PLANETS, PEDAGOGY, AND PARTNERSHIPS:

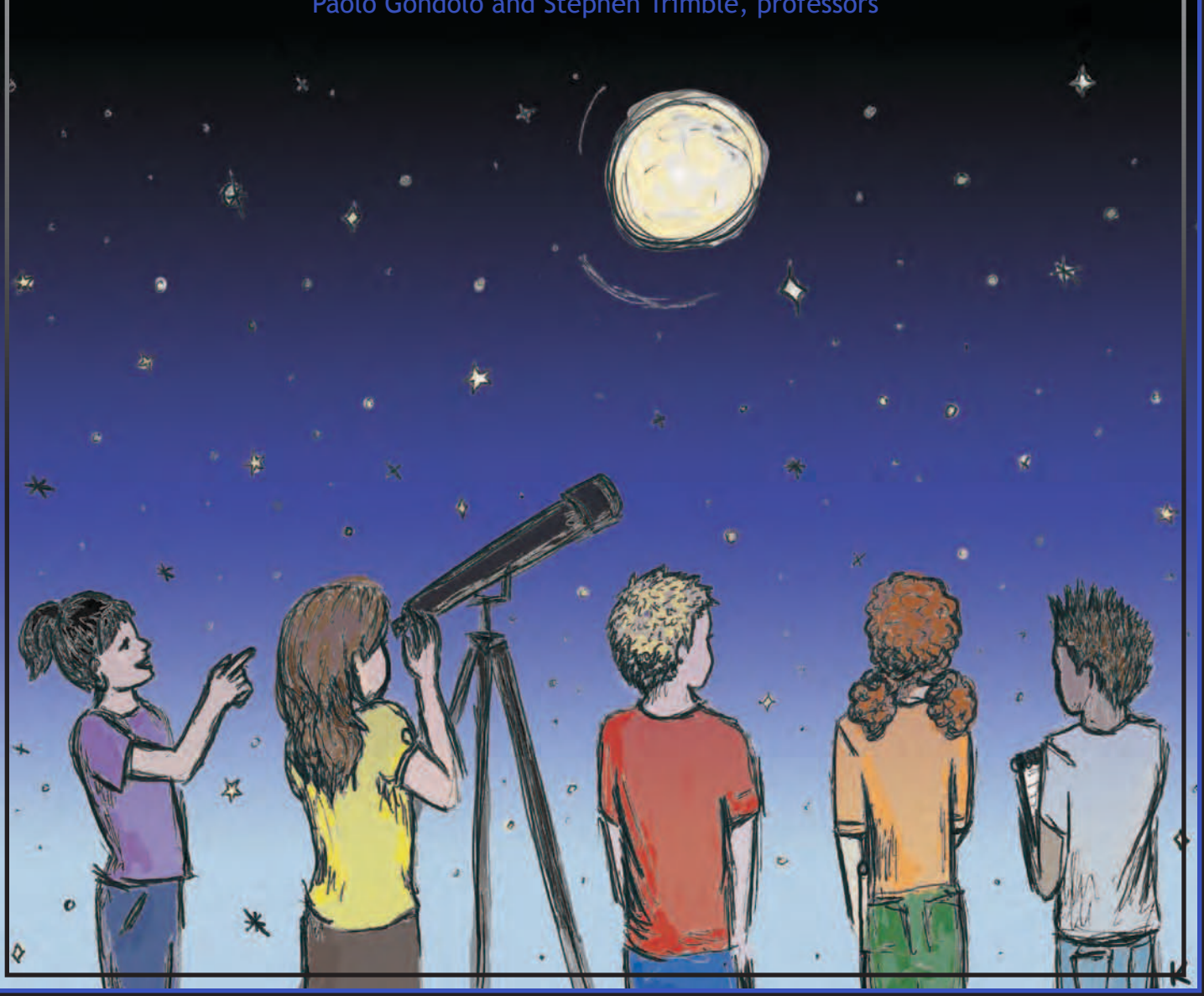
SHEDDING LIGHT ON A DARK MATTER

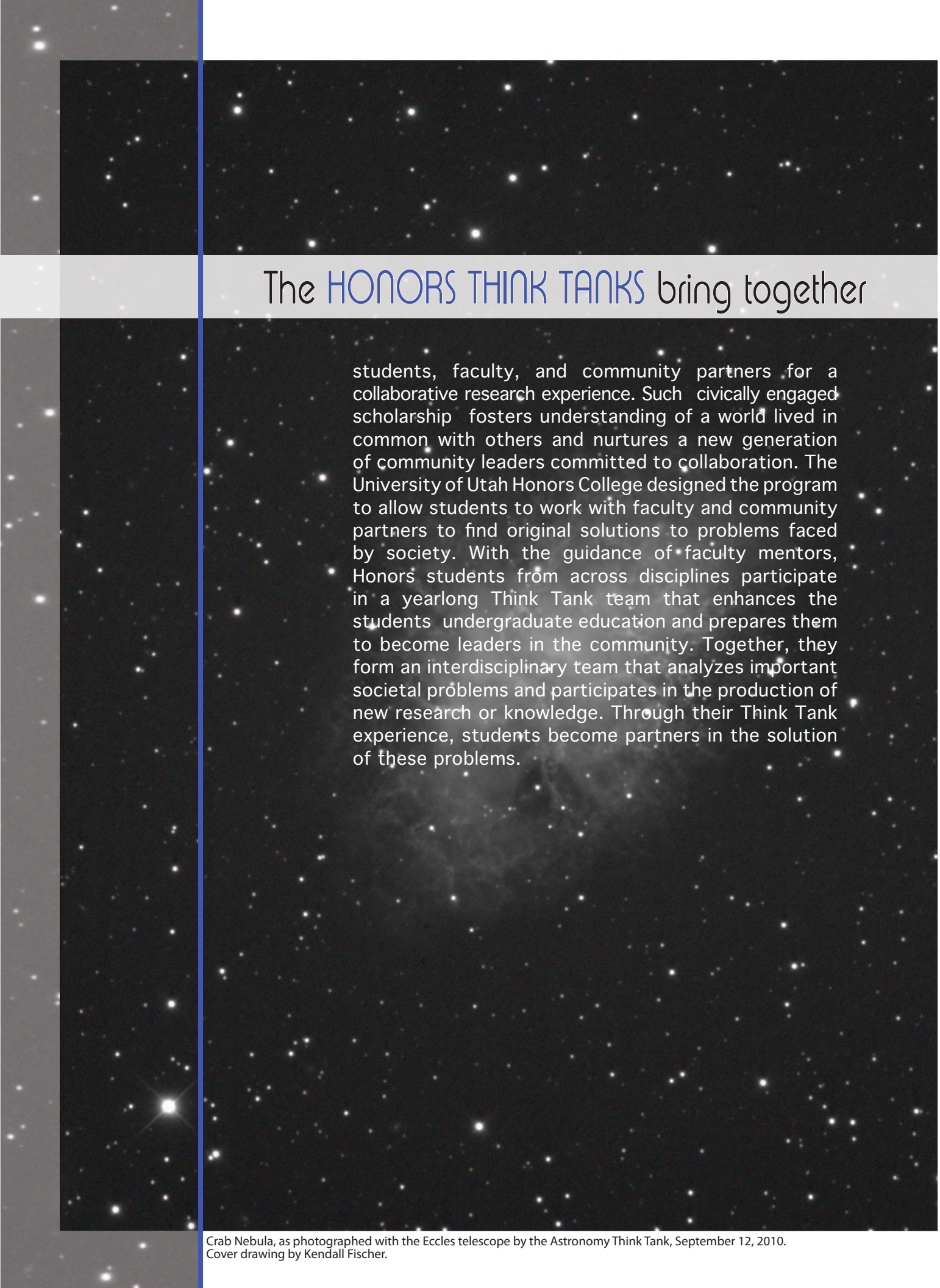
THINK TANK ON ASTRONOMY

Honors College
University of Utah 2010-2011

Dustin N. Daugherty, Kendall Fischer, Rosalie Griffin, Richard E. Kimball, Ashlynd Mikkelson, Eliana C. Sanchez, Gregory J. Varanese, and Andrew Webb

Paolo Gondolo and Stephen Trimble, professors





The HONORS THINK TANKS bring together

students, faculty, and community partners for a collaborative research experience. Such civically engaged scholarship fosters understanding of a world lived in common with others and nurtures a new generation of community leaders committed to collaboration. The University of Utah Honors College designed the program to allow students to work with faculty and community partners to find original solutions to problems faced by society. With the guidance of faculty mentors, Honors students from across disciplines participate in a yearlong Think Tank team that enhances the students undergraduate education and prepares them to become leaders in the community. Together, they form an interdisciplinary team that analyzes important societal problems and participates in the production of new research or knowledge. Through their Think Tank experience, students become partners in the solution of these problems.

Crab Nebula, as photographed with the Eccles telescope by the Astronomy Think Tank, September 12, 2010.
Cover drawing by Kendall Fischer.

Introduction

Martha Bradley, Dean of the Honors College, has an especially persuasive way of inspiring professors and professionals to teach at the Honors College. One day at an Honors reception, she and Steven Denkers of the Willard L. Eccles Foundation, approached Professor Paolo Gondolo, director of the High Energy Astrophysics Institute. They told Gondolo how exciting it would be to create an Honors Think Tank based on the astronomy program he and his colleagues were developing at the Department of Physics and Astronomy.

