

**Results of the
Digital WAVE Summer Design Studio Evaluation
Cohort 2
September 2010**

**Prepared for
The Miami Science Museum**

by

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Results of the Digital WAVE Summer Design Studio Evaluation Cohort 2

Executive Summary

Digital WAVE is a program of the Miami Science Museum to provide informal education opportunities for teens to learn about climate science, digital technologies and related careers. Funded by the ITEST program of the National Science Foundation, Digital WAVE supports year-round activities for teens in Miami, Florida. The overall goals of Digital WAVE are to develop a replicable informal learning model that will build teens' digital design skills, while increasing their awareness and interest in technology intensive environmental careers. Activities take place at the Miami Science Museum, at related science institutions, and in the virtual world simulation in Teen Second Life.

This report details the results of data collection for the second Cohort of participants in the Digital WAVE two-week summer program from August 9-20, 2010. Data collection took place through demographic surveys, pre- and post-surveys and the analysis of user traffic data for Digital WAVE in Teen Second Life.

Twenty-six students were recruited for Cohort 2 and twenty-four completed the summer program for a retention rate of 92%. The average student was 16 years of age and 55% of the cohort was male. The majority represented minority students with high levels of need, with 100% participating in the free and reduced lunch program at their school. Nearly three-fourths (73%) spoke languages other than English at home and all but one (95%) reported that their parents were not born in the United States. When asked about their academic support network, they reported that they relied on friends, teachers, other school staff, other students, and parents. Most joined the program because of encouragement from mentors at the Museum, because they believe the experience will help them go to college, and because of their love of science and technology.

After participation in the Digital WAVE Design Studio, teens experienced gains in confidence, skill and attitudes related to the goals of the program. Major findings of the report are as follows:

Confidence Levels

Participants reported significant gains with mean differentials of +.44 to +.51 in their confidence levels for tasks related to 3-D modeling and design, presenting their work to a group and honoring their commitments to a project.

Cohort 2 teens also reported gains in confidence ranging from +.02 to +.38 for items related to creating avatars, navigating, participating and designing in Teen Second Life.

Participants also reported gains in confidence ranging from +.14 to +.33 for items related to workforce development skills such as time management negotiating and planning with a team, and receiving feedback and critiques from others.

Technical Skill Levels

Participants reported increased skill levels for Second Life building tools for all eight items related to 3-D modeling, animation and building in Second Life.

The teens also reported high levels of skill for creating in Second Life and for using Second Life communication tools.

Attitudes about Climate Science and Instructional Technology

After participation in Digital WAVE, students responded positively to items related to learning about plants and animals, understanding what scientists do, interest in science, and seeing how data “fits together.”

They are more likely to agree that “climate change is causing global warming”, “multiple factors are involved in climate change”, and climate change affects their daily lives.

Awareness and Interest in STEM Academic and Career Pathways

Results of pre- and post-questionnaire indicate that the Digital WAVE Summer Institute was effective in increasing awareness and interest of STEM pathways. After participating in the Digital WAVE summer program, 100% of respondents were more likely to understand the purpose of Advanced Placement classes and 96% of students who completed the Digital WAVE Design Studio expressed plans to take advanced placement classes in STEM subjects in the future (an increase of 20% compared to the start of the program). After participating in Digital WAVE, 96% plan to attend college and 77% plan to major in a science or technology field in college (an increase of 9% compared to the start of the program).

After participating in the Digital WAVE summer program, 100% of students who completed the Digital WAVE Design Studio expressed awareness and interest on comparative surveys in a wide and diverse spectrum of STEM careers. Careers expressed by students in pre- and post-questionnaires included engineering (50%), computing and technology (50%), business-related technology (50%), biology (23%), earth science and environmental science (23%), mathematics (18%), chemical science (14%), space and astronomy (14%), and physics (9%).

