

# David Strength

 [projects.vrac.iastate.edu/REU2013/](http://projects.vrac.iastate.edu/REU2013/)

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## Final Presentations and Final Thoughts

Posted on [August 2, 2013](#) by [strength](#)

I can't believe today was the last day... All of our diligent work throughout the summer culminated today in a poster symposium for all of the REU sites hosted by ISU. We fielded questions from interested students and faculty, and I gained valuable experience in presenting research to a diverse audience from different educational backgrounds and perspectives. I also discovered that more learning occurs when someone challenges your work. Although the summer program is over, our group intends to continue research and development so that our tutor can be deployed in two thermodynamics classes of 80 students each this fall semester. At that point, we can begin collecting data related to the effectiveness of our instructor's pedagogical approach and our tutor's interface and logic. Based on our preliminary results from our research this summer, we are optimistic about the positive impact this tool will have on future engineering students.

We are all extremely fortunate to have been a part of the SPIRE-EIT program this summer. The faculty, staff, and mentors are all friendly, helpful, and caring, and the research conducted here continues to amaze me. I thoroughly enjoyed our series of luncheon lectures, which featured presentations by HCI faculty and graduate students that covered a broad variety of HCI topics. These lectures, a journal club, and research "how-to" talks opened my eyes to an alternate and exciting world of research that I can pursue upon graduation. I applied to this REU because of its unique focus on interdisciplinary teamwork and education including crash courses in graphics, modeling, and research, and the program exceeded my expectations. This REU is truly special, and I would recommend it to any capable student wishing to explore the evolving boundary between humans and technology.

I will greatly miss everyone at VRAC and my incredible fellow interns who together made this summer an unforgettable experience.

## The Storm before the Storm

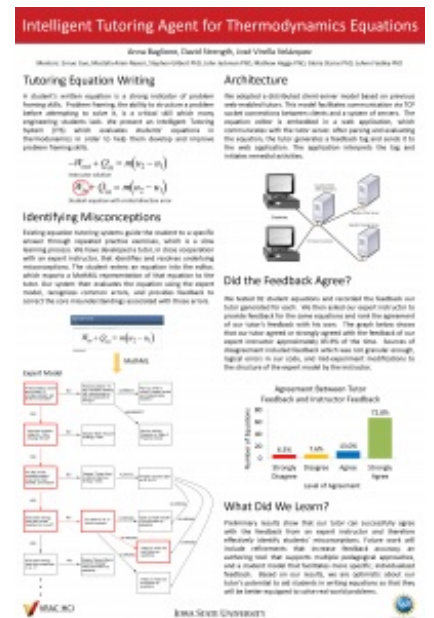
Posted on [August 2, 2013](#) by [strength](#)

I was hoping today would be the calm before the storm, but that wasn't the case at all. Throughout the day I juggled practice poster sessions, a post-summer focus group, a survey, finishing the demo, revising the paper, transferring files, and saying early goodbyes. Tomorrow will be even more hectic with our real poster presentations, video interviews, cleaning, and packing. This week really has been a sprint, and it's showing no signs of slowing down until the very end.

## Another Informative Graduate School Talk

Posted on [July 31, 2013](#) by [strength](#)

I met with Stephen today to discuss the graduate school path. I expressed my interests in games, learning, and audio engineering, and he directed me to several relevant resources including books, conferences, graduate programs,



The poster is titled "Intelligent Tutoring Agent for Thermodynamics Equations" and is authored by Steve Bagdasarian, David Strength, and Vivek Velupillai. It is presented at the 2013 IEEE International Conference on Systems, Man, and Cybernetics (SMC).

**Tutoring Equation Writing**  
A student's written equation is a strong indicator of problem-solving skills. Feedback helps the student to evaluate a problem before attempting to solve it. It is a critical skill for many engineering students, but it is often an overlooked area of research. This paper presents an intelligent tutoring system for teaching students to write equations. The system is designed to help them develop and improve their problem-solving skills.

**Architecture**  
The system is a distributed client-server model based on a process-oriented architecture. The model facilitates communication between the tutor and the student. The system is implemented in a web application, which communicates with the student's computer. After solving an equation, the system generates a feedback flag and sends it to the user's computer. The application interprets the flag and provides appropriate feedback.

**Identifying Misconceptions**  
Writing equation tutoring systems guide the student to a specific answer through repeated practice questions, which is a time-consuming process. We have developed a tutor that incorporates an expert model that identifies and corrects student misconceptions. The expert model is a rule-based system that requires a logical representation of the equation to be solved. Our system then analyzes the equation using the expert model, recognizes common errors, and provides feedback to correct the user's misunderstanding associated with those errors.

**Expert Model**  
The expert model is a rule-based system that identifies and corrects student misconceptions. It is implemented in a web application, which communicates with the student's computer. The expert model is a rule-based system that requires a logical representation of the equation to be solved. Our system then analyzes the equation using the expert model, recognizes common errors, and provides feedback to correct the user's misunderstanding associated with those errors.

**Did the Feedback Agree?**  
We tested the student equation and recorded the feedback our tutor generated. We then asked our expert model to provide feedback for the same equation and used the agreement of our tutor's feedback with the user. The graph below shows that our tutor agrees on average 80% and the feedback of our expert model is approximately 80% of the time. Because of the agreement between the feedback, we can generate more targeted advice in our GUI, and the expert model is used to provide feedback to the student of the expert model by the tutor.

**Agreement Between Tutor Feedback and Instructor Feedback**  
The graph below shows the number of equations that were agreed upon by the tutor and the instructor. The x-axis represents the level of agreement (Strongly Disagree, Disagree, Agree, Strongly Agree) and the y-axis represents the number of equations. The data shows that the tutor and instructor agree on approximately 12.5% of the equations.