As Gondolo puts it, his challenge was twofold–"to formulate a class that unlike pure astronomy classes addresses a community problem, and find a partner with a humanities perspective." His own frustrations in trying to undo the scientific misconceptions of many people had made combating science illiteracy a "focal point" for Gondolo. Thus he thought posing such a question to the students of the Honors College could yield positive results. Following a series of suggestions for prospective co-instructors from Dean Bradley and Associate Dean Thomas Richmond, Gondolo had what he calls a "fruitful meeting" with award-winning writer and photographer Stephen Trimble.

While Trimble's knowledge of astronomy was limited to what he had "read in *National Geographic* and in books by his nature-writing colleagues," he had some experience in science, namely a master's degree in ecology and evolutionary biology. More importantly, he is a writer whose skills complemented Gondolo's background of pure science and would prove an invaluable resource in formulating the Think Tank's final document. He had co-taught a Think Tank in 2008-2009 and had enjoyed it immensely. When approached by the Honors College about co-teaching the upcoming Think Tank on astronomy, he was intrigued.

As Trimble is "affiliated faculty" in the Honors College and a free-lance writer and photographer, he knew he could fulfill the role of the "community" partner of the team. Since many of his writing projects featured interviews with local and regional science educators, he also brought to the table many valuable contacts and guest lecturers for the course.

Jackson Elementary School students, Salt Lake City. Photo by Ashlynd Mikkelson.