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Introduction

Digital WAVE is a program of the Miami Science Museum to provide informal education opportunities for teens to learn about climate science, digital technologies and related careers. Funded by the ITEST program of the National Science Foundation, Digital WAVE supports year-round activities for teens in Miami, Florida. The overall goals of Digital WAVE are to develop a replicable informal learning model of teens that will build their digital design skills, while increasing their awareness and interest in technology intensive environmental careers. Activities take place at the Miami Science Museum, at related science institutions, and in the virtual world simulation in Teen Second Life.

Evaluation of Digital WAVE at the Miami Science Museum is conducted by lead evaluator Kathleen Tyner of The University of Texas at Austin with a team of researchers from Hi-Beam Consulting. This report details the results of data collection for the second cohort of participants in the Digital WAVE Design Studio, which took place over a two-week period from August 9-August 20, 2010.

The summer program evaluation relied on data collected through pre- and post-data questionnaires related to skill, confidence, attitudes and awareness of careers related to climate science and advanced digital technologies. A survey was also administered to collect participant demographics. User traffic data for Digital WAVE in Teen Second Life was archived through the use of traffic data collection software and analyzed by avatar/user and total site visits to the virtual world.

Demographic Profiles for Cohort 2

Twenty Cohort 2 participants in the Digital WAVE Design Studio completed an anonymous demographic survey on to determine social and contextual factors related to the Digital WAVE summer program implementation.

The average age was 16 years and the majority (55%) was male. Nine girls participated. Tenth grade rising was the mode. Three were in 9th grade, six were in 10th grade, five were in 11th grade and five were in 12th grade. Sixteen teens (73%) reported that they spoke languages other than English at home.

A majority of the participants (12) reported that they were not born in the United States (60%) and a majority (95%) also reported that their parents were not born in the United States. They expressed their racial/ethnic identity as African American (9), Hispanic, non-white (7), White, non-Hispanic (1), Afro-Caribbean (1), Asian American (1), and Middle Eastern (1).

Nine (9) of the participants (45%) lived in one parent homes. The others lived with two parents (7), grandparents (2), on their own (1), and with one parent and one step-parent (1). They reported that their mothers had completed high school (7), had some college (2), or had completed a Bachelor's Degree (2) or Graduate Degree (2). Seven were unsure of their mother's highest level of education. Seven (35%) were unsure of their father's highest education level. The rest reported that their fathers' had completed elementary or middle school (1), high school (5), some college (3), a Bachelor's Degree (1) or a Graduate Degree (2). All 20 students (100%) participated in the free and reduced lunch program at their schools.

When asked about the subject areas in which they needed the most help, 7 reported science, 6 reported math, and 8 reported humanities subjects such as reading (2) and English (4), Social Studies and History (2). Two participants did not respond to the question.

The Digital WAVE Summer Design Studio participants were asked, "In addition to the Digital WAVE Program, where do you usually go for help with schoolwork?" They reported that they worked with their friends (10), teachers (9), other school staff such as librarians and counselors (7) or other students in their classes (7). Ten students worked with tutors (5) or older brothers and sisters (5), and 6 looked to their parents for help. They also sought out Miami Science Museum staff (2), Digital Wave Program Staff (1), or someone at their church (1). One student reported that they had "no one" for academic support.

Participants were also asked if they participated in "any clubs, sports teams, or church youth groups at your high school or in your community?" Fourteen (14) participants did cite social groups after school and 6 did not. When asked to list the most important social groups, they listed, "Girl Scouts, football, House of Peace, soccer, S.A.D.D., Woman of Tomorrow and church choir."

Tables that display complete responses to survey questions related to demographic data and recruitment/retention factors are located in Appendix A.

Recruitment and Retention

Digital WAVE staff and mentors from the Miami Science Museum recruited 26 students for the 2-week Digital WAVE Summer Design Studio that took place from August 9 to August 20, 2010. The attrition rate is calculated by subtracting two students who participated in only one day of the program. Twenty-four (n=24) students completed the summer program for a retention rate of 92%. The average attendance for the remaining cohort totaled 7 days for a total attendance rate of 70%. Four students (17%) attended all ten sessions and six students (25%) missed just one of the ten days.