**What Did We Learn?**  
Preliminary results show that our tutor can successfully agree with the feedback from an expert instructor and therefore effectively identify student misconceptions. Future work will include refinements that increase feedback accuracy, an emphasis on the student's problem-solving process, and a student model that focuses more on specific, individualized feedback. Based on our results, we are optimistic about our tutor's potential to aid students in solving equations so that they will be better prepared for future coursework.

and professors. This information will kick-start my graduate school application process, and I am deeply grateful for the kindness, generosity, and wisdom of the faculty at VRAC. I've been exposed to a new world this summer as well as a path I had not considered before. I'm glad I've had the opportunity to spend one summer in industry and another in research because the broader my perspective, the better prepared I am to discern my path upon graduation.

We proofed our poster this morning, so by now it's printed and ready to go. We worked on the demo for the remainder of the day, and we'll finish it tomorrow before the practice poster session. I think we're going to postpone adding audio to the demo video until after the program is over; playing audio during the poster session would draw attention away from us. After the audio is added, the video may be useful for explaining the tutor to future audiences in non-poster session environments.

## Design and Demo

Posted on [July 30, 2013](#) by [strength](#)

Our poster was sent to the printer today, so now we're turning our attention to the demo for Friday and the paper. This stage of the project demands a broad range of skills including design, data analysis, communication, and video editing, so we're having to wear several hats at once. On that note, I'm glad I'll be taking a principles of webpage design course this semester so that my design sensibilities can improve; design work has consumed the past few days. The demo for Friday will consist of a looping video that demonstrates the idea and functionality behind our tutor, so we'll be recording narration and stitching together corresponding text and images. Though we don't have much time left, we want to create an attractive video that effectively communicates the story of our project. Tomorrow will decide whether or not our vision for the demo is realized.

## The Kick of the Race

Posted on [July 30, 2013](#) by [strength](#)

I competed in cross-country during my freshman and sophomore years of high school, and I learned many lessons from that sport. One of those lessons was how to finish a race. The kick, or final stretch of the course, is the stage when you expend your last reservoirs of energy as you approach the finish line. The kick is always fast, exhausting, and memorable.

Welcome to week 10, the kick of the race.

Deadlines are swiftly approaching, and we must stay focused and productive to meet them. We received and analyzed our results, and our tutor's feedback agreed with our instructor's feedback 85.9% of the time. Our poster is finished, pending some feedback from our professor, and tomorrow we'll begin working on our demo. We have enough content for our paper, but it needs refining. If we have time, we'd like to revise portions of our code based on our results and run another set of experiments for the paper.

A strong race demands a strong finish, and our team will strive to make that happen.

## Super Smash Interns – Game Night

Posted on [July 26, 2013](#) by [strength](#)

Last night a group of interns and graduate students clashed in the conference room for the long-awaited video game night. After failing to system link two Xbox 360 consoles for a Halo LAN party, we migrated to Super Smash Bros. Brawl for the rest of the night. Playing games with friends is one of my favorite activities, so I'm glad I had the opportunity to play with the friends I've made here.

Jose, Sheneeka, and I led the final Journal Club session this morning. We discussed an article on accessibility for SBVI (Students who are Blind or Visually Impaired) in which a haptic glove is used to resolve deictic references by instructors. In other words, when teaching mathematics, instructors will point to a graph or diagram and say statements such as, "This point..." The glove guides the SBVI's hand to the corresponding location on a tactile graph in front of the student. Our guest was a graduate student who is blind, and he brought up several accessibility considerations when designing user interfaces. "What is universal design if not everyone can use it?"

We're planning to run our experiment this afternoon after refining our checks for rates problems.

## Lessons Learned

Posted on [July 25, 2013](#) by [strength](#)

Today we are still trying to refine our tutor's checks before conducting our experiment (hopefully later this afternoon). We are constrained by time because we need to obtain our instructor's feedback tomorrow afternoon in order to collect all of our results. After the results are collected, then we can write the paper and finish the poster before Monday. We continue to encounter bugs as we test equations, so we should have been testing more often during the development phase. I suppose this summer is meant to be a learning experience, and I'm certainly learning many lessons as we approach the end.

## Graduate School Talk and Etiquette Luncheon

Posted on [July 24, 2013](#) by [strength](#)

Thelma Harding, the Graduate College Program Coordinator, spoke with us yesterday during our luncheon lecture about the application process for graduate school, which was previously foreign to me. I now understand that the process requires significant budgeting of both time and money for research, travel, and application fees. Senior year is going to be especially challenging with upper-level courses, portfolio building, job applications, and graduate school applications. I want to keep as many options open as possible, so I plan to pursue both paths simultaneously and see what happens.

Today we attended an etiquette luncheon which taught us proper manners and conduct for formal dining in an interview or business trip setting. Etiquette can go a long way toward making a strong first impression, and I was surprised by the quantity of rules I didn't know or consider before. For example, there is a system of nonverbal communication with the servers that is completely based on utensil and dish location and orientation. Overall, I'm grateful that I was exposed to these rules before truly needing them, and now I'm prepared to tackle any formal dining situation with style.

## Preparation for Experiment

Posted on [July 23, 2013](#) by [strength](#)

A chain of deadlines is pulling us forward this week, and we must juggle several tasks if we hope to finish. We're debugging our checks while trying to predict unpredictable student input, which seems like a never-ending task; yet, we only have a couple of days to iron out the wrinkles in our system before we conduct our experiment. The expert instructor provided us with approximately 50 exams today with 2 problems each that provide 5 equations to test for each exam. Therefore, we have a healthy pool of 250 equations to feed our equation tutor and determine its effectiveness. We received feedback on our poster today from the problem framers group, so we'll update the poster while we write the paper this week.

## Lions, Tigers, and Bears, and Rhinos, and Interns, and Penguins, and Orangutans, and...

Posted on [July 22, 2013](#) by [strength](#)

Zebras, and Gorillas, and ... okay, I'll stop for now. I bet you can guess our weekend activity. That's right, we took a road trip to the Omaha Zoo! Home of the world's largest indoor desert and nocturnal exhibits as well as one of the largest indoor rainforest exhibits, the Omaha Zoo was a vast challenge for visitors. After extending our adventure by an hour, we still didn't have enough time to visit all of the exhibits within 5 hours. Thanks for letting me borrow this awesome picture, Anna!