Those of us who applied for the course were inspired by this description in the University course catalog:

> *In our times, more and more issues (climate change, energy crisis, genetic engineering, etc.) call for responsible citizens and leaders to have a basic knowledge of science. And economic development increasingly needs professionals with a high-level knowledge in mathematics and science. However, the current school system has challenges in providing both basic and advanced scientific education: science is often misrepresented as a boring series of facts, and teachers are asked to stretch into areas in which they may not be familiar.*
>
> *The Astronomy Honors Think Tank will explore how to make people scientifically equipped to contribute effectively to 21st century society on the premise that astronomy can be used as a fascinating gateway to the sciences. Astronomy appeals to people of all ages and seems less scary and less complicated than mathematics or engineering. We will start by experiencing a real scientific environment with a hands-on project using the new research-grade Willard L. Eccles telescope at the University of Utah. At the same time, we will learn about the current situation in scientific education and about the existing approaches to raise the level of scientific knowledge, focusing on astronomy: for example, television programs and demonstrations in schools, the Center for Mathematics and Science Education at the University of Utah, innovative courses like Physics for Future Presidents at the University of California, Berkeley. Finally we will see to formulate a report containing practical suggestions on how to use astronomy as a means of improving general scientific knowledge and as an entryway into other science and engineering studies.*

Our exploration of science education in the K-12 school system began with a catalog of our own experiences. No one can forget the teachers who blew stuff up in crazy science experiments or fed mice to the class pet. We expanded our analysis to that of our close friends and family by conducting interviews about their experiences with science. We quickly discovered that effective science education depends primarily on the teacher's understanding and presentation. A class trip to Frisco Peak helped solidify this discovery.

PLANETS, PEDAGOGY, AND PARTNERSHIPS: *SHEDDING LIGHT ON A DARK MATTER*

In September 2010, our class spent a weekend at the observatory on the ten-thousand-foot Frisco Peak, roughly twenty miles west of Milford, Utah. The University of Utah constructed their new research-grade Eccles telescope here. We wanted to experience science in action, and we did just that.

We Think Tank students spent much of the night observing the cosmos and distant galaxies through the Eccles telescope with guidance from Paolo Gondolo and Paul Ricketts, a graduate of the Physics department. We saw firsthand that nothing can compare to a hands-on experience with science. This trip focused our Think Tank. How can we help teachers implement real hands-on experiences for their students in order to *improve* their classroom presentation of science?

Astronomy unit, Salt Lake Center for Science Education sixth-grade class. Photo by Gregory Varanese .

To further explore these questions, we began interviewing experts in science education, psychology, physics, astronomy, and pedagogy. Paolo Gondolo and Inese Ivans from the Physics department gave us a "short course" in astronomy. We took an insider's trip to the Clark Planetarium in downtown Salt Lake to learn more about the programs they provide for third-grade and sixth-grade classrooms as part of the state science curriculum. We were surprised to find out how little the K-12 teachers actually used the Clark Planetarium's demonstration kits. The trip to the Clark Planetarium helped us realize the importance of identifying resources that were already available and finding more ways to implement those resources.

To do this, we began interviewing other experts on science education. One of our earliest guest speakers, Sarah George, the executive director of the Utah Museum of Natural History, stressed the importance of showing people "the real thing" for science education. Her lecture reinforced our Think Tank's belief in the importance of hands on learning.

Hugo Rossi, interim director of the Center for Math and Science Education at the University of Utah, introduced the concept of science as a multidisciplinary field to our Think Tank. Moreover, he outlined the roadblocks to more successful science education - funding, teacher training, and the need for more modern technology in classrooms–which came up in our class discussions for weeks to come.

We also had the privilege of meeting with Julie Gess-Newsome, director of the Center for Science Teaching and Learning at Northern Arizona University. She elaborated on the disconnect between science education theory at the university level and the reality of how science is taught in K-12 schools. The most enduring piece of advice she offered to our Think Tank was to not "reinvent the wheel" in our final project.

Building on what our group heard, we began to think about alternative approaches to science education. Stephen Trimble introduced us to nature writing and brought science writer Chris Cokinos, author of *The Fallen Sky*, to class to provide an example of successful synthesis between science and creative writing. His visit reinforced our Think Tank's belief in the importance of a multidisciplinary approach.

Sylvia Torti, another science writer, as well as a biologist, spoke to us about the Rio Mesa field station that she directs. The station, located an hour outside Moab, provides an outlet for both local and University students to perform field research on ecological aspects of the surrounding land. We considered focusing our project on the Rio Mesa Program but decided we wanted to work closer to home.

We were then exposed to the successes of two science-specific schools in the Salt Lake Valley: Salt Lake Center for Science Education (SLCSE) and the Academy for Math, Engineering, and Science (AMES). Our class heard from Ken O'Brien, Coordinator of Curriculum and Professional Development at the Salt Lake School District's Center for Science Education; the principal of SLCSE, Larry Madden; and the veteran educator and founder of AMES, Al Church. Meeting with these three educators exposed our Think Tank to unusually

The Astronomy Think Tank meeting in the University of Utah Honors Center. Photo by Paolo Gondolo.

The University of Utah's research-grade Eccles Telescope, Frisco Peak, Utah. Photo by Stephen Trimble.

successful examples in science education. What were these schools doing right? How have they inspired such passion and generated success when so many other schools have failed?

In thinking about a possible outreach program, we spoke with Rosemarie Hunter and Joel Arvizo from University Neighborhood Partners (UNP). We learned the importance of utilizing existing partners. They inspired us to go beyond a one-time outreach model toward an enduring, sustainable partnership.

As we began formulating ideas for our class project, we focused on the information we had gathered over the course of the first semester. Our class split into three groups composed of students whose individual proposals contained similarities. In line with avoiding trying to reinvent the wheel, one group proposed building our class project off the existing Clark Planetarium outreach programs, while another favored creating a program to fit under the UNP umbrella. The third group argued for field research at schools with successful science education credentials to improve science education throughout the Salt Lake Valley.

Despite these differences, each group ironically came back to the table with variations of a similar idea. We wanted to create a partnership between the organizations that were already doing things right. In a series of exploratory meetings, we pitched our idea to the Clark Planetarium, University Neighborhood Partners, SLSCE and Jackson Elementary. All agreed to be involved in a new university course created by our Think Tank.

