Science Projects Make Great Graduation Projects !

Examples & Helpful Hints

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Helpful Hints

- Start early-Junior year
- Make sure projects are “doable”.
- Be creative, ask “What if ____?”
- Students, advisors and mentors should have a passion for the topic.
- Be prepared for most of your time to be spent in the planning and preparation phase of the project.
- It’s OK if the product doesn’t turn out “right”. You’ll still learn something!
- **SCIENCE INVESTIGATIONS MAKE GREAT GRADUATION PROJECTS!!!**

Some examples:

- **Eric Luibrand**
- **Paolo Valerio**
- **Kyle O’Donnell**

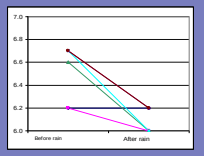
The Effect of Suburban Retention Ponds on the Concentration of Polluted Runoff

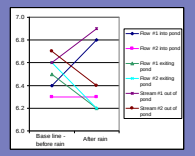
Question

Are suburban retention ponds effective at reducing the amount of pollutants entering streams as they are designed to do?

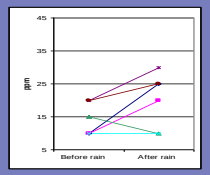
Sample collection

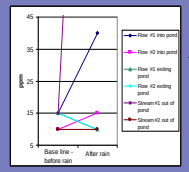
Testing





pH

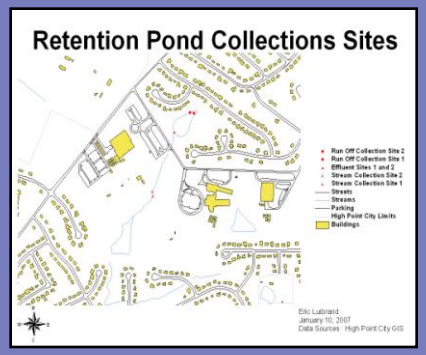




Alkalinity

Procedures

- Collect water samples approximately an hour and a half into a rainfall to identify the spate.
- Collect two samples from each of three locations by submerging the top of a nalgene bottle.
- Test the samples for nitrites and nitrates, ions contributing to hardness, alkalinity, and pH will also be tested.



Data

Date Collected	Site Name	SS mg/L	NO3+NO2 µg/L	Total Hardness gpg	Total Alkalinity ppm	pH
12/6/06	BL IN - 1	11.70	278.83	15	10	6.2
12/6/06	BL IN - 2	12.80	274.42	10	10	6.2
12/6/06	BL OUT - 1	11.60	285.39	10	15	6.6
12/6/06	BL OUT - 2	10.80	285.08	10	10	6.7
12/6/06	BL STREAM -1	6.96	455.54	15	20	6.7
12/6/06	BL STREAM -2	11.09	477.40	10	20	6.7
12/13/06	IN-1-12:30	8.11	200.93	20	25	6.2
12/13/06	IN-2-12:30	22.43	136.53	20	20	6
12/13/06	OUT-1-12:30	20.23	160.40	15	10	6
12/13/06	OUT-2-12:30	19.87	253.96	10	10	6
12/13/06	STREAM-1-12:30	8.64	446.32	20	30	6.2
12/13/06	STREAM-2-12:30	14.51	456.08	25	25	6.2

Date Collected	Site Name	SS mg/L	NO3+NO2 µg/L	Total Hardness gpg	Total Alkalinity ppm	pH
12/19/06	BL IN -1	15.51	119.38	10	15	6.4
12/19/06	BL IN -2	15.33	89.17	10	10	6.3
12/19/06	BL OUT -1	20.71	98.58	15	15	6.5
12/19/06	BL OUT -2	18.71	84.38	10	15	6.6
12/19/06	BL STREAM -1	20.17	219.48	10	15	6.6
12/19/06	BL STREAM -2	12.77	367.17	10	10	6.7
1/5/07	IN -1-4:45	1.50	3817.44	40	40	6.8
1/5/07	IN-2-4:45	1.89	367.26	25	15	6.3
1/5/07	OUT-1-4:45	12.73	233.40	10	10	6.2
1/5/07	OUT-2-4:45	14.46	226.24	10	10	6.2
1/5/07	STREAM-1-4:45	15.00	364.03	180	250	6.9
1/5/07	STREAM-2-4:45	14.03	371.33	10	10	6.4

Statistics

BASELINE	Suspended Solids	Nitrites & Nitrates	Total Hardness	Total Alkalinity	pH
Mean Baseline Sample	14.01	252.90	11.25	13.75	6.52
Mean Precipitation Sample	12.78	586.16	32.08	37.92	6.28
Variance Baseline Sample	17.43	18701.19	5.11	14.20	0.04
Variance Precipitation Sample	45.10	1047021.55	2247.54	4556.63	0.09
Observations Baseline Sample	12.00	12.00	12.00	12.00	12.00
Observations Precipitation Sample	12.00	12.00	12.00	12.00	12.00
Pearson Correlation	-0.09	-0.26	-0.20	0.16	0.02
Hypothesized Mean Difference	0.00	0.00	0.00	0.00	0.00
df	11.00	11.00	11.00	11.00	11.00
t Stat	0.52	-1.08	-1.51	-1.25	2.33
P(T<=t) one-tail	0.31	0.15	0.08	0.12	0.02
t Critical one-tail	1.80	1.80	1.80	1.80	1.80
P(T<=t) two-tail	0.62	0.30	0.16	0.24	0.04
t Critical two-tail	2.20	2.20	2.20	2.20	2.20

Results

- After a rainfall, the pollution and ions increased, while the pH decreased significantly.
- The greatest concentration of pollution was at sites 1 and 2, where runoff water entered the pond, the least was where the water exited the pond, effluent sites 1 and 2, even though the differences were not significant.
- Site 1, where the runoff water entered the pond, had about ten times more nitrites and nitrates than any other sample. It also had greater hardness and alkalinity.
- The first stream site had a dramatic rise of hardness, alkalinity, and pH on January 5, 2007.
- The stream had the highest concentration of suspended solids, followed by Sites E1 and E2.
- More precipitation samples are needed.