This week we're striving to finish the implementation of our equation tutor by writing the final checks, adding code to our existing checks for robustness, and testing student equations. We need to conduct our experiment before the end of the week because our paper draft is due on Friday, and we need results to discuss. Besides coding, we're beginning to piece our paper together and prepare our tutor for integration within the XDraw application.



## Science Center + Scientists = Giddiness

Posted on [July 19, 2013](#) by [strength](#)

Today we were treated to a tour of the usability lab at the Principal corporate office and the Science Center of Iowa in downtown Des Moines. The former explained the process of conducting studies for website navigation and evaluating overall design, which is another example of HCI in industry. After leaving Principal, we stopped at Panera for a delicious lunch before venturing to the Science Center. We could barely contain our excitement (a constant chorus of giggles could be heard) as we entered the spacious building and soaked in the bright colors and imaginative exhibits. We were given a private tour of the center by the CEO and director as well as the chief program coordinator, and the excitement emanating from both as they spoke with us only added to our own. We were given behind the scenes tours of the IMAX projection system, animal care center, and the weather forecast in a sense (we all made cameos on the local network's weather report).

After the generous tours, we explored the sprawling exhibits which spanned physics, engineering, space, and nature. I was very impressed by the level of interaction offered by the various activities, the most popular of which being the rocket launch. Children and adults can build rockets using provided crafts and test their designs immediately using an air launcher which propels the rocket into a netted area with distance markers. After launching, participants can refine their designs to improve their performance, which encourages rapid prototyping, testing, and learning.

The Science Center reminded me that science is awesome, and I purposefully use that adjective here; the complex elegance of our universe is awe-inspiring and therefore worth studying. It's not every day that you have the chance to launch a rocket designed by yourself, appear on TV, pet two snakes, generate hydroelectric energy, watch the universe form on a sky dome, and play with nanoparticles in ferrofluid, so I want to extend my thanks to our program directors, coordinators, and mentors for creating such wonderful memories for us throughout this summer.

## Rutgers and UPENN Presentations

Posted on [July 19, 2013](#) by [strength](#)

Today we shared projects with the REU sites at Rutgers and UPENN over a Google hangout. Although these activities consumed most of the day, I enjoyed learning about the cognition and robotics research being conducted by these REUs. You can always learn something from watching others present, and I believe REU sites should foster more interaction and collaboration in the future. Sandwiched between presentations, our luncheon lecture informed us of Autism Spectrum Disorder (ASD) research and its importance in



today's society. A group of designers developed an iPad app which engages people with autism while teaching them letters and communication, and I was moved by the compassion and love these researchers have for their users. I realize that some businesses care more about their end users than money itself, but I feel that research typically doesn't treat money as the primary priority; rather, many researchers deeply care about others and the impact their work will have on society. That is a refreshing realization.

## Situated Cognition and Games

Posted on [July 17, 2013](#) by [strength](#)

Dr. Nadolny, a researcher of situated cognition, spoke to us during our luncheon lecture yesterday. Situated cognition is the idea that learning does not occur in a vacuum; the context, environment, and pedagogical method of the learning is tightly bound to the quality of cognition. Situated cognition encompasses a variety of topics, and Dr. Nadolny specifically researches augmented reality and educational games for the purpose of enriching education. I can envision myself entering this field of research because it combines my interest in developing games with the higher purpose of aiding students. Our educational system desperately needs improvement, and creating beneficial educational tools would contribute to that mission.

We've almost completed our first draft of the poster, and our presentation is updated for tomorrow. After practicing it a few times later today, we should be fine. We need to become accustomed to multitasking at this stage because we must juggle implementation tasks with research tasks such as drafting the paper.

## Poster Draft, Presentation Rebooted

Posted on [July 16, 2013](#) by [strength](#)

Our poster draft is beginning to take form, but we still lack images and decisions on fine details such as font, sizing, and color. The challenge is to tastefully and succinctly design our poster so that a passerby could gather the gist of our project without reading any of the fine text. Our images must simultaneously convey our message and describe our methods. We'll iron out the details tonight and update our midsummer presentation in preparation for our research exchange with REU programs at UPENN and Rutgers on Thursday. After meeting with John again, I resolved the error I was receiving while converting our equation editor to an ASP User Control. A User Control encapsulates a component, which allows that component to be reused and inserted into other projects like a cartridge, so now we can transfer the editor to John's client web application.

## Equation Editor Embedding Endeavor

Posted on [July 15, 2013](#) by [strength](#)

Stern faces crinkling from concentration stare intently at tiny laptop screens. Wires dangling from earbuds sway

Stem faces blinking from concentration state intensity at any laptop screens. Wires dangling from carrels sway back and forth as heads bob to the beats. Fingers peck at keyboards furiously... pausing... back to the notebook... scribbling... back to typing. Welcome to week 8, the beginning of crunch time for our team. We've discovered that we're much more effective when each team member works alone on a different area of the project – we are introverts after all. Jose is writing the checks, Anna is solving the distribution property problem, and I'm transitioning our architecture to the actual server. Whenever we need guidance or another to bounce ideas off of, then we'll briefly interrupt one another because if we all try to tackle a problem at once, then the situation is akin to too many cooks in the kitchen.

We met with one of the problem framers to discuss the integration of our editor with the existing web application. I'll be stripping the png rendering functionality from the sample application below provided by the developers of MathFlow so that I can render student equations and store them in a database.