In addition, participants were asked to respond to pre- and post-questions about their reasons for joining the Digital WAVE program. On a scale of 1=Low/3=High, they were most likely to select encouragement from mentors at the Museum (post-mean, 2.62) and

their “love of science, math, engineering and technology” (post-mean, 2.62). They also participated in the Digital Wave Program because they believe it will help them go to college (post-mean, 2.60).

Confidence, Skill and Attitudes

Cohort 2 participants in the Digital WAVE Design Studio were asked to complete a questionnaire to measure confidence, skill and attitudinal levels before and after their Digital WAVE summer experience. Aggregated results were tabulated by mean and post-surveys were compared with baseline. Tables that display mean differentials for each survey item are located in Appendix B.

Confidence Levels for Cohort 2

On a scale of 1=Low/5=High, participants were asked to report their confidence in performing tasks related to the Digital WAVE Design Studio curriculum. Baseline data indicated that Cohort 2 had some experience with technology applications related to simulations and virtual worlds, with most reporting a range of 3.0-4.0 as they entered the program. They experienced gains in confidence on 10 of 12 items with mean differentials ranging from +.14 to +.51.

After completion of the Digital WAVE Design Studio, participants reported significant gains in their confidence levels for tasks related to creating 3-D computer models (+.45), creating an avatar (+.38), and navigating in virtual worlds (+.18).

Confidence in Soft Skills for Cohort 2

Cohort 2 participants were asked to report their confidence in workforce development skills and related interactions needed for project-based work, sometimes referred to as “soft skills.” Post-survey mean ranged from 3.55- 4.27 on a scale of 1=Low/5=High. The participants reported gains in confidence levels for “soft skills”, including: presentation skills (+.51), project planning (+.33), working with a team (+.31), and honoring one’s commitments to the project (+.44).

Hard Skill Ratings for Cohort 2

In pre- and post-measures, Cohort 2 participants were asked to rate their skill levels on applications related to the Digital WAVE Design Studio treatment on a scale of 1=Low/5=High. When asked about their skill in the use of Second Life building tools, mean differentials indicated increased skill levels for all ten items with a range of mean differentials from +.15 to +.55. The highest gains were reported in editing audio (+.55), using software to animate objects (+.49), recognizing dimensions for the X=Y-Z axes by color (+.48), creating a primitive 3-D model from the Polygon menu (+.45), and using software to create an avatar (+.40).

Attitudes about Science and Instructional Technology for Cohort 2

Participants in the Digital WAVE Design Studio were asked to express their agreement or disagreement with items related to science and climate change on a scale of 1=Strongly Disagree/5=Strongly Agree. Mean differentials for post-surveys indicate that after their Digital WAVE experience, Cohort 2 participants agree or slightly agree with items related to being interested in learning about plants and animals (4.09), understanding what scientists do (3.91), finding the activities they do in science class to be interesting (3.86), and seeing how data “fits together” (3.77).

The affective instrument was based on a field-tested instrument from the EcoMUVE project at Harvard Graduate School of Education. It included some reverse items. On reverse items, participants indicated that it is important to learn about ecosystems. Two reverse items may have created some confusion. When asked, “It is easy to figure out what causes changes in environment,” the post-mean was 3.73 (+.21). When asked “is it hard to connect the things you are learning about in science with what you already know”, the post mean was 2.73 (.+29). These mean differentials indicate that students may not yet understand the intricate complexity of climate change theories and research and that they may be challenged by the ability to connect their new knowledge to existing knowledge. However, it is more likely that the results were influenced by many of the learners’ second language skills in English, in particular when Spanish is a first language, creating more confusion about the intent of the reverse negative items. Based on the field-test of the instrument in Summer 2010, reverse items will not be used in data collection with Digital WAVE students in the future.