The Effect of Suburban Retention Ponds on the Concentration of Polluted Runoff

Eric Luibrand

Under the direction of Dr. JoAnn Burkholder

January 20, 2007

Critical Question

- Are suburban retention ponds effective at reducing the amount of pollutants entering streams as they are designed to do?

Retention Ponds

- Man-made ponds in residential areas designed to reduce pollutants
- Drainage from neighborhoods flows into the ponds
- The pollution settles and is absorbed by aquatic plants
- The water than leaves the pond and enters a stream

The Tested Retention Pond

Procedure

- Collect water samples approximately an hour and a half into a rainfall to identify the spate.
- Collect baseline samples so that the spate will have something to be compared to.
- Test the samples collected for the indicator pollutants of nitrites and nitrates, ions contributing to hardness, alkalinity, and pH will also be tested.
- Compare results from baseline samples and rainfall samples to determine if the retention pond is a effective.

Baseline Sample

- A sample taken when there had been no precipitation events for at least one week.
- Baseline samples were taken in order for the precipitation events to be compared to, so that the size of the spate may be determined.
- This will also help to determine if the retention pond is effective when there has been a rainfall or if there has not.

Details on Procedures

- Collect two samples from each of three locations by submerging the top of a nalgene bottle.
- Two samples were collected from the two feeder concrete culverts running into the pond.
- Two additional samples were taken from the area where the water left the pond and entered the stream.
- The last two samples were taken from the stream.

Testing Pictures

Statistical Results

Date		SS	NO3+NO2	Total Hardness	Total Alkalinity	pH
Collected	Site Name	mg/L	µg/L	gpg	ppm	
12/6/06	BL IN - 1	11.70	278.83	15	10	6.2
12/6/06	BL IN - 2	12.80	274.42	10	10	6.2
12/6/06	BL OUT - 1	11.60	285.39	10	15	6.6
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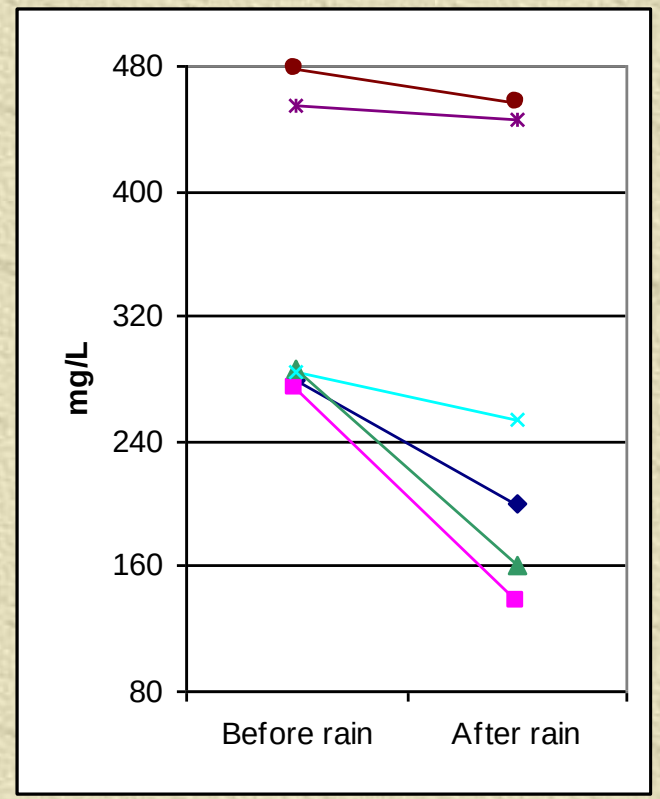
12/6/06	BL STREAM -1	6.96	455.54	15	20	6.7
12/6/06	BL STREAM -2	11.09	477.40	10	20	6.7
12/13/06	IN-1-12:30	8.11	200.93	20	25	6.2
12/13/06	IN-2-12:30	22.43	136.53	20	20	6
12/13/06	OUT-1-12:30	20.23	160.40	15	10	6
12/13/06	OUT-2-12:30	19.87	253.96	10	10	6
12/13/06	STREAM-1-12:30	8.64	446.32	20	30	6.2
12/13/06	STREAM-2-12:30	14.51	456.08	25	25	6.2