## Wheel-spinning and Conference Wrap-up

Posted on [July 13, 2013](#) by [strength](#)

Today was the official end of the AIED 2013 conference hosted in Memphis, TN. One of the key advantages that conferences offer is a group of experienced peers who can give you feedback or insight on your topic. For instance, we spoke with a gentleman who is developing an educational game for kindergarteners in Seoul, South Korea, and he pointed out the challenge of analyzing misconceptions. The origin of misconceptions might factor into a tutor's remedial potency

when comparing students who have been taught incorrectly versus students who have never been introduced to the material. Another advantage is a wide sample of presentation styles and personalities. I jotted down the aspects of presentations that I enjoyed as well as those that annoyed me. My favorite talk, whose corresponding paper was nominated for the best conference paper award, targeted wheel-spinning, a term coined to denote an unproductive and infinite loop in a tutoring system. If a student doesn't achieve "mastery" of a topic (in this case, answering three questions correctly in a row) after eight tries, then subsequent practice problems will not benefit the student. Worded another way, the student will never achieve mastery, regardless of the number of additional practice problems provided. This is the worst case scenario for a tutor, and not enough time and attention is devoted to this bottomless pit of a problem.

Tomorrow is the GIFT workshop, so I will end my post here and rest.

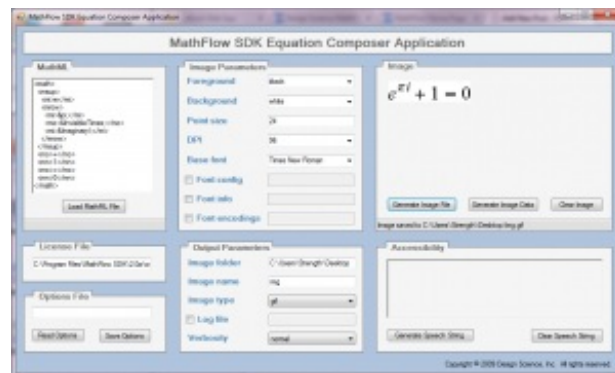
## Posters, Presenters, and Bears... Oh My! AIED 2013!

Posted on [July 12, 2013](#) by [strength](#)

In the hustle and bustle of packing and preparing yesterday, I failed to mention our field trip to John Deere. We were given an excellent factory tour of John Deere's Engine Works facility in Waterloo, which reminded me of the tour of the Nissan plant in my hometown. If you think factories are boring, then you've never toured one. They are magnificent marvels of mechanical, industrial, chemical, and other assorted flavors of engineering, and I always walk away impressed by the ingenuity of humankind.

Today has been quite eventful, so I'll give a brief rundown of my life in the past 21 hours:

- wake up at 3:00 am
- drive to airport
- fly to Atlanta (eastern time)



- fly to Memphis (back to central time)
- attend AIED (Artificial Intelligence in Education) conference from 12-5:30ish
- start blog
- attend banquet at Memphis Zoo
- watch sea lions perform
- eat fancy dinner in a lodge whose backyard is the grizzly exhibit
- finish blog (currently)

This is my first academic conference, and I'm so thankful that I'm able to experience this environment as an REU. After attending several interesting talks (e.g. affective analysis using keystrokes, finding the motivational sweet spot for game-based learning, tracing mind wandering, etc.), I was able to practice asking questions to presenters from a low-stress position. I'm somewhat overwhelmed by all the information I received today, so I need plenty of sleep to process it all (currently running on less than 4). Several of the talks tomorrow focus on educational games, an area of ITS I wish to explore further, so to say that I'm excited is certainly an understatement.

### **“Mr. Watson—come here—I want to see you.”**

Posted on [July 9, 2013](#) by [strength](#)

These are the first words spoken through the telephone by Alexander Graham Bell on March 10, 1876. Today we connected our equation editor to our equation tutor and established successful, significant communication, and I must have shared the same excitement as Mr. Bell when he first realized the success of his invention. Okay, so maybe our server communication isn't as exciting as the first words through the telephone... but still. For someone who's never touched web development, this moment is somewhat magical. We can now enter an equation into the equation editor, click submit, send the equation across the Web to a Java server, parse the equation, analyze the equation for errors, and send feedback back to the equation editor. Pretty neat. We met with the Problem Framers today and decided to deploy the equation editor in 1-2 weeks, which means we have a lot of refinements to code. I'm confident that we'll meet the deadline, though.



### **Ada Hayden Revisited and Parsing Progress**

Posted on [July 8, 2013](#) by [strength](#)

We had an enjoyable and long weekend in Ames that consisted of another visit to the beautiful Ada Hayden Heritage park, grilling, movies, and fireworks. Ada Hayden offered a multitude of unexplored paths and hills to climb that we missed out on during our first visit as a group. We discovered three secluded ponds in addition to the small lake at the park's entrance while walking the perimeter trail. The bridge was especially nice because it offered a cool

breeze during the heat of the day.

The pace is quickening as we enter week 7, but I feel that we're finally making progress on the core component of our project. We can parse MathML files into strings, but now we need to code the checks for these strings. My focus today is to link the equation editor to our tutor server.

## Preliminary Presentation Passed

Posted on [July 3, 2013](#) by [strength](#)

Although we weren't able to present to the UNC group due to technical difficulties, we still presented to our fellow REU groups and mentors. Everyone explained their problems and methods clearly so that I now have a solid perception of other projects and the challenges they present. For the remainder of the day, we will concentrate on parsing MathML into a string representation for (hopefully) easier analysis. I'm looking forward to the long weekend and the sleep it promises.



## Presentations

Posted on [July 2, 2013](#) by [strength](#)

A good presentation should tell a story. After receiving helpful feedback on our initial presentation from our mentors, we redesigned and restructured our slides to form a small narrative.

We hope our changes will engage our listeners and place them in the shoes of the students we aim to benefit. The audience needs a clear understanding of the problem we're addressing, why that problem is important, and how our methods will uniquely address those problems. We'll be presenting to fellow REU students and faculty from our site as well as the University of North Carolina Charlotte tomorrow.

