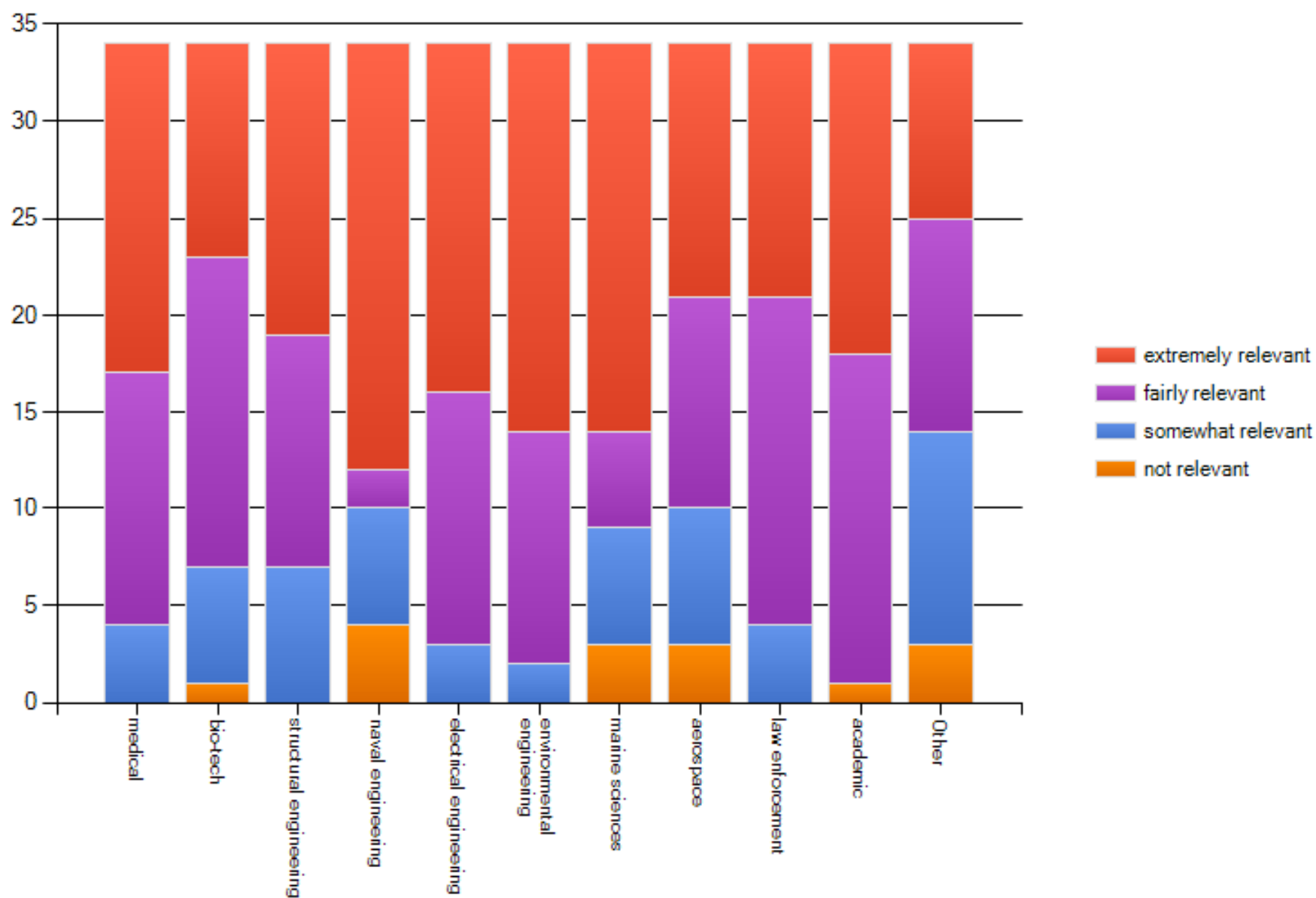
Results of Survey - Examples

I want to know how to build boats and submarines

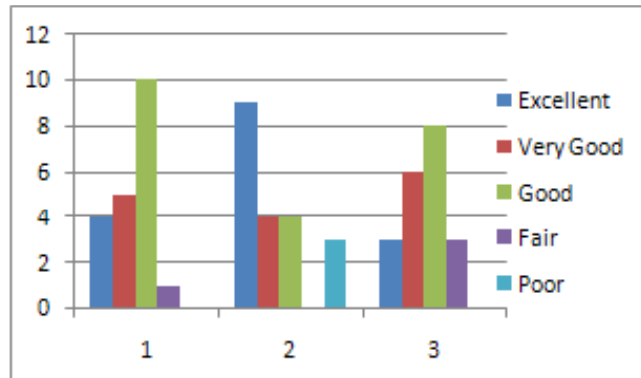
85% agree or strongly agree.

comment: shows a strong correlation between student interest and program offering. Will be interesting to learn if this high agreement rating sustains throughout the program. In surveys since 2007 conducted by Education Design, INC on five other STEM science learning projects, the average “agreement” response rate is 58%.