Statistical Results

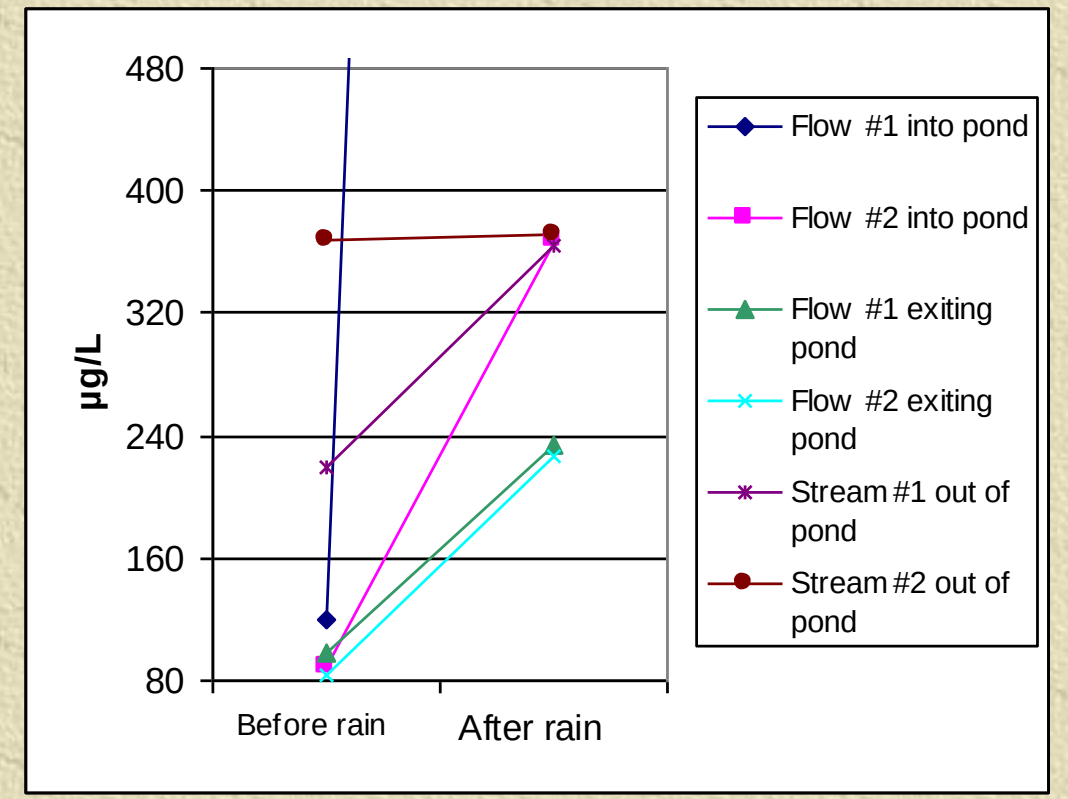
Suspended Solids

Base Line		***Precipitation***	
Mean	14.01	Mean	12.78
Standard Error	1.21	Standard Error	1.94
Median	12.79	Median	14.25
Mode	#N/A	Mode	#N/A
Standard Deviation	4.17	Standard Deviation	6.72
Sample Variance	17.43	Sample Variance	45.10
Kurtosis	-0.57	Kurtosis	-0.52
Skewness	0.31	Skewness	-0.44
Range	13.75	Range	20.93
Minimum	6.96	Minimum	1.50
Maximum	20.71	Maximum	22.43
Sum	168.15	Sum	153.40
Count	12.00	Count	12.00

Statistical Graph Nitrites & Nitrites



1st Set



2nd Set

Interpreting the Results

- After a rainfall, the pollution and ions increased, and the pH decreased.
- The most pollution was where the runoff water entered the pond, the least was where the water exited the pond, and the stream was in between.
- The first site where the runoff water entered the pond had about ten times more nitrites and nitrates than any other sample. It also had a more hardness and alkaline ions and a higher pH. This was on January 5, 2007.
- The first stream site had a dramatic rise of hardness, alkalinity, and pH on January 5, 2007.

Problems Encountered

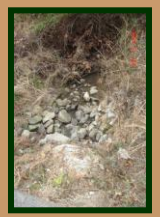
- At first I had only collected from the stream in order to determine the spate. After consulting with Dr. Burkholder, I changed my process to testing the spate and testing the effectiveness of the retention ponds.
- I could not collect samples during school hours or late at night.
- I did not collect samples if there had been rain within a week in order to make each event as independent as possible.
- The test strips I used were meant to measure only large quantities of pollutants so the results would usually show a zero, so I had to change which pollutants I would measure.

Conclusions and Implications

- **The suburban retention pond is effective at reducing the amount of pollutants. entering the stream. Trash was also prevented from entering the stream.**

An Analysis of Rain Water Runoff Using City Green

Question: Is there a difference in pollution amounts immediately after, 24 hours after and 48 hours after a rain event in a suburban retention pond and stream?



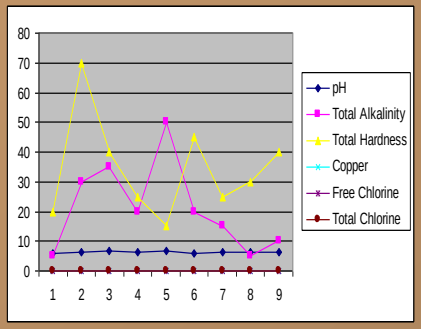
Procedure:

•For every significant rainfall, water samples were collected after 24 and 48 hours by submerging a nalgene bottle into the water source.