We began to draft a course syllabus outlining what we imagined for the proposed university course. We concluded that a service-learning course housed in the Honors College is the most effective way to attract interested and driven students to the cause of improving science education through astronomy. The class would be self-sustaining as well as self-improving. We had learned enough over the prior semester to realize that we wanted to create a program that would live longer than our Think Tank.

The next step was to meet with Clark Planetarium, UNP, SLCSE, and Jackson Elementary to discuss our preliminary drafts in order to incorporate their feedback. Just as importantly, we met the teachers with whom the University students in the class we are proposing would work. Their voices provided us with valuable input.

We converged on Ken O'Brien as the ideal instructor for the new course, since he has expertise not only in academic science but also in pedagogy and school administration. After looking over our now well-developed proposal and class syllabus, he agreed to teach our course. Following our meeting with Ken, we continued our study of learning theory with guest speakers Kirsten Butcher and Clayton Pierce of the University of Utah's College of Education. Their insights helped our class fine-tune our proposal.

Our proposed course is truly a synthesis of our collective experience and learning over the past two semesters. The class will have its initial run in spring semester of 2012. Following the success of the pilot run, we hope to add the class to the University of Utah General Catalog as a sustainable and self-improving partnership and one day expand it to other schools in the Salt Lake Valley.

Think Tank student Dustin Daugherty on top of Frisco Peak, after a night of observations with the University of Utah's Eccles Telescope. Photo by Stephen Trimble.

"Get out of the classroom!"
Paul Chung, McGillis School

"Power is built into science. Mastering it feels good and is empowering."
Rosemarie Hunter

"We don't understand nothing!"
[referring to Dark Energy]
Paolo Gondolo

"The illiterate of the 21st century will be those who cannot learn, unlearn, and relearn."
Julie Gess-Newsome

"Everything you can touch, taste, see, or smell in this room was once inside a star."
Inese Ivans

"Where in the education system do we teach stud

ves science!"
Paolo Gondolo

ultiple
of knowing."
Ken O'Brien

dents how to ask really good questions?" Ken O'Brien

"Kids are naturally curious.
Why do they stop?"
Ken O'Brien

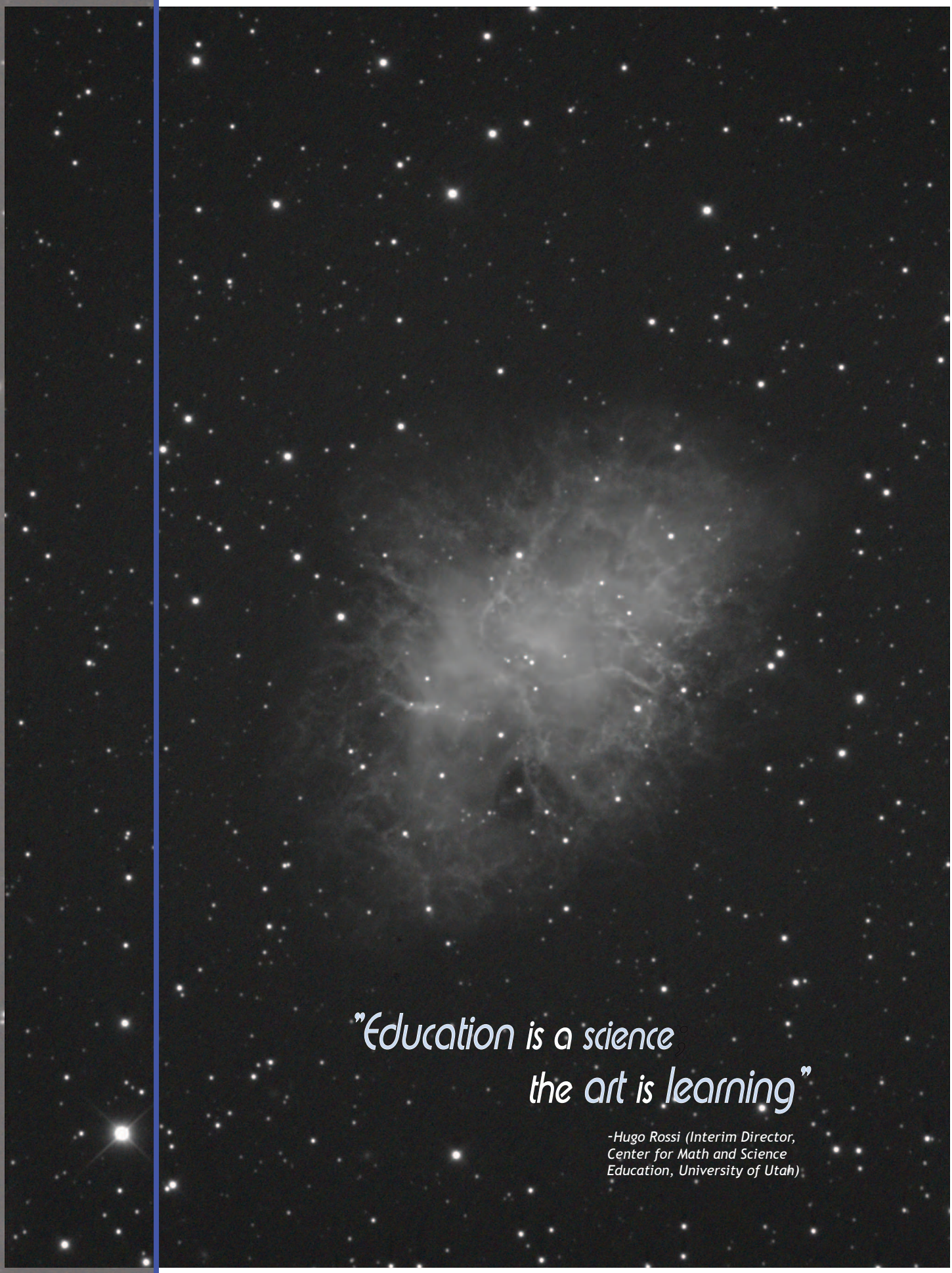
"Teachers worry about students struggling. Struggling is good."
Kirsten Butcher

"Think *when*, not *if* you go to college..."
Paolo Gondolo

"Put power where the [power] ownership comes from—with the people and community."
Joel Arvizo

"The ability to change thinking happens at a relationship level."
Rosemarie Hunter

NGC 891 Galaxy, as photographed with the Eccles telescope by the Astronomy Think Tank, September 12, 2010.