## MathFlow Madness

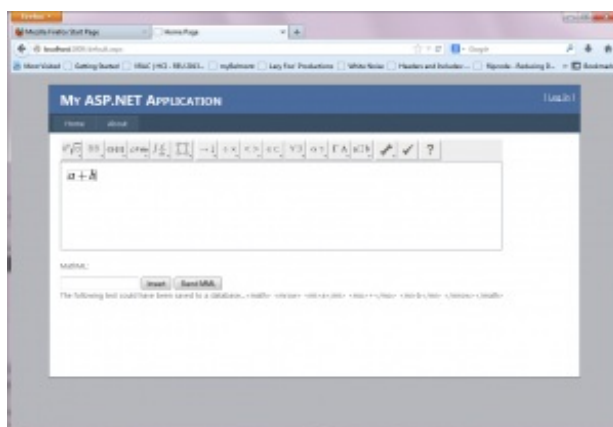
Posted on [July 1, 2013](#) by [strength](#)

We have access to the Mathflow SDK (Software Development Kit), but I've been struggling all morning to understand how the components work together. I managed to run a sample editor applet in Visual Studio using ASP.NET, but I'm not sure how to integrate the applet with our environment. Anna and Jose have been working on our check functions, but those depend on the exact MathML representation that MathFlow exports. Here's a screenshot of the simple editor:

## Ledges and Lion King

Posted on [June 29, 2013](#) by [strength](#)

We nailed down our tutor's feedback tree with our subject matter expert, which is a definite step forward for our project. We now know the types of checks we need to develop in the coming weeks as well as the feedback response for each student error. We're still wrestling with our frontend tool, Mathflow, which is supposed to facilitate the input of student equations. Hopefully we can quickly understand how to use the





Mathflow SDK and create an editor soon. Stress levels are rising as the scope of our project shifts and seemingly expands with every meeting.

Today we visited Ledges State Park, one of Iowa's first state parks, which is only twenty minutes away from Ames. Boasting beautiful bluffs and canyons, the area is a jewel in the otherwise flat land of Iowa. After trail hiking, rock skipping, and lunch munching, we ventured to a high outcrop overlooking the Des Moines River that resembled Pride Rock from the Lion King. Simply breathtaking.

"Look, Simba. Everything the light touches is our kingdom."

## Research Rally Caps

Posted on [June 28, 2013](#) by [strength](#)

Just finished the first draft of our literature review and three organic poptarts, though we've revised the format several times throughout the day. It's not perfect, but it will serve as a solid foundation for the remainder of the paper. Our next task is the methods paragraph in which we describe our tutor's architecture, input method, and feedback generation in enough detail so that our project could be repeated in the future.

Today was group photo day, and we tried our hand at the popular DBZ action shot for our photo finale. I'm taking the liberty of posting Paul's favorite shot.

Great form, Christian.

## Feedback Frenzy

Posted on [June 26, 2013](#) by [strength](#)

A literature review is an integral component of an academic paper. It sets the stage for your research similar to the way the setting of a story prepares the reader for an adventure. The literature review describes what other researchers have accomplished in your field, what methods they're leveraging, and what areas remain unexplored. Significant research addresses gaps within the literature surrounding a particular research topic. We're currently summarizing articles in anticipation for piecing our literature review together, which is due tomorrow. We're noting the various methods of student input, tutor feedback, and the architecture of existing tutor equations. Hopefully we can synthesize the best examples of each of these areas in order to build the most effective equation tutor.



## Can't See the Forest for the (XML) Trees

Posted on [June 25, 2013](#) by [strength](#)

Our team is currently focusing on understanding XML trees and how to effectively parse them for meaning. The equation tutor must not only detect errors in the tree representations of student equations, but it must also utilize context clues surrounding each error to categorize a student's misconceptions. We're having difficulty translating the above requirement into code because of inexperience with XML, and the large scope of the problem is slightly overwhelming. We need to divide the problem into manageable chunks in order to wade through the details; if you want to eat an elephant, you have to take one bite at a time.

Tonight we're focusing on our literature review and research question paragraph, as they are both due in the

following days.

## Farmer's Market, Final Models

Posted on [June 24, 2013](#) by [strength](#)

Farm fresh fun! That's the catch phrase I made up for Saturday's adventure, which swept us to downtown Des Moines before the rooster crowed. Okay, we didn't leave THAT early, but everyone was sleepy and relatively quiet when we staggered to the SUVs at 7 for departure. The closed streets were lined with multicolored tents with vendors marketing their goods which ranged from organic produce to breakfast burritos to barbecue to crab rangoon to jewelry to ... you get the idea. They had almost everything! We enjoyed listening to a variety of live music and appreciating the sheer number of dog breeds represented at the market. Good times...

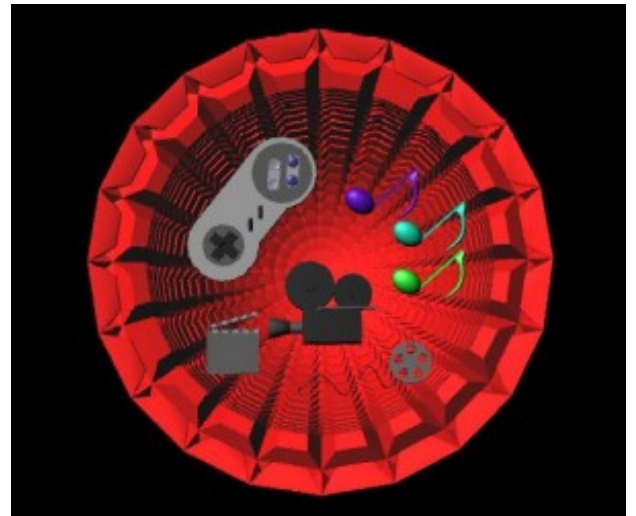
Today we presented our final Maya models, and once again I was impressed by the quality of models produced by the groups. The amount of improvement displayed by everyone in just a week is pretty amazing, and everyone seemed to enjoy the journey. Thanks, Ted!

Here's our final team crest model. Anna modeled the notes, Jose modeled the film equipment, and I modeled the SNES controller.