•Test water samples with test papers used to identify the quantitative value of pollutants per sample. (Carolina Biological 9 Factor Water Test Kit)

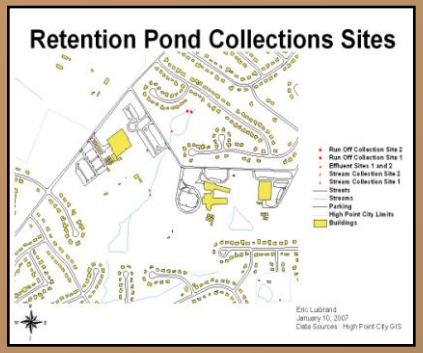
Data

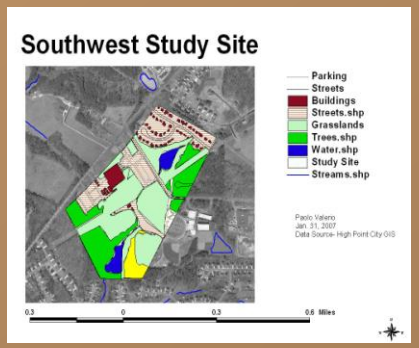
Date	Precipitation	Hour	pH	Total Alkalinity	Total Hardness	Copper	Free Chlorine	Total Chlorine
10/22/2006	.11 inches	initial	5.7	5	20	0	0	0
10/23/2006	.12 inches	24	6.4	30	70	0.05	0	0
10/24/2006	.11 inches	48	6.8	35	40	0	0	0
10/28/2006	.35 inches	24	6.2	30	25	0	0.1	0.1
10/29/2006	.35 inches	48	6.8	50	15	0	0	0.1
11/10/2006	.83 inches	24	6.1	30	45	0	0	0
11/5/2006	.83 inches	48	6.2	35	25	0	0	0
11/17/2006	1.77 inches	24	6.4	5	30	0	0	0.1
11/18/2006	1.77 inches	48	6.5	10	40	0	0	0



Analysis

pH		Total Alkalinity		Total Hardness		Copper		Free Chlorine		Total Chlorine	
Mean	6.344	Mean	21.11111111	Mean	34.444	Mean	0.005555556	Mean	0.011111	Mean	0.033333
Standard Error	0.116	Standard Error	4.986548852	Standard Error	5.5556	Standard Error	0.005555556	Standard Error	0.011111	Standard Error	0.016667
Median	6.4	Median	20	Median	30	Median	0	Median	0	Median	0
Mode	6.4	Mode	5	Mode	25	Mode	0	Mode	0	Mode	0
Standard Deviation	0.347	Standard Deviation	14.95363204	Standard Deviation	16.667	Standard Deviation	0.016666667	Standard Deviation	0.033333	Standard Deviation	0.05
Count	9	Count	9	Count	9	Count	9	Count	9	Count	9





The main focus was to be able to catch spates each time it rained. Spates are important because they contain the bulk of runoff material which were used to identify the concentration of pollutants in the study. Pollution concentrations increased over time.

The Effect of Temperature on the Frequency of Mallet Instruments

How does change in temperature effect the sound produced by mallet instruments?
In what aspects is that change detrimental to the band's overall sound, in regards to the four basic elements of music?

Basis of Western Music

•Western music is arranged in half-steps throughout an octave.

•In Hertz, the relation between half steps is defined as Frequency + (12^{th}root of 2)*(Frequency)

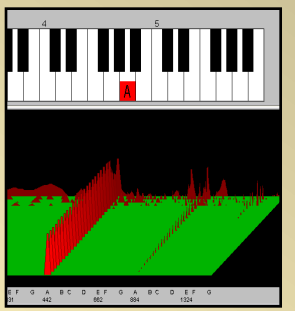
•After twelve half-steps the frequency is doubled producing a note one octave higher

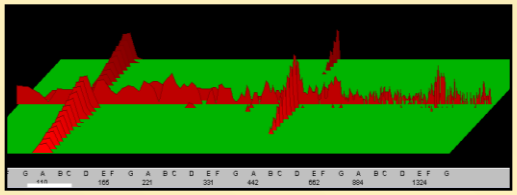
Procedures

•Materials: digital thermometer, instrument bars from the bells, marimba, xylophone, and vibraphone
• Each bar is suspended on its own rack – Bars tested in same order – Marimba, xylo, vibes, bells
• A quiet room was climate controlled to 24°C – Testing 3/day Sounds recorded using Post Code Modulation (PCM - 22.050 kHz, 16 Bit, Mono, 43kb/s) format – basis of .wav file
• Standing freezer was brought to warmest setting(8°C) thermometer suspended from the center testing 2/day
• Freezer lowered to -7°C same sampling methods used as described above

Results

5 cents between half-steps is significant
This creates destructive interference
The goal is to create constructive interference
Bells → **3.1** and **7.3** cents
Vibraphone → **6.3** and **16.5** cents
Xylophone → **2.3** and **4.3** cents
Marimba → Fundamental pitch displacement





Raw Data for Frequency and Temperature

Tempurature 24°C			
Marimba	Xylophone	Vibraphone	Bells
221.5Hz	443Hz	440Hz	884Hz
221.6Hz	442.8Hz	440Hz	884Hz
221.4Hz	442.8Hz	440.2Hz	883.5Hz
220.9Hz	442.5Hz	440Hz	884Hz
221.8Hz	442.8Hz	440Hz	885Hz
221.1Hz	442.5Hz	440.2Hz	883.5Hz
221.9Hz	442.3Hz	440.2Hz	884Hz
221.3Hz	442.3Hz	440Hz	883.5Hz
221.6Hz	442.8Hz	440Hz	884Hz
221.3Hz	442.8Hz	440Hz	884Hz
220.9Hz	442.8Hz	440Hz	884Hz
221.8Hz	443Hz	440.2Hz	883.5Hz
221.1Hz	442.3Hz	440Hz	884Hz
221.5Hz	442.5Hz	440Hz	884Hz
221.6Hz	442.8Hz	440Hz	884Hz