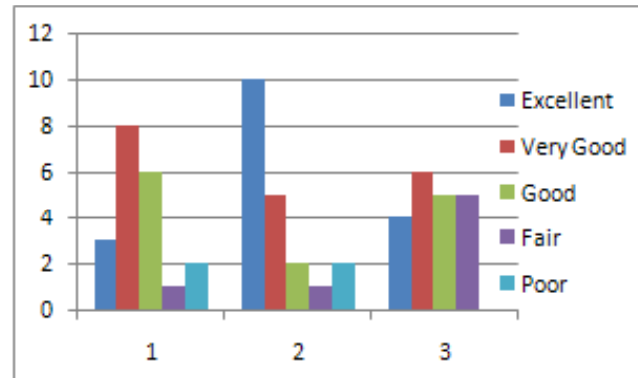
Please rate how relevant you think the following STEM careers are to your region:



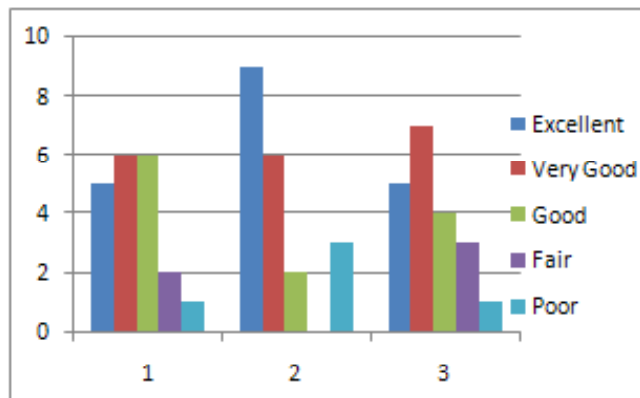
Student Responses in Central Virginia Summer Academy



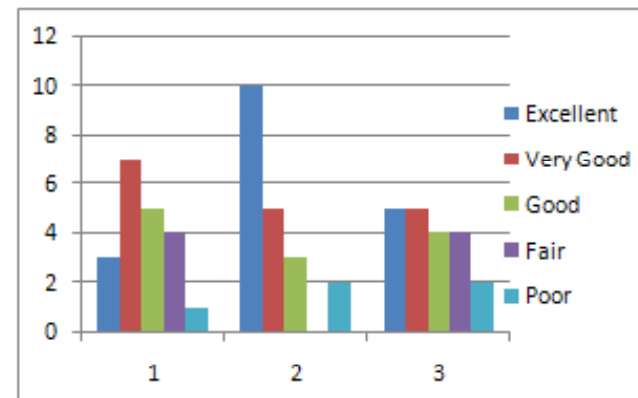
Marine kit I - Shipyard Operations



Marine kit II - Ship Construction Simulations



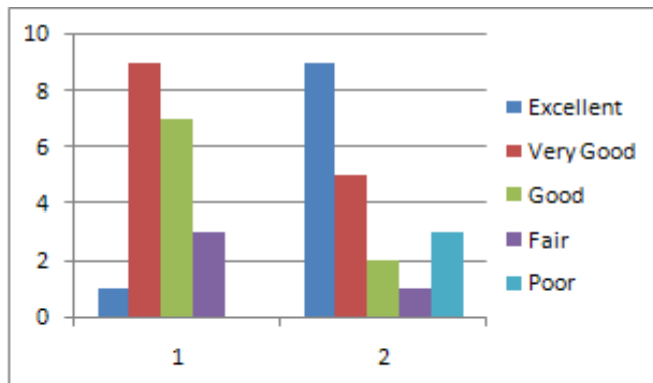
Marine kit III - Ship Stability Simulations



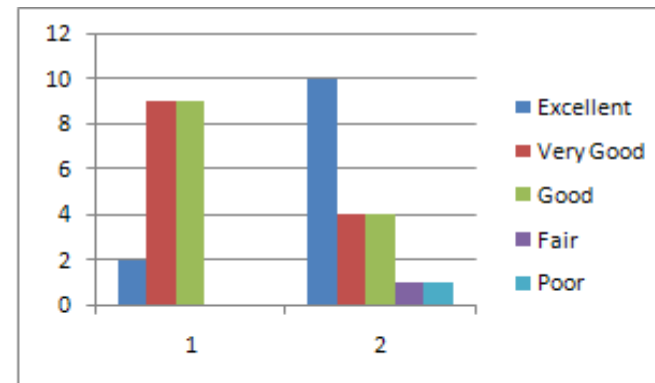
Marine kit IV - Ship Disaster Investigation