"Education is a science
the art is learning"
-Hugo Rossi (Interim Director,
Center for Math and Science
Education, University of Utah)

PLANETS, PEDAGOGY, AND PARTNERSHIPS:
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Course Proposal

UNIVERSITY OF UTAH
HONORS COLLEGE

CROSS-LISTED IN: STEM / EDUCATION / SERVICE / HONORS
HONORS 3400

SPRING SEMESTER 2012

Instructor: Ken O'Brien
Coordinator of Curriculum and Professional Development at the Salt Lake School District's Center for Science Education

Office Hours: By Appointment

Meeting Locations: Honors College, SLCSE, Jackson Elementary
Meeting Time: Wednesdays 12:00 noon – 3:00 PM
Credit Hours: 3

Course Description

"Planets, Pedagogy, and Partnerships" provides an opportunity for unique interaction in astronomy, teaching methods and pedagogy. Students learn the necessary skills to effectively teach core astronomy concepts at the sixth grade level. A multi-faceted approach will expose University students to a broad range of learning influences: guest lecturers on astronomy and learning theory, Clark Planetarium guidance, interaction with sixth grade teachers along with mentoring sixth grade students and working to involve parents in the process.

In the first phase of the course, class members will learn basic astronomy, including mastery of Clark planetarium modules designed to explore the seasons, moon phases, properties of a solar system, galaxies, and the universe. Pedagogical instruction will follow, including adapting to the sixth grade student environment, leading classroom presentations, conducting engaging activities, and gathering feedback for the Clark planetarium in an unobtrusive manner. A comprehensive exam will ensure University students understand the course materials being taught and do not carry misconceptions into the sixth grade classrooms.

The second phase of the course will allow students to work closely with sixth grade teachers, parents, and community partners at Jackson Elementary and the Salt Lake Center for Science Education. Engaging parents early on and inviting them to share cultural backgrounds relevant to astronomy will enrich the intended learning outcomes. University students will act as mentors to sixth grade students, applying the knowledge and confidence gained during the first phase of the class.

This reciprocal relationship gives the University students the hands-on time in the classroom required to become effective mentors—and learn from their partners. The auxiliary goal of collecting thoughtful and accurate feedback will help the Clark Planetarium identify actionable steps to improve their programs. At the end of the class, all partners in the sixth grade classrooms, the Clark Planetarium, and the University students will stand a far better chance at achieving their goals in science literacy and the pursuit of lifelong learning.

Rationale

Our changing world requires adaptation. We learn how to interact with the earth as each generation progresses. Great scholars and scientists, whether pursuing pure knowledge or practical solutions, wade through oceans of mysteries, unlocking secret gems of the universe. These rare gems amplify our library of knowledge and provide benefits to all societies.

Like a child who learns to crawl, walk, and run, we grow through our adaptation to newly obtained knowledge and mysteries. The increasingly rapid development of humanity, laced with multiple layers of connections now existing in our globalized society, now grants us the opportunity to make significant discoveries in leaps and bounds. Young students, with their unbounded curiosity and natural desire to explore their world, hold in their hands the potential for revolutionary progress.

Honors students can play a role in allowing this potential to blossom as they nurture young minds through the exploration of the planets, stars, solar system, and space. After mastering basic astronomy and being exposed to contemporary learning theory and teaching methods, students in this class can inspire children to creatively imagine, dream higher, and transcend old-fashioned educational paradigms. Honors students integrate learning disciplines and teaching methodologies in fun and engaging ways. By learning core astronomy topics, creating enjoyable activities, and mentoring sixth grade science classes, the University students can instill hope and confidence in those whose potential is yet untapped.

Objectives

By the end of this course University of Utah students will:

1. Understand how science is carried out, address common misconceptions about astronomy principles, and appreciate scientists as individuals and community members.
2. Comprehend core astronomy concepts from the perspective of both student and teacher.
3. Master specific teaching methods and multiple approaches to facilitate effective learning in K-12 students.
4. Work alongside elementary educators, parents, and community leaders to implement hands-on learning of core astronomy concepts by sixth grade students at partner-schools.
5. Mentor sixth grade students as they learn astronomy.
6. Inspire students to enjoy science and pursue studies in science-related fields.
7. Sustain a meaningful community partnership between the University of Utah, the Clark Planetarium, partner-schools, and parents.
8. Establish effective communication tools to provide constructive input and feedback for all parties involved in the partnership.

Texts and Resources

Students will be required to read sections of the following texts:

Academic Astronomy Text(s):

Chaisson, Eric, and S. McMillan. (2010). *Astronomy Today.* 7th ed. Boston: Addison-Wesley, 2010. - A concise overview of astronomy principles essential to the course.

Cultural/Historical Astronomy Texts:

Aveni, Anthony. *Stairways to the Stars.* Wiley, 1999. - This book delves into the historical importance of astronomy to the ancient cultures of the British Isles, the Maya and the Inca. Aveni's work illuminates the importance of the stars for human civilization and allows university students to better connect to the heritages of many in sixth-grade classrooms.