Tempurature 8°C			
Marimba	Xylophone	Vibraphone	Bells
111Hz	443Hz	441Hz	885.5Hz
110.5Hz	443.3Hz	441.7Hz	885.5Hz
110.6Hz	443.3Hz	441.7Hz	885.5Hz
110.7Hz	443Hz	441.7Hz	885Hz
110.7Hz	443.4Hz	441.7Hz	885.5Hz
110.4Hz	443.4Hz	441.7Hz	885.5Hz
110.6Hz	443.3Hz	441.7Hz	885.5Hz
110.6Hz	443Hz	441.5Hz	885.5Hz
110.6Hz	443.3Hz	441.7Hz	885.5Hz
110.6Hz	443.5Hz	441.7Hz	885.5Hz
110.4Hz	443.3Hz	441.7Hz	885Hz
110.7Hz	443Hz	441.7Hz	885.5Hz
110.7Hz	443.3Hz	441.7Hz	885.5Hz
110.4Hz	443.5Hz	441.7Hz	885.5Hz
110.6Hz	443.4Hz	441.7Hz	886Hz

Tempurature -7°C			
Marimba	Xylophone	Vibraphone	Bells
111.1Hz	443.8Hz	444Hz	887.6Hz
110.9Hz	444Hz	444.3Hz	887.6Hz
111.1Hz	443.8Hz	444Hz	887.6Hz
110.1Hz	444Hz	444.3Hz	887.6Hz
443.3Hz	443.8Hz	444.3Hz	887.6Hz
110.9Hz	443.8Hz	444.3Hz	887.6Hz
443.3Hz	443.8Hz	444Hz	887.6Hz
110.9Hz	444Hz	444.3Hz	887.6Hz
110.9Hz	443.8Hz	444.3Hz	887.6Hz
110.8Hz	443.8Hz	444Hz	887.6Hz
110.9Hz	443.8Hz	444.3Hz	887.6Hz
443.5Hz	443.8Hz	444Hz	887.6Hz
443.5Hz	443.8Hz	444.3Hz	887.6Hz
443.5Hz	443.8Hz	444Hz	887.6Hz
110.9Hz	443.8Hz	444.3Hz	887.6Hz

Anova: Single Factor - Bells

SUMMARY

Groups	Count	Sum	Average	Variance
Bells	15	13259	883.93	0.1381
Bells	15	13282	885.47	0.05238
Bells	15	13314	887.6	5.5E-26

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	101.73	2	50.867	801.15	**3.57E-34**	3.2199
Within Groups	2.6667	42	0.0635			
Total	104.4	44				

Anova: Single Factor - Vibraphone

SUMMARY

Groups	Count	Sum	Average	Variance
Vibraphone	15	6601	440.053	0.0084
Vibraphone	15	6625	441.64	0.034
Vibraphone	15	6663	444.18	0.0231

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	130	2	64.9962	2975.8	**5.71E-46**	3.2199
Within Groups	0.917	42	0.02184			
Total	130.9	44				

Anova: Single Factor - Xylophone

SUMMARY

Groups	Count	Sum	Average	Variance
Xylophone 24	15	6640	442.67	0.05952
Xylophone 8	15	6649	443.27	0.03238
Xylophone -7	15	6658	443.84	0.00686

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	10.33	2	5.1636	156.849	**3.28E-20**	3.2199
Within Groups	1.383	42	0.0329			
Total	11.71	44				

Anova: Single Factor - Marimba

SUMMARY

Groups	Count	Sum	Average	Variance
Marimba 24	15	3321	221.42	0.10029
Marimba 8	15	1659	110.607	0.02352
Marimba -7	15	3326	221.707	26334.1

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	123114	2	61557.2	7.01262	**0.00236**	3.22
Within Groups	368679	42	8778.06			
Total	491793	44				

Final Conclusions

Temperature change makes mallet instruments resonate at higher frequencies, which is opposite of the band's trend

Temperature change has greater impact in a group situation than in a solo setting

Limit or remove mallet performance in temperatures less than 10°C

Except for Xylophone and exposed or necessary mallet sections

Problems → Minor software problems - Minor format incompatibilities - Band missing all of the mallet's A's
Future Project Improvements → Use an industrial freezer - Test more notes and temperatures, particularly warmer temperatures Attain instruments made from different materials