1. Learning from Presentation 2. Learning from Hands on activities 3. Explanations in Hand outs

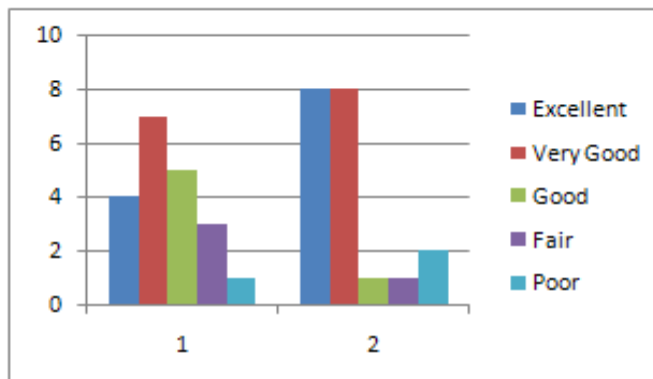
Student Responses in Central Virginia Summer Academy



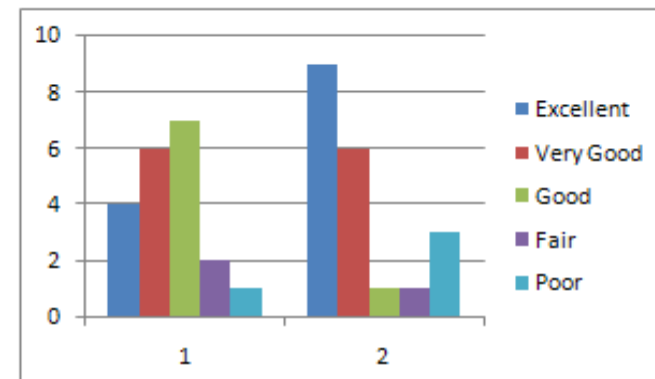
Instructional Module I - Ship Terminology



Instructional Module II - Ship and Offshore Structures



Instructional Module III - Hull Design

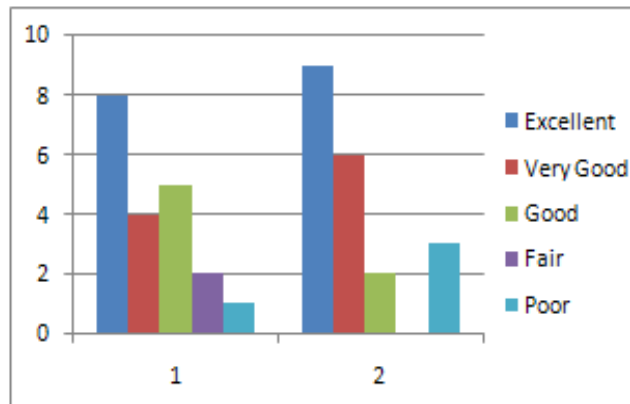


Instructional Module IV - Ship Operations

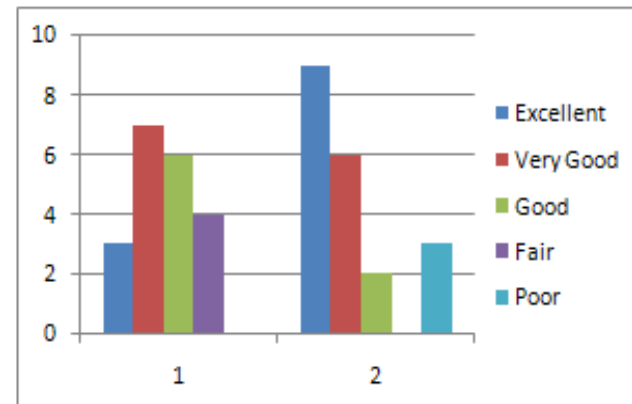
1. Learning from Presentation

2. Learning from Hands on activities

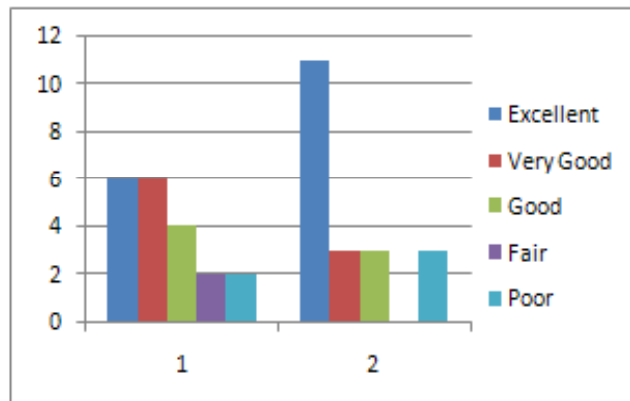
Student Responses in Central Virginia Summer Academy