## SNES Crest

Posted on [June 22, 2013](#) by [strength](#)

Today was filled with our last modeling class, a journal club, and our fourth HCI session. In the midst of classes, I began modeling an SNES controller for my group's final modeling project. Each member of our group is creating a model that represents a hobby/passion, and then we will merge those models into a single crest that represents our group as a whole. I've enjoyed modeling subjects I'm interested in throughout the week, and this project is the perfect extension of the week's assignments. I find that I'm drawn to simpler, geometric modeling over more complex models; for example, I'm much happier with the spherical object in the background of my last post than I am with the more complicated pikmin model. Perhaps the reason is my desire for dimensions to be precise and shapes orderly as opposed to eye-balling proportions. Here's a screenshot of my progress so far. Also, for those of you interested, I was able to play with Google Glass for the first time today. First impressions: picture and video capture is neat; voice recognition needs improvement; awkward, upward nod turns the power on; most people assume humorous body language positions while using it.



## A Planet for a Pikmin

Posted on [June 20, 2013](#) by [strength](#)

We are approaching the end of our modeling class, so today I explored animation. I followed a tutorial for creating a landscape by warping a plane and applying the grass brush tool to the surface. After adding turbulence to the scene in the form of wind, I could animate the grass to sway, though extremely slowly. I still haven't figured out how to render an animated scene with a high frame rate (or any for that matter), but maybe I'll stumble upon the solution tomorrow. I also fixed some abnormalities with my pikmin model, adjusted proportions in the torso, and added emissive light to the core of another previous model which is displayed in the background.

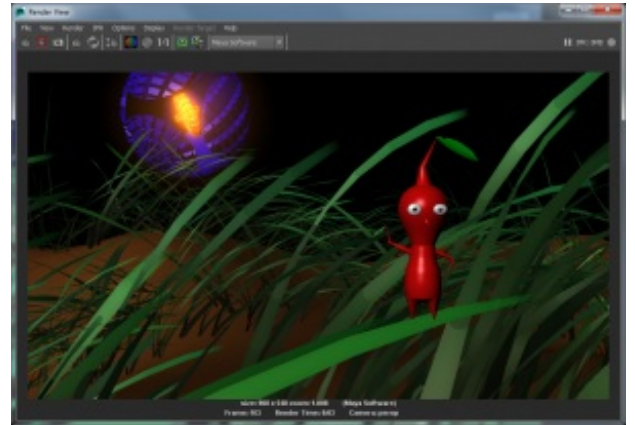


Our team attended a productive meeting with our mentors today. We set Monday as a deadline for coding a simple server and client program as well as a basic XML parser. Literature review is also due next week, so our team is picking up the pace to meet the oncoming challenges.

## Wild Pikmin Appears!

Posted on [June 19, 2013](#) by [strength](#)

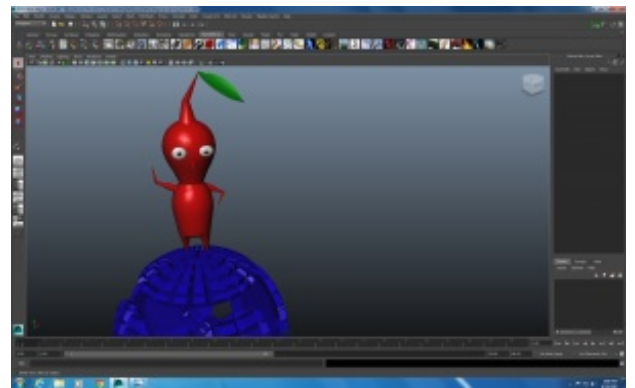
We had another great modeling class today, and our instructor, Ted, wrapped up the lesson by showing us some of his modeling work. I had no idea he made a living creating art for indie video games and other projects, and I even recognized some of the games and names of collaborators. The Scale game was particularly interesting, as its perspective concept promises a wealth of perplexing puzzles. Our task today was to model a character, and I chose a red pikmin from the Nintendo series, Pikmin. I possess many fond memories from playing Pikmin 2, so having a chance to model a character from that game using software that was probably used to make the original models is a neat experience.



## Sheep and Spaceships

Posted on [June 18, 2013](#) by [strength](#)

As you can see from others' posts, our Maya assignment involved creating a dinosaur or some other animal from a single cube using extrusions. Blocky animals caused me to think of Minecraft, so I created a sheep from that game and decided to display it along a spaceship structure I made during instruction. Fun fact: there was actually a game called Sheep in Space for the Commodore 64 which has players launch sheep to defend against an alien invasion. Makes sense.

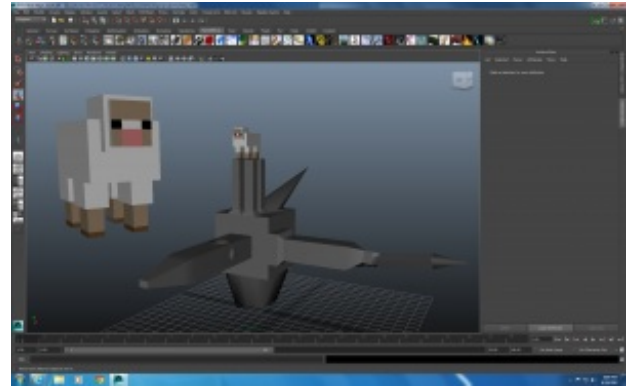


Our team will begin coding our tutor soon, and I'm looking forward to learning about servers and sockets.