The Effect of Temperature on Frequency of Sound for Mallet Instruments

Kyle O'Donnell

Southwest Guilford High

Under the direction of Kyoshia Carter, SWGHS

January 20th, 2007

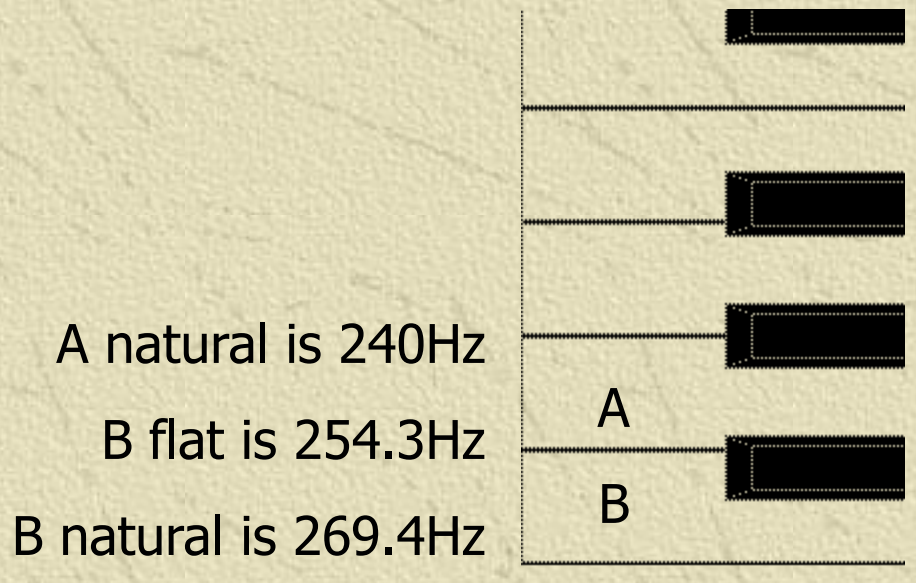
Research Question

- How does change in temperature affect the sound produced by mallet instruments?
  - In what aspects is that change detrimental a marching band's overall sound, in regards to the four basic elements of music?

Four Basic Elements of Music

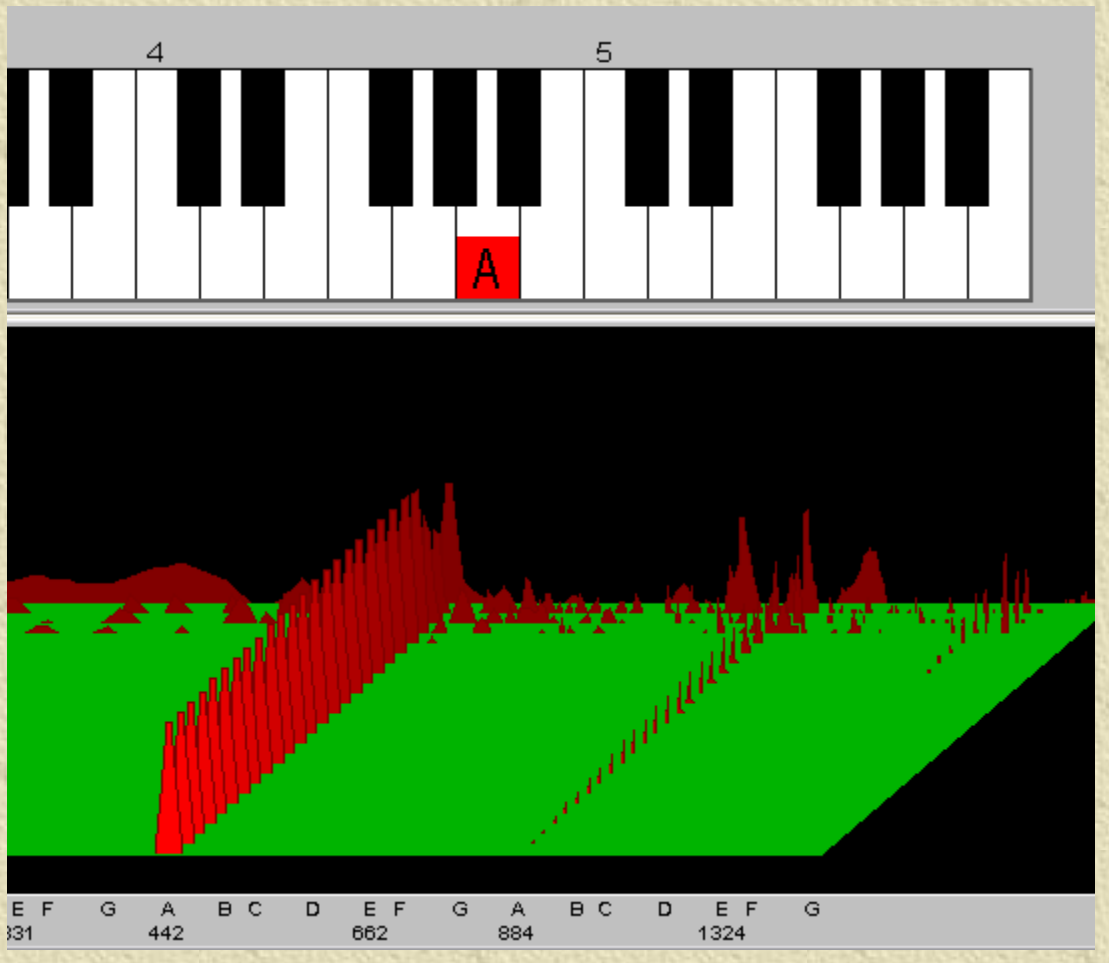
- **Tone** – Pitch or frequency
- **Intonation** – Relation between different notes or pitches, specifically harmony
- **Balance** – Appropriate volume for number of musicians and part
- **Blend** – Intersectional tuning and phrasing

Example



- When one note is played overtones, frequencies an octave or two above the fundamental pitch, are produced.

Overtone



How is Sound Produced on Mallet Instruments?