Cohort 2 students are more likely to agree that “climate change causes global warming” (post-mean 3.45, mean differential of +.45), that there are multiple factors involved in climate change (post-mean 3.73, mean differential of +.33), and that climate change affects their daily lives (post-mean 3.73, mean differential of +.45)

When asked if they “enjoy learning about science at your school” participants remain neutral (post-mean, 2.77), but they are more enthusiastic when asked if they enjoy learning at the Miami Science Museum (post-mean 3.55, mean differential +.38).

Awareness and Interest in STEM Career Pathways

Results of pre- and post-questionnaire indicate that the Digital WAVE Summer Institute was effective in increasing awareness and interest of STEM pathways. After participating in Digital WAVE, 100% of respondents were more likely to understand the purpose of Advanced Placement classes and 96% reported that they planned to take an AP course in STEM subject in the future. Ninety-six percent plan to attend college and 77% plan to major in a science of technology field in college.

After participating in the Digital WAVE summer program, 100% of students who completed the Digital WAVE Design Studio expressed awareness and interest on comparative surveys in a wide and diverse spectrum of STEM careers. Careers expressed

by students in pre- and post-questionnaires included engineering (50%), computing and technology (50%), business-related technology (50%), biology (23%), earth science and environmental science (23%), mathematics (18%), chemical science (14%), space and astronomy (14%), and physics (9%).

Awareness of Academic Pathways

Digital WAVE Design Studio participants were asked to respond to questions related to their awareness of academic pathways related to STEM education. Slightly more than half (59%) of the participants reported that they had received some counseling about Advanced Placement Courses. After participating in Digital WAVE, 100% of respondents were more likely to understand the purpose of Advanced Placement classes and 96% reported that they planned to take an AP course in STEM subject in the future. Ninety-six percent of the students said that they “plan to go to college.”

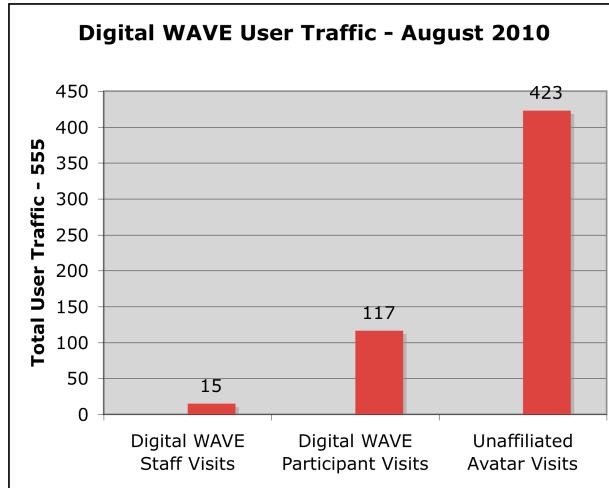
Digital WAVE Traffic in Teen Second Life

In-world user traffic data for the Digital WAVE program in Teen Second Life is collected and reported with database software and analyzed in Excel by number of visits and by user avatar names. The traffic data for Cohort 2 was collected and reported for in-world visits between August 1-31, 2010, a time period which corresponds with their Digital WAVE Summer Design Studio activities, but which also measures avatar traffic from users who are not directly affiliated with Digital WAVE.

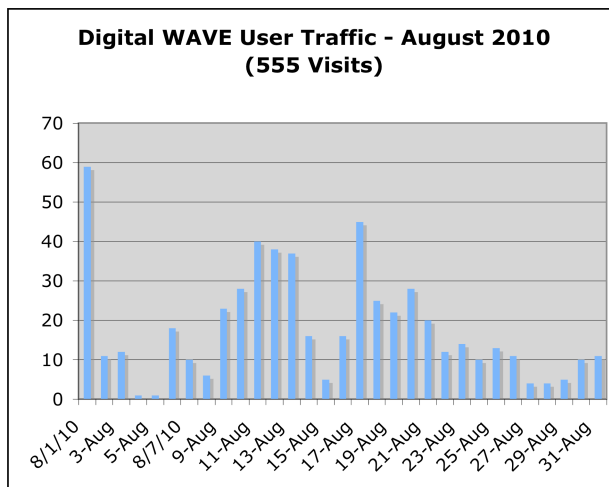
In order to distinguish participation from the Digital WAVE avatars and staff from those avatars that were not affiliated with the program, the traffic data is broken into three categories: 1) Digital WAVE participants, 2) staff and 3) non-affiliated users, defined as those users without direct connections to the Digital WAVE program and who gravitate to Digital World from other simulations, grids or sectors in Teen Second Life.