## Meeting Maya and Calvin

Posted on [June 17, 2013](#) by [strength](#)

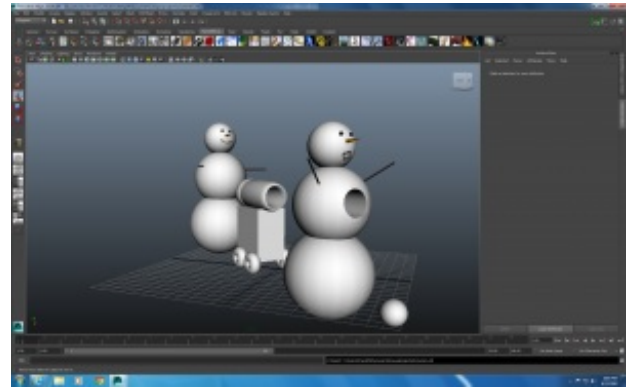
After a long weekend of coding, we presented our OpenGL projects today; games included 3D Pong, Balloon Burst, Bop It, and Minion Maze (I took the liberty of naming a couple of them). I'm very impressed with the complexity of each game and the quality of everyone's work. Bop It won first place with sound and sleek OpenGL models — great job, Cyber Sickness team! We began modeling class in Maya today, and our first assignment was a snowman scene. My mind immediately jumped to the Calvin and Hobbes comic books in which Calvin creates some very... atypical snowmen. I recreated one of my favorite snowmen scenes from those comics:



## Light at Last and Rafiki

Posted on [June 15, 2013](#) by [strength](#)

Teamwork makes the dream work. It's one of my favorite corny sayings, but today it was proven true once again; after group collaboration, we finally solved the diffuse light conundrum. Shading was not being applied properly because the light's properties needed to be specified every frame instead of initialized once at the beginning of the program. Although Liat was using multiple lights instead of one, she suggested moving the light's properties to another function. Dubious, I changed the code and eureka—shading! At that moment I experienced the same joy Rafiki felt when he realized that Simba was still alive in *The Lion King*. Hence, another life lesson was reiterated today: be open to suggestions... especially when you're out of ideas.

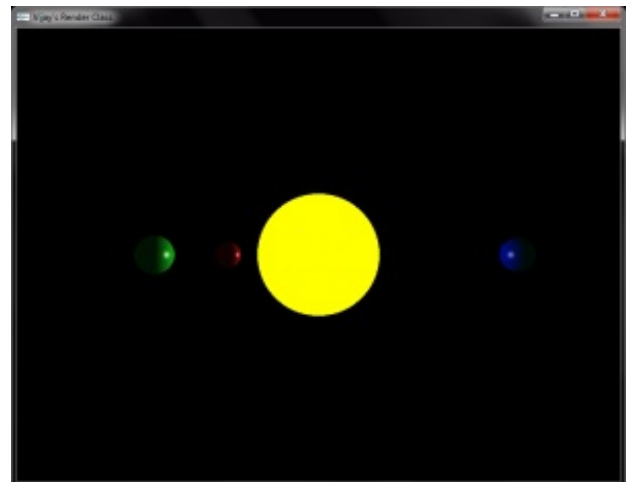


Tomorrow (technically today) will be another busy Saturday full of learning MathML and sockets while coding our OpenGL project. Oh, and I forgot to mention Sky Zone! I can't wait to play dodgeball with trampolines!

## DBZ, Planets, and Light Painting

Posted on [June 13, 2013](#) by [strength](#)

Lights, lights, lights... Seems to be the theme for the past 48 hours. After struggling with the lighting in OpenGL for quite some time, Raphael confirmed that I had all the necessary components present and all I lacked was parameter tweaking. Whew... I'm not going crazy. I'll play around with the settings tonight as time permits, and tomorrow I'll ask Sebastian for advice. I appreciate his willingness to review concepts from the previous classes, and I have to say that his slide presentations are the most aesthetically pleasing and functional that I've seen. Seriously, they're impressive. We presented our graphics project idea today, which will be a 2D version of Pong with 3D models. I expect camera rotation will create a neat effect as soon as the user realizes that the paddles and ball



are actually cubes instead of squares.

We also participated in light painting, which takes advantage of a long exposure and allows light to be traced in the resulting photo. In this picture, Sheneeka and I are locked in an intense DBZ energy blast battle.

## Tangled Thermal Tango

Posted on [June 12, 2013](#) by [strength](#)

I finally got around to studying thermodynamics; Matt's videos were very clear and well-paced. Hopefully our meeting today will help us chart out a branching tree of user input and feedback for our equation tutor. The graphics course is very challenging so far, but by the end of each day the concepts begin to make sense. I've attached my current solar system, which is far from perfect, but I'm working in the right direction.

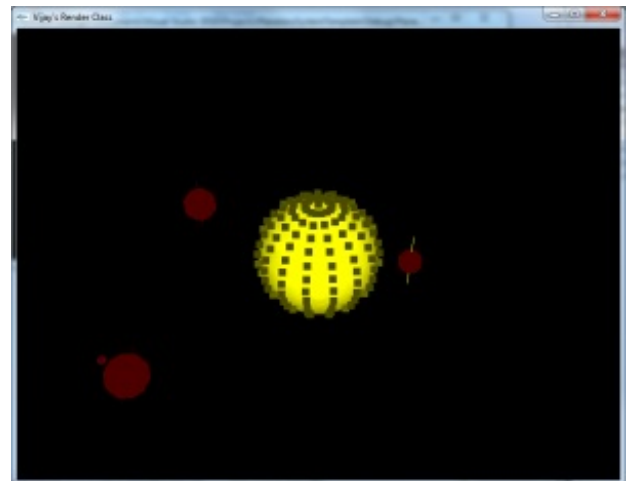
The light source is centered inside the sun, and the light should diffuse on the other planets. I need to tweak the emission parameter of each planet to show diffusion.



## Solar System Samba

Posted on [June 11, 2013](#) by [strength](#)

After a quick lesson on matrix transformations through OpenGL, we were tasked with creating a 3D model subset of our solar system, and my appreciation for linear algebra subsequently sky-rocketed (pun definitely intended). Much of the code is already written in a template form, so one of the challenges is understanding what lines affect what in the model. Well, I need to cut this post short because I need to run to a Problem Framers meeting. Maybe I'll post a screenshot of the solar system tomorrow.