1. Cells release energy from chemical bonds
2. Energy translates into movement
3. The mallet falls, striking a bar
4. The force causes the bar to resonate at a predetermined frequency
5. The resonating bar produces sound waves

Procedures

- Materials: digital thermometer, instrument bars from the bells, marimba, xylophone, and vibraphone
- Each bar is suspended on its own rack – Bars tested in same order – Marimba, xylo, vibes, bells
- A quiet room was climate controlled to 24°C – Testing 3/day Sounds recorded using Post Code Modulation (PCM - 22.050 kHz, 16 Bit, Mono, 43kb/s) format – basis of .wav file
- Stand-alone freezer was brought to warmest setting (8°C) – thermometer suspended from the center – testing 2/day twi
- Freezer lowered to -7°C same sampling methods used as described above

Results - Bells

Mean frequency for each temperature and cents change.

- 24°C → 883.9Hz (Standard)
- 8°C → 885.5Hz (3.1 cents)
- -7°C → 887.6Hz (7.2 cents)

- P-Value → 3.57E-34 *Statistically significant changes in frequency

Bells – Analysis

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Bells	15	13259	883.9333333	0.138095238
Bells	15	13282	885.4666667	0.052380952
Bells	15	13314	887.6	5.53916E-26

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	***P-value***	*F crit*
Between Groups	101.7333333	2	50.86666667	801.15	**3.57E-34**	3.219942293
Within Groups	2.666666667	42	0.063492063			
Total	104.4	44				

Results - Vibraphone

- Mean frequency for each temperature and cents change.

- 24°C → 440Hz (Standard)
- 8°C → 441.6Hz (6.3 cents)
- -7°C → 444.2Hz (16.2 cents)

- P-Value → 5.71E-46 *Statistically significant changes in frequency

Vibraphone – Analysis

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Vibraphone	15	6600.8	440.0533333	0.008380952
Vibraphone	15	6624.6	441.64	0.034
Vibraphone	15	6662.7	444.18	0.023142857

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	129.9924444	2	64.99622222	2975.844477	5.71027E-46	3.219942293
Within Groups	0.917333333	42	0.02184127			
Total	130.9097778	44				

Results - Marimba

- Mean frequency for each temperature and cents change.

- 24°C → 221.4Hz (Standard)
- 8°C → 110.6Hz (-866 cents)
- -7°C → 443.4Hz (1735.4 cents)
  111.1Hz (-862.2 cents)

- P-Value → .0024 *Statistically significant changes in frequency

Marimba – Analysis

Anova: Single Factor

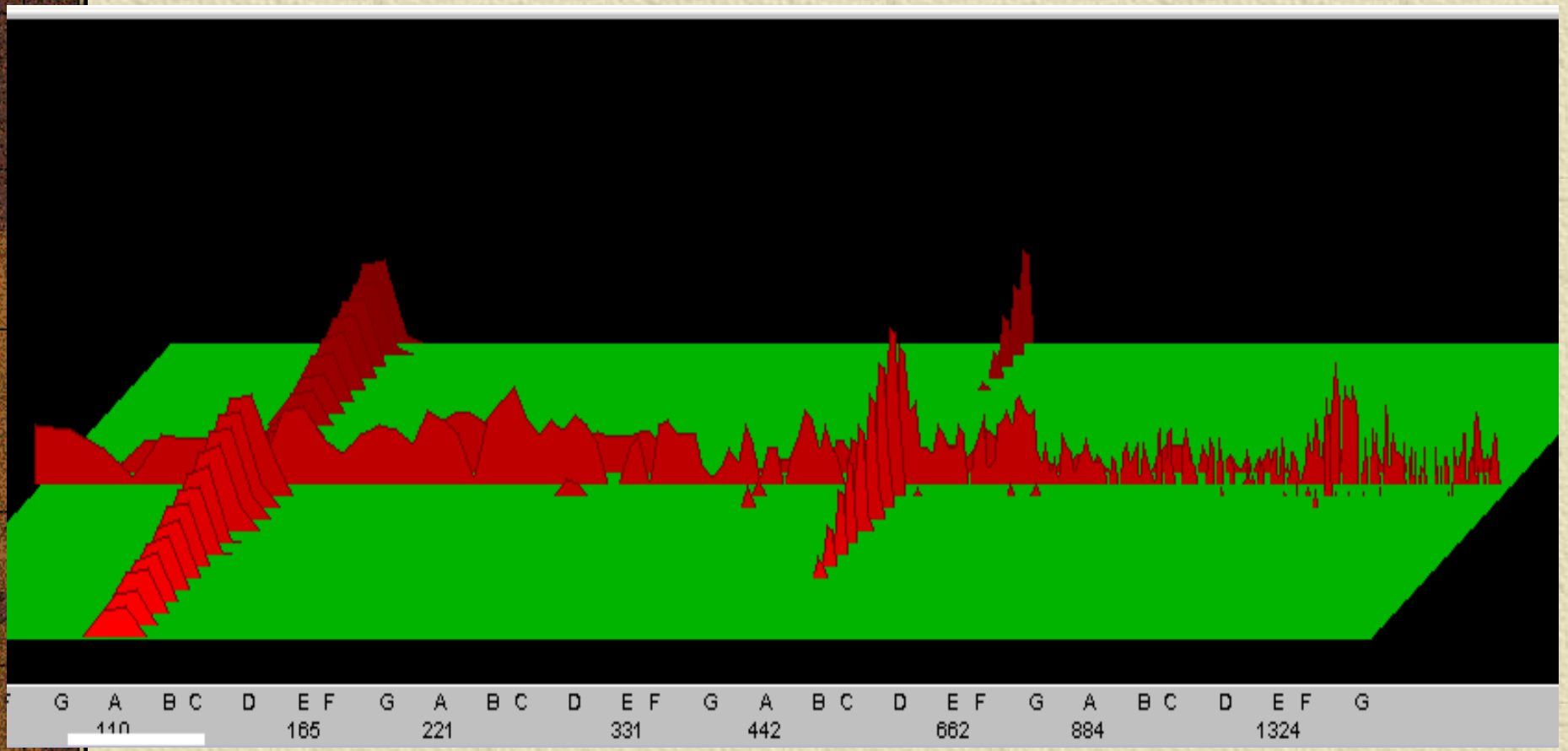
SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Marimba 24	15	3321.3	221.42	0.100285714
Marimba 8	15	1659.1	110.6066667	0.02352381
Marimba -7	15	3325.6	221.7066667	26334.05495