In August 2010, a total of 555 avatar visits to Digital WAVE in Teen Second Life were recorded. Of these, 26 teen participants in the Digital WAVE program for Cohort 2 visited the in-world simulation a total of 117 times. Traffic data for individual avatars shows that the visits for each Cohort 2 participant ranged from 0-7 during this time period for an average of 4.5 visits per participant. Four (4) staff members, evaluators and fabricators visited the Island 15 times in August.

The Digital WAVE traffic counter also recorded 423 visits in August 2010 from users who were not directly affiliated with the Digital WAVE summer program. Anecdotal evidence from participants indicated that the avatars from other areas of Teen Second Life who visited the Digital WAVE simulation were valued advisors who assisted the Digital WAVE participants with information about virtual world navigation, object creation, and areas of interest in Teen Second Life. Table 1 displays the August 2010 user traffic results by user profile.



Daily visits to the Digital WAVE simulation on NASA Island in Teen Second Life fluctuated according to program activities. For example, high volume traffic corresponds with group activities and object creation in-world during the Digital WAVE Design Studio from August 9-20, 2010. Low traffic volume during that time corresponds with field trips and other “real world” experiences. The total user traffic from August 9-20, 2010 total 329 visits from all avatars. Table 2 displays user traffic by date.



Results for Cohort 2 participants in the evaluation of the Digital WAVE Design Studio in August 2010 indicate that after participation in the Digital WAVE Design Studio, teens experienced gains in confidence, skill and attitudes related to the goals of the program. Results are intended for use in program improvement and refinement, including the refinement of data collection instruments and methodologies. Complete results of questionnaires are detailed in Appendix A and B.

**APPENDIX A:
RESULTS OF THE DEMOGRAPHIC SURVEY
Digital WAVE Summer Design Studio
COHORT 2 (SUMMER 2010)**

DEMOGRAPHIC SURVEY RESULTS – COHORT 2 DIGITAL WAVE SUMMER 2010 DESIGN STUDIO

Table 1: Cohort 2 - Language at Home

Language Spoken at Home	N= 20
English	6
Creole	7
Spanish	8
Chinese	1
Total	22

*Total may exceed 20 due to multiple responses.

Table 2: Cohort 2 - Grade Level

Your current grade level:	N= 20
9 th	3
10 th	6
11 th	5
12 th	5
No response	1
Total	20

Table 3: Cohort 2 - Age

Your current age:	N= 20
13	2
14	2
15	3
16	5
17	7
18	1
Total	20

Table 4: Cohort 2 - Gender

Your gender:	N= 20
Male	11
Female	9
Total	20

Table 5: Cohort 2 - Parental Support Factors

Who do you live with?	N= 20
Two Parents	7
One Parent	9
One Parent and One Step-Parent	1
Grandparent(s)	2
Other Relative	
Foster Guardian	
On my own	1
Total	21

Table 6: Cohort 2 - Mother's Education Level

What is your mother's highest level of education?	N= 20
Elementary or Middle School	
High School	7
Some College	2
Bachelor's Degree	2
Graduate Degree	2
Not Sure	7
Total	20

Table 7: Cohort 2 - Father's Education Level

What is your father's highest level of education?	N= 20
Elementary or Middle School	1
High School	5
Some College	3
Bachelor's Degree	1
Graduate Degree	2
Not Sure	7
No response	1
Total	20

Table 8: Cohort 2 - Racial/Ethnic Identity

What is your racial or ethnic identity?	N= 20
African American	9
Afro-Caribbean	1
Haitian	1
Hispanic / Latino	7
Asian American	1
Pacific Islander	
Native American	
White, non-Hispanic	1
Middle Eastern	1
Total*	21

*Total may exceed 20 due to multiple responses.