## Triforce, OpenGL style

Posted on [June 10, 2013](#) by [strength](#)

I spent most of the weekend coding the GUI for Collinear Four, and we finally finished thanks to the debugging skills of Anna and Jose. Memory errors are always interesting, and it helps to have an extra pair of eyes or two to track down the culprit code. Our first OpenGL class had us create 2D dots and spell our names with primitives, such as points, lines, and polygons. I got a little carried away and created the pixel art for Yoshi's egg, and later I incorporated the Triforce into the spelling of my name. I can't wait until we dive into 3D graphics, as I've been meaning to learn OpenGL as an extension to SDL. We'll decide on our final graphics project topic tomorrow, so stay

tuned.

## IRB and Tutor Specs

Posted on [June 7, 2013](#) by [strength](#)

Yesterday we participated in our first craft of research lesson in which we learned about the Institutional Review Board (IRB). In order to conduct research, an application must be sent to this committee and reviewed for ethical appropriateness. In other words, if your experiment can hurt others, then the IRB will prevent you from conducting your study. Although our research is more educational, for which an IRB certificate is not required, Stephen wants us to complete an IRB form for the experience. As we delve further into the project, we may find that our methods require a certificate. We also received additional project specifications for the equation tutor from Mathew, our thermodynamics resource.



## Gatsby Conspiracy and Graphics

Posted on [June 6, 2013](#) by [strength](#)

I really appreciate the extracurricular activities that the program has planned for us. Last night we ventured to the movie theaters, and I watched Gatsby in 3D with some of the group, although we learned today in a luncheon lecture that 3D movies are a lie. The movie actually consists of two 2D movies played simultaneously for each eye, and our amazing brains create the 3D effect via triangulation. Upon hearing this, I felt like giving my brain a standing ovation or a pat on the back of the cranium, but then I realized that my own brain was encouraging me to do so. Positive feedback loop, perhaps? Back to the story. Nik provided an excellent presentation on true 3D image processing, and he even holds a patent on a 3D image compression format he developed during his research. Wow. This technology is the future of telecommunications. Seriously.

Lastly, I'm definitely beginning to feel overwhelmed by the volume of material I need to learn: Thermodynamics, XML, MathFlow, Tutoring Systems . . . the list continues. I absolutely love learning, but there are always some lingering fears of the unknown. It's an uncomfortable feeling, but it's part of the process.

## Yeah, about Galaga...

Posted on [June 5, 2013](#) by [strength](#)

After much deliberation, I decided that I wasn't comfortable forcing my teammates into using a graphics library whose API would distract from learning and implementing basic C++ concepts. Complexity of games increases exponentially as dimensions are added, so we will first create a console-based game of Connec-\*ahem\*-Collinear Four. By starting simple, everyone can contribute to the design and implementation of the game, whereas a graphical game would require more specialized knowledge. If there's time, then we will wrap the logical skeleton of our console-based game with the muscles and skin of a GUI. That way we can take advantage of both a pedagogical approach and a graphical approach. Yay, synergy!

Other thoughts: During the problem framers meeting yesterday, we decided that an equation tutor would be the most beneficial use of our time for all parties involved. We will begin preliminary research on that topic as soon as possible. Also, it was refreshing to hear Jim Oliver tell us during a luncheon lecture that over-qualification is a wide misconception in the U.S., and the vast majority of STEM PhDs land jobs in industry, not academia.

## Galaga, Games, and Galloping through the Fourth Wall

Posted on [June 4, 2013](#) by [strength](#)

I'm still new to blogging, so transitioning from essay-appropriate, formal writing (yawn) to informal writing is an odd experience. So, to alleviate that feeling, I'm currently breaking the fourth wall of blogging by mentioning blogging. \*sound of glass breaking and rubble forming as I burst through this post/computer monitor/something destructible with my mind\* Anywho, our group is currently deciding what game to make for our C++ project, and Galaga has been tossed around as a possibility. I've programmed an arcade clone before—Pong—within a team, so I'm confident in our group's ability to recreate a bare-bones clone of Galaga. However, time is the limiting reactant because I've never created a game in less than a week. Additionally, I want my group members to have a fruitful learning experience over the course of the short project, so that aspect must be taken into consideration. We may turn to another game idea in the coming day, but regardless of what we choose, I know we'll have a blast. (See what I did there? Blast, Galaga? Arcade shooter? . . . )

## Myers-Briggs and Ropes Course

Posted on [June 3, 2013](#) by [strength](#)

This past Friday we attended a Myers-Briggs Type Indicator session to discuss the characteristics of each letter within the 16 possible personality types. After reading about these characteristics and discussing them, I realized that I align with the Feeling trait more than the Thinking trait, which I had previously been assigned. We also spent our Saturday at a ropes course boasting a myriad of team-building activities. The centerpiece of the course was a triangular climbing tower with three climbing faces offering multiple paths for each. I challenged myself to climb the path with two suspended vertical logs that swayed with the wind. Despite feeling fear and doubting myself a third of the way to the top, I eventually trusted myself and my belayers and completed the climb!

## Project Introductions

Posted on [May 31, 2013](#) by [strength](#)

Faculty and graduate student mentors presented each REU project for the summer to the entire group, and then each research team met for its first project meeting. Our team was formally introduced to our project leader and graduate mentors, and they briefly explained the architecture of the current iteration of the ITS. We discussed several issues with the system that our team could target for our project. Upon first impressions, this REU is well organized, team-based, and teaching-oriented. The program is designed to provide exposure to many technical areas such as C++ programming, modeling, graphics, and HCI, even if specific projects do not leverage one of these areas. I hope to gain effective research skills, a taste of graduate school, and basic competency in the aforementioned areas.

## Orientation

Posted on [May 30, 2013](#) by [strength](#)

Upon taking a tour of the VRAC facilities, I am very impressed with the technologies present and the resources available to students in the program. The lab in which REU interns will be working is divided into separate pods for each research team, but all the pods are located in a fairly small and open space to facilitate collaboration. We participated in a few research studies yesterday, so we experienced a taste of virtual reality projects currently conducted by graduate students. Today we will be introduced to the C6, which boasts a 360-degree virtual reality experience. I am eager and slightly anxious to begin research on my group's topic, Intelligent Tutoring Systems (ITS).