Bartusiak, Marcia, editor. *Archives of the Universe: 100 Discoveries That Transformed Our Understanding of the Cosmos.* Vintage, 2006. - Bartusiak compiles primary accounts charting the progression of astronomy from past to present. Like *Stairways to the Stars*, this work portrays the historical importance of astronomy.

Williamson, Ray. *Living the Sky.* University of Oklahoma Press, 1987. - Especially relevant given our geographic locale, *Living the Sky* delves into the rich astronomical myths of Native American cultures in what is now known as the American Southwest. Like the prior two works, Williamson helps readers understand the importance of astronomy to different cultures.

His accounts bridge the humanities and sciences, providing a multidisciplinary approach to astronomy education.

Pedagogical/Teaching Astronomy Texts:

Bransford, John D., Ann L.Brown, and Rodney R.Cocking, editors. *How people learn: brain, mind, experience, and school*. National Academy Press, Washington, D.C., 2000. - This widely acclaimed and groundbreaking research report on the science of how individuals learn will help the class look at pedagogy from a fresh perspective.

Pasachoff, Jay, and J. Percy. *Teaching and Learning Astronomy*. 1st Edition, Cambridge University Press, 2009. - Written to supplement teachers' knowledge of astronomy, this text highlights new places for astronomy in the curriculum, the use of technological tools like the Internet, and outside resources such as planetariums. This work can instill in university students unconventional yet effective ideas they can bring to sixth grade classrooms.

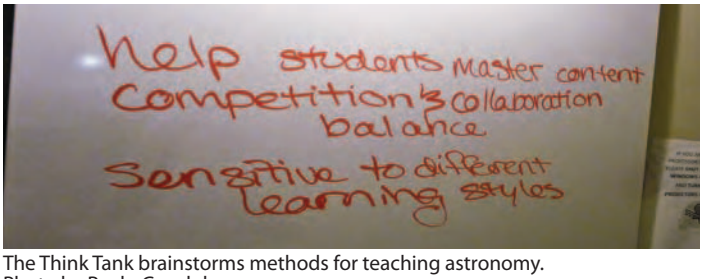
Pompea, Stephen. *Great Ideas for Teaching Astronomy*. 3rd Edition, Brooks Cole, 2000. - A collection of ideas for astronomy education from over forty teachers across the globe, this text complements *Teaching and Learning Astronomy*.

Additional Resource(s):

Various brief articles relevant to course content will be posted on WebCT at a later time.

Students will learn how to demonstrate key astronomical concepts (i.e. moon phases, seasons, the solar system and the universe) through the use of education kits supplied by the Clark Planetarium, whose staff will provide instruction manuals with information relevant to the use and underlying concepts of the kits.

"Private Universe" video.



The Think Tank brainstorms methods for teaching astronomy.
Photo by Paolo Gondolo.

Course Content and Assignments

Part I: Learning Astronomy

Week 1
01/11

Introduction to the course. Students meet classmates and professor and discuss what the class will do, why the class is important, and what is expected of the students. The instructor will explain WebCT postings and answer questions students may have about the syllabus.

Guest Speaker: Joel Arvizo, University Neighborhood Partners, to talk about community partnerships

Homework: Reading from *Astronomy Today*

WebCT Post: What are your expectations of this class and why is science education important?

Week 2
01/18

Astronomy: Introduction. Students begin learning everything they need to know to understand astronomy at a sixth-grade level. There will be in-depth discussions on Moon Phases, Seasons, the Solar System, the Universe, and the importance of correcting misconceptions.

Guest Speaker: Paolo Gondolo, University of Utah Physics Department

Homework: Reading from *Astronomy Today*

WebCT Post for Weeks Two and Three: Did you learn anything today that you didn't know before? Think of some ideas that you could use to teach these concepts that would be different from the stereotypical "lecture-textbook" format.

Week 3
01/25

Astronomy: Mastery. Discussion and review of assigned readings as well as astronomy concepts.

Homework: Reading from *Astronomy Today* and the Clark Kit manual

Week 4
02/01

Clark Kits: Introduction. Students learn the basic assembly and demonstration of the Clark Planetarium Kits with the help of a member of the Clark education department. Students not only learn how the kits represent astronomy principles but also explore how these kits affect teaching and learning.

Guest Speaker: Duke Johnson, education manager, Clark Planetarium

Homework: Review Clark Kit Manual

Web CT Post: What do you find most useful in using the Clark Kits for the instruction of basic astronomy? What do you think will be most appealing about the kits for young elementary students? Did the kits bring to life anything that you thought was previously difficult to comprehend or that you think would be difficult to comprehend as an elementary student?

Week 5
02/08

Clark Kits: Mastery. Students practice material from last week, learn from any mistakes, and connect the kits to astronomy concepts. A Clark educator will show how to properly demonstrate the kit to a class of sixth graders.

Guest Speaker: Robert Bigelow, Clark Planetarium

Homework: Master the kit and basic astronomy knowledge if you have not yet done so.

WebCT Post: What do you find most difficult about the Clark Kit? Realistically speaking, how do you think the Clark Kits could be improved?

Week 6
02/15

Astronomy Test. Following review and questions about basic astronomy concepts and Clark Kits, students take an exam that tests comprehension of everything learned thus far. Students must score well on this test in order to be cleared to teach this material. Following the exam, the instructor will discuss next week's assignment: meeting with the sixth grade teachers. Students will then be placed at Jackson or SLCSE elementary school.

Homework: Reading from *Great Ideas for Teaching Astronomy*. Students contact their assigned sixth-grade teachers.

WebCT Post: How do you feel about teaching young students? What was your own elementary school science education like? What do you think your instructor can do to help you during this experience?