Table 9: Cohort 2 - Country of Origin

Were you born in the US?	N= 20
Yes	8
No	12
Total	20

Table 10: Cohort 2 - Country of Origin

Were your parents born in the US?	N= 20
Yes	1
No	19
Total	20

Table 11: Cohort 2 - Disciplinary Support

What subjects do you need most help with? N=20	Respondents listed more than one subject in four cases.
Biology	
Math (Algebra)	6
Science	7
Reading	2
English	4
Social Studies	1
Computers	
History	1
None	2
Total*	23

*Total may exceed 20 due to multiple responses.

Table 12: Cohort 2 Academic Support

In addition to the Digital WAVE Program, where do you usually go for help with schoolwork? (Select all that apply)	N= 20
Other students in my class	7
Friends	10
My teacher	9
Other school staff (librarian, counselor, principal)	7
Digital WAVE program staff	1
A tutor	5
My older brother or sister	5
My parent or guardian	6
Someone at my church	1
Someone at my workplace	
No one	1
Miami Museum Mentor	2
Total*	54

*Total may exceed 20 due to multiple responses.

Table 13: Cohort 2 Free/Reduced Lunch

Do you participate in the free or reduced lunch program at your school?	N= 20
Yes	20
No	
Total	20

Table 14: Cohort 2 Social Activities

Do you belong to any clubs, sports teams, church youth groups at your high school or in your community?	N= 20
Yes	14
No	6
<i>“If so, list the more important ones here:” football, Girl Scouts, House of Peace, soccer, S.A.D.D., Woman of Tomorrow, church choir</i>	
Total	20

Appendix B:

Cohort 2 Mean Differential for Pre/Post Surveys Digital WAVE Design Studio (SUMMER 2010)

Table 1: Cohort 2 Confidence

How confident do you feel about your ability to do the following: (1=Low/5=High)	Mean (1=Low/5=High)		Mean Differential (1=Low/5=High)
	Pre N=25	Post N=22	
<i>Use the Second Life Building Tools</i>			
Create a 3-D computer model	3.50	3.95	+.45
Producing my own video	3.50	3.36	-.14
<i>Creating for Second Life</i>			
Creating my own avatar	3.48	3.86	+.38
<i>Communicating in Second Life</i>			
Participating in social networks	4.12	4.14	+.02
Navigate in virtual worlds	4.00	4.18	+.18
<i>Skills Needed for Project-Based Work</i>			
Receive feedback and critique the work of others	4.04	4.18	+.14
Present my work to a group	3.72	4.23	+.51
Solve problems and troubleshoot	3.72	3.55	-.17
Plan my own project	3.44	3.77	+.33
Work with a team	3.96	4.27	+.31
Honor my commitments to the project	3.56	4.00	+.44
Complete project goals in a timely manner	3.52	3.68	+.16

Table 2: Cohort 2 Skill

Please rate your skill in using software to design video games and other media?	Mean (1=Low/5=High)		Mean Differential (1=Low/5=High)
	Pre N=25	Post N=22	
<i>Use the Second Life Building Tools</i>			
Use the software to create objects	3.20	3.55	+.35
Create a primitive 3-D model from the Polygon menu	2.64	3.09	+.45
Recognize dimensions for the X-Y-Z axes by color	2.88	3.36	+.48
Create dynamic effects in a media product using lighting	2.58	2.73	+.15
Create dynamic effects in a media product using texturing	2.46	2.77	+.31
Edit video	2.78	3.05	+.27

Table 2, Continued: Cohort 2 Skill			
Edit audio	2.54	3.09	+55
Use software to animate my objects	2.46	2.95	+49
<i>Creating for Second Life</i>			
Use the software to create an avatar	2.96	3.36	+40
<i>Communicating in Second Life</i>			
Navigate in a virtual world	3.40	3.59	+19