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	123114.4351	2	61557.21756	7.01262243	0.002356004	3.219942293
Within Groups	368678.5027	42	8778.059587			
Total	491792.9378	44				

Marimba – In Depth Analysis



Importance of Results

- 5 cents between half-steps is significant
  - Creating destructive interference
  - Goal is to create constructive interference
- Bells → 3.1 and 7.3 cents
- Vibraphone → 6.3 and 16.5 cents
- Xylophone → 2.3 and 4.3 cents
- Marimba → Fundamental pitch displacement

Impact on Basic Elements of Music

- Tone – Considerable impact
- Intonation
  - Instruments by themselves the intervals between notes are similar, although pitches are skewed
  - Cross-sectional cords with mallets will be compromised
- Balance – Unaffected
- Blend - Altered

Problems

- Minor software problems
- Minor format incompatibilities
- Band missing all of the mallet's A's

Future Project Improvements

- Use an industrial freezer
- Test more notes and temperatures- particularly warmer temperatures
- Attain the same instruments made from different materials

Final Conclusions

- **Temperature change makes mallet instruments resonate at higher frequencies, which is opposite of the band's trend.**
- **Temperature change has greater impact in a group situation than in a solo setting**
- **Limit or remove mallet performance in temperatures less than 10°C**
  - **Except for Xylophone and exposed or necessary mallet sections**

Benefits for Students

- Good preparation for college
- Good preparation for business
- Gives students the opportunity to present at professional conferences
- Gives students the opportunity to compete in academic settings
- Gives students insight into careers
- Builds confidence

Benefits for Learning

- Increases organizational skills
- Enhances process skills
- Improves writing skills
- May be interdisciplinary
- Requires creativity
- Improves visual/spatial thinking skills
- Improves communication skills

Establish Partnerships

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NC Environmental Science and Education Resources

file:///Users/irawhitaker/Desktop/edresources.htm

Google

Drudge Broadway.com Fox News Rush AppleCare Apple – Support .Mac Login Pogo My Yahoo! Yahoo!

Environmental Education Resource Database

For one-stop shopping for environmental education resources in North Carolina, check out the Environmental Education Resource Database. Search this comprehensive database for the very best in environmental education professional development opportunities, field trips, outreach programs, grants and contests and awards.

EE and Student Achievement	HOT TOPIC : Global Climate Change
The Office of EE has compiled a body of research affirming the connection between environmental education and improvements in student behavior and academic achievement.	Global climate change is a hot topic these days. As an educator, as a parent, or as a concerned individual, it can be difficult to know where to go for balanced, quality information. Our Global Climate section is meant to highlight high quality learning resources as well as share global climate change-related news stories.
EE Lesson Plans	**Schools in the News**
Trying to find environmental education lesson plans? Check out Learn NC and type "environmental education" into their lesson plan search engine!	Click here for the latest news about environmental education happenings in North Carolina's schools!
High School Graduation Project Support	**Grants for EE projects**
Coming Soon!	Funding opportunities to get your environmental education program or project off the ground can be found here.
EE Bibliography	**Professional Development**
This environmental education bibliography features catalogs, audio cassettes, books, series, periodicals, videos, web sites, and activity guides. Entries listed in the	Check out the Events Calendar for the latest professional development opportunities across the state. Click here for more information regarding the NC EE Certification Program. It's a great

Resources for Science Projects

- **Science Project Ideas, information and support for Science Fair ...**
  www.**scienceproject**.com/
- **Science Fair Projects - Project Ideas Demonstrations and Instructions**
  chemistry.about.com/od/**science**fair**project**s/**Science**_Fair_**Project**s.htm
- **Agricultural Ideas for Science Fair Projects**
  www.ars.usda.gov/is/kids/fair/**ideas**.htm
- **Cool Science Fair Project Ideas and Science Fair Projects**
  sciencepage.org/scifair.htm
- **Nexus Research Group - Science Fair Main page**
  www.nexus**research**group.com/**science**_fair/sci_fair.htm
- **Science Projects**
  www.infoplease.com/homework/sci**project**sfaq.html
- **Research Project Ideas: Applying Science to Sustainablity**
  www.ithaca.edu/faculty/sallen/Sustainability/**research**.html
- **Neuroscience For Kids - science fairs**
  faculty.washington.edu/chudler/fair.html
- **Genomics Interest Area**
  www.**science**buddies.org/mentoring/**project_ideas**/home_Genom.shtml?from=Home