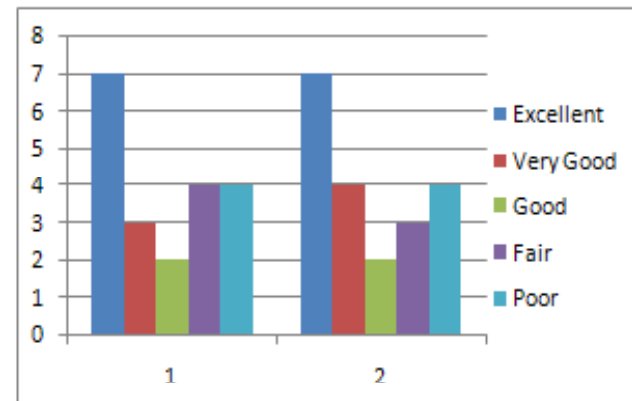
Science



Math



IT-Google Sketch-Up

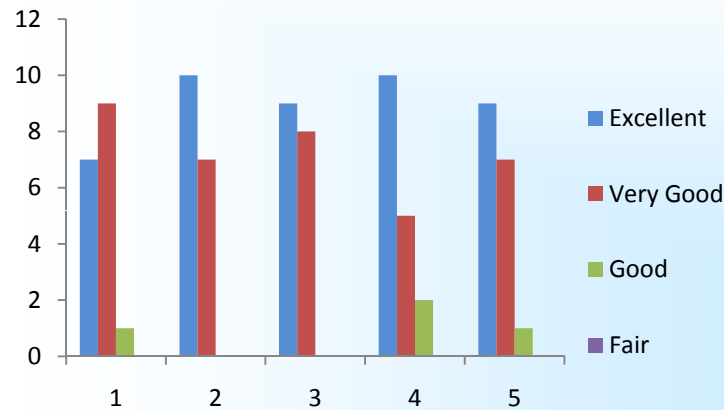


Counseling

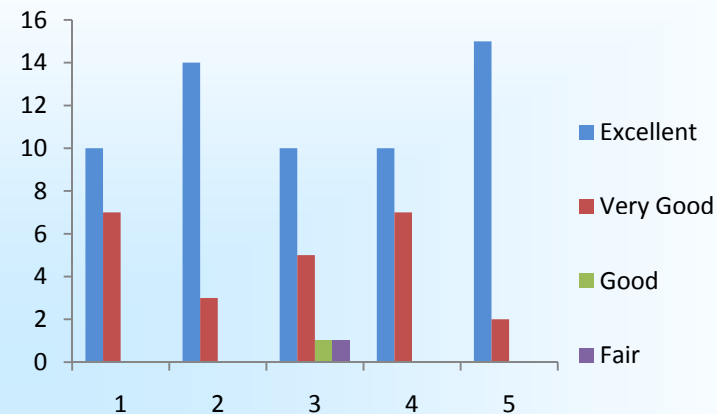
1. Learning from Presentation

2. Learning from Hands on activities

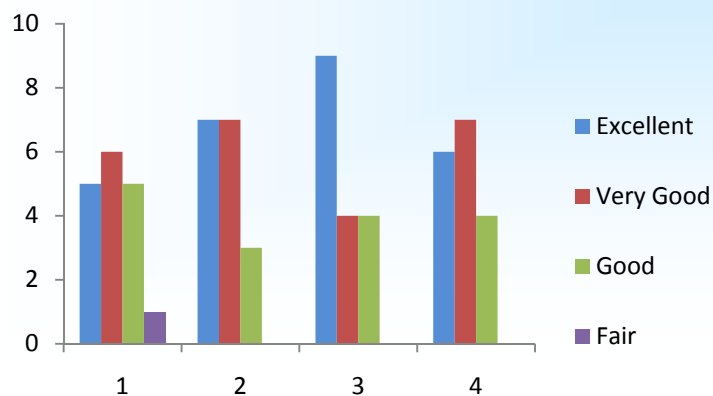
Teacher Responses in Hampton Roads



Day 1: Marine Kits (ODU)



Day 2: Math and Science Integration (ODU)



Day 2: Curriculum Integration (ITTIP)

1. Quality of Presentation
2. Presenters' Knowledge of the Material
3. Organization of Information
4. Quality of Hand-outs
5. Content and Quality of hands-on activities

Thank You

<http://www.themarinetech.org>



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