Week 7
02/22

Meet with the sixth-grade teachers. The teachers will visit the class to discuss scheduling, expectations of university students, classroom observation protocol, and their experiences in teaching young children. If students did not receive an adequate grade on the exam, they must retake it either after class or find time to retake it before they go to the sixth-grade classrooms. After discussion with the sixth-grade teachers, time can be used to work with the Clark Kits if needed.

Guest Speakers: sixth-grade teachers from Jackson and SLCSE

Homework: Reading from *Teaching and Learning Astronomy*. Schedule a session of classroom observation with one of the sixth-grade teachers.

WebCT Post: Remember a teacher whom you

admired when you were in elementary school. What made that teacher memorable? Did that teacher have an impact on your learning?

Part II: Field Work

Week 8*
02/29

Classroom Observation. Students will observe the sixth-grade classroom in their assigned elementary school. The teacher will introduce the university students and then the students will introduce themselves and their project to the sixth graders. Careful notes should be taken on what types of teaching methods are utilized by the teacher. How does he/she engage the sixth-grade students? After observing the classrooms, students should better understand how to conduct themselves while at the elementary schools.

Homework: Reading from *How People Learn*. Be ready to use the Clark Kits.

WebCT Post: Summarize your experience observing the classroom. What did you learn from the sixth-grade teacher? How were the sixth-grade students motivated to be actively engaged in the classroom?

Week 9*
03/07

1) Jackson Elementary School

The Clark will visit Jackson elementary school during this week. Students assigned to Jackson will work with the Clark during their presentation using their knowledge of the Clark Kit.

2) SLCSE Elementary School

The Clark will visit SLCSE elementary the following week. Students assigned to SLCSE will work with the teacher and use the Clark Kit to demonstrate the basic astronomy principles. The instructor will travel to SLCSE to accompany and observe the University students.

Homework: Email the University instructor with details on how the lessons are going. Are there any problems that need to be addressed?

WebCT Post: How was your TA experience? What went well? What could have gone better?

Week 10*
03/14

1) Jackson Elementary School

The Clark will visit SLCSE elementary during this week. Work with the teacher and the Clark Kit to demonstrate and review basic astronomy principles. The instructor will travel to Jackson this week to accompany and observe the University students.

2) SLCSE Elementary School

The Clark will visit SLCSE elementary school during this week. Students assigned to SLCSE will work with the Clark during their presentation using their knowledge of the Clark Kit.

Homework: Reading from *Stairway to the Stars* for Week 12.

WebCT post: Compare and contrast the days you went to the elementary schools when the Clark was there and when they were not.

Week 11
03/21

Spring Break. Enjoy the break: no WebCT postings.

Week 12
03/28

Recap/Intro to Culture Unit. After students reflect on the TA experience in class, the instructor will discuss what he observed in each sixth-grade class and offer guidance on how to gather feedback for both future

classes and the Clark Planetarium. Exploration of teaching cultural astronomy will follow.

Guest Speaker: Sandra Buendia, principal of Jackson Elementary, to talk about culture & astronomy

Homework: Reading from *Living the Sky*.

WebCT Post: Does astronomy have a cultural impact on you? Many early civilizations told stories inspired by the stars and the night sky; what is it about space that has fascinated humankind for so long? What kind of an impact has new technology and understanding of space had on astronomy's impact on today's culture?

Week 13*
04/04

Students will work with the sixth-grade teacher to finish the astronomy unit. Students can revisit the Kit to highlight special interests or to review. Students will collect feedback from sixth-graders and teachers. Did the students enjoy the presentations? Were the demonstrations effective? What do the teachers think?

Homework: Post feedback on WebCT

WebCT Post: Reflect on the feedback you have just received.

Part III: Culture & Conclusion

Week 14*
04/11

Cultural Unit. University students and the sixth-grade teachers will discuss cultural aspects of astronomy: mythology, calendars, exploration, and stories based on the stars. Teaching will connect culture to astronomy. This unit has a potential writing component, as well.

Homework: Start Final Reflection (See week 16)

WebCT Post: Does astronomy have any cultural impact on the students you worked with? Looking forward to next week, discuss the importance of community in education.

Week 15*
04/18

Star Party. This will be open to all students in the sixth-grade classrooms and to their community: parents, friends, teachers, etc. The Star Party will take place at the Observatory on the University of Utah campus. University students can use this opportunity to excite the sixth graders not only about astronomy but about science in general. We hope that community members will be inspired by participating in the star party to continue this encouragement beyond the end of the class.

Homework: Finish Final Reflection

Week 16
04/25

Final Reflection Due. Summarize your class experience. What did you think was especially important? What about the class needs improvement? Please put serious thought into this, as your comments will be used to shape the class in the future. Class time for this week will be devoted to a summary discussion about the entire semester's experience.

* Classes 8-10 and 13-15 will be held off-site (Jackson Elementary, SLCSE elementary, and the University Observatory).

Sixth grade classroom, Salt Lake Center for Science Education.
Photo by Gregory Varanese.

Assessment

Grading Policy:

WebCT Weekly Journal Entries 300 pts

Formal Feedback to the Clark Planetarium 100 pts

Written Exam on Astronomy concepts 150 pts

Teacher and Professor Student Evaluations 300 pts

Final Presentation 150 pts

TOTAL POINTS: 1000 pts

Grading Scale:

A 93-100	A- 90-92	
B+ 87-89	B 83-86	B-80-82
C+ 77-79	C 73-76	C- 70-72
D+ 67-69	D 63-66	

ADA Statement

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.

All written information in the course can be made available in alternative format with prior notification to the Center for Disability Services.

Faculty and Student Rights and Responsibilities

All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. Students have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, and I will do so, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.