Table 3: Cohort 2 Attitudes about Science and IT

How much do you agree or disagree with the following statements:	Mean (1=Low/5=High)		Mean Differential (1=Low/5=High)
	Pre N=25	Post N=22	
I like learning about animals and plants.	3.68	4.09	+41
I understand what scientists do to study ecosystems.	3.80	3.91	+11
I think the activities we do in science class are interesting.	3.68	3.86	+18
I can look at data that I collected and see how it fits together.	3.76	3.77	+01
It is easy for me to use tables and graphs to figure things out.	3.72	3.68	-.04
I don't like learning about science. **	2.32	2.59	+27
It is <i>not</i> important to learn about ecosystems.**	2.76	2.73	-.03
It is hard for me to connect the things I am learning about in science with what I already know.**	2.44	2.73	+29
It is easy to figure out what causes changes in the environment.**	3.52	3.73	+21

** Reverse differential – (a negative differential is a good result)

Table 4: Cohort 2 Beliefs about Science and Climate Change

<i>Climate Change</i> (1=Low/4=High)	MEAN (1-Low/5=High)		Mean Differential (1=Low/5=High)
	Pre N= 25	Post N= 22	
Do you think that climate change is causing global warming now?	3.00	3.45	+ .45
Do you think that multiple factors are involved in climate change?	3.40	3.73	+ .33
Do you think that climate change affects your daily life?	3.28	3.73	+ .45
Do you enjoy learning about science at your school?	2.72	2.77	+ .05
Do you enjoy learning about science at the Miami Science Museum?	3.17	2.55	+ .38
Do you consider yourself “environmentally friendly?”	2.60	2.55	- .05

Table 5: Cohort 2 Recruitment Information

Reasons for joining the Digital WAVE Program:	MEAN 1=Low/3=High		Mean Differential (1=Low/3=High)	Does Not Apply to Me	
	Pre N=25	Post N=22		Pre	Post
Encouragement from my Parents	1.82	2.00	+ .18	8	4
Encouragement from mentors at the Museum	2.41	2.62	+ .21	7	3
Encouragement from teachers	2.33	1.94	- .39	10	4
My love of science, math, engineering and technology	2.56	2.62	+ .06	6	3
Digital WAVE will help me go to college	2.60	2.60	0	3	1
I wanted to do something interesting	1.61	1.81	+ .20	2	
I want to meet new people	1.89	1.93	+ .04	5	3

Table 6: Cohort 2 Awareness of Advanced Level Courses and Confidence

Please check the answer that best applies:	YES		YES Differential	NO (Displayed by numerical frequencies)	
	<i>Pre</i> N=25	<i>Post</i> N=22		<i>Pre</i> N=25	<i>Post</i> N=22
<i>Displayed by percentage of responses</i>					
Did you understand the purpose of Advanced Placement classes?	96%	100%	+4%	1	
Did you ever receive counseling about Advanced Placement Courses?	68%	59%	-9%	8	9
I plan to go to college.	100%	96%	-4%		1
Do you plan to take advanced placement classes in STEM subjects in the future?	76%	96%	+20%	6	1
Do you plan to major in a science or technology field in college?	68%	77%	+9%	8	4

Table 7: Cohort 2 Career Goals

Which of the following careers do you want to pursue in the future?	YES		YES Differential
	<i>Pre</i> N=25	<i>Post</i> N=22	
<i>Displayed by percentage of responses</i>			
Biology	28%	23%	-5%
Business (Technology-related)	48%	50%	+2%
Chemical Science	12%	14%	+2%
Computing & Technology	48%	50%	+2%
Earth Science and Environmental Science	16%	23%	+7%
Engineering	56%	50%	-6%
Mathematics	16%	18%	+2%
Physics	16%	9%	-7%
Space & Astronomy	16%	14%	-2%