Accommodations Policy

Some of the writings, lectures, films, or presentations in this course may include material that conflicts with the core beliefs of some students. Please review the syllabus carefully to see if the course is one that you are committed to taking. If you have a concern, please discuss it with me at your earliest convenience.

Note: The syllabus is not a binding legal contract. It may be modified by the instructor when the student is given reasonable notice of the modification.

The University of Utah's research-grade Eccles Telescope, Frisco Peak, Utah. Photo by Stephen Trimble.

Statement of Expectations of Professionalism

As a part of my participation in this class, HONORS 3400, I will act as a teacher's aide to a sixth grade teacher in the Salt Lake valley. This role requires me to behave in a professional manner during my interactions with the sixth grade teacher and his or her students, remembering that I represent the University of Utah in the community.

In addition to using my own good judgment, the University has specific guidelines, listed below. These apply to time spent coordinating with the sixth grade teacher as well as observing, teaching, or assisting the sixth grade class, and any other related activities.

I will be prompt and dependable.
My appearance will be neat and modest.
I will maintain good communication with my sixth grade teacher mentor.
I will be responsible and prepared.
I will not bring cell phones or any other distracting electronics.
I will be respectful of people and property.
I will act as a teacher and not as a friend or peer to the students. This entails keeping appropriate physical and emotional distance from the students.
I will review this statement with my community partner (sixth grade teacher) and discuss with him/her the implications of each guideline as it pertains to our partnership.

I understand and agree to the above statements of professionalism during my participation in this University of Utah class as a teacher's aide in a sixth grade classroom.

Neatly Printed Name	Signature	Date

Paolo Gondolo and the Think Tank students at the Eccles Telescope, Frisco Peak. Photo by Stephen Trimble.

Think Tank participants

A native of New York City, Dustin Daugherty enrolled in the University of Utah after moving to Salt Lake in the spring of 2009. He is a Foreign Language Area Studies Fellow and is currently working towards a degree in Asian Studies and Economics with a minor in Mandarin Chinese.

Kendall Fischer will graduate from the University of Utah in summer 2011 with an Honors Degree in Speech Communication with an emphasis in Interpersonal Communication and a minor in Spanish Language. Kendall is passionate about experiencing, learning, caring, growing, and sharing.

Rosalie Griffin is from Bountiful, Utah. At the University of Utah, she is an Honors Biomedical Engineering student, and an athlete on the University Track and Field team. Rosalie loves to learn about science because it helps her understand the world around her.

Richard Kimball graduated from the University of Utah in May 2011. As an Honors Information Systems graduate, Richard considers learning a life-long pursuit and plans to continue studies in the fields of Computer Science and Mathematics.

Ashlynd Mikkelson is originally from St. George, Utah. At the University of Utah, she is an Honors Exercise Physiology student with a Nutrition minor. Ashlynd is passionate about the health sciences and looks forward to living a long and happy life.

Eliana Sanchez is from Layton, just north of Salt Lake City, Utah. She will graduate from the University of Utah in 2013 with an Honors Degree and a Bachelor of Arts in Philosophy. Eliana has strong interests in fair trade and sustainable development in underprivileged communities. Eliana plans to attend law school and pursue a legal career specializing in sexual harassment in the workplace.

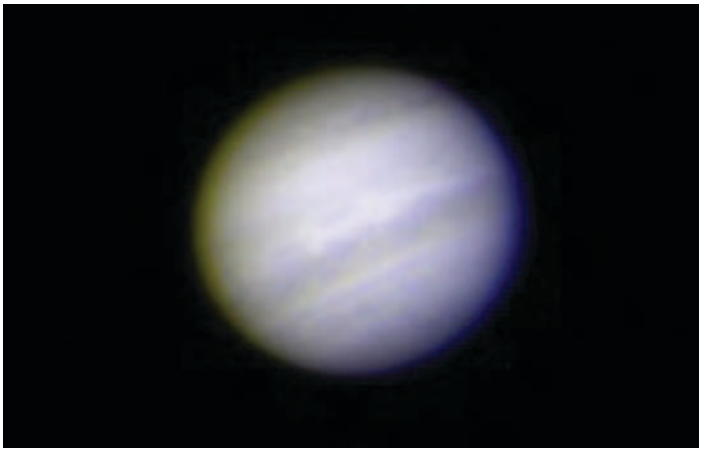
Greg Varanese recently moved from Colorado to Utah, for a promotion with Recreational Equipment Inc. He will graduate from the University of Utah in May, 2012 with a Business Management HBS and a minor in Sociology. In his spare time, Greg reads, snowboards, long-boards and canyoneers in Southern Utah.

Andrew Webb is from South Jordan, Utah. He is studying Marketing Research and French at the University of Utah. Andrew enjoys music, campus life, the outdoors, road trips, fine dining, shoes, Starcraft, free-boarding, snowboarding, and reading.

Professors

Paolo Gondolo is a sought-after world-class astrophysicist working on the nature of dark matter. With more than 100 highly-cited publications in scientific journals, and a reputation as a clear lecturer, he is often invited to other US institutions, Europe and Asia for collaborations and teaching. A Professor in the Department of Physics and Astronomy at the University of Utah, and Director of the High Energy Astrophysics Institute, he led the Astronomy Initiative that brought new astronomy faculty to the University, together with a new astronomy curriculum and research and educational facilities.

Stephen Trimble was a Wallace Stegner Centennial Fellow at the University of Utah's Tanner Humanities Center in 2008-2009; he has been teaching in the Honors College ever since. As writer, photographer, and editor, he has published more than twenty award-winning books, most recently *Bargaining for Eden: The Fight for the Last Open Spaces in America*. He divides his time between Salt Lake City and the redrock country of Torrey, Utah. His website is: www.stephentrimble.net.



Jupiter, as photographed with the Eccles telescope by the Astronomy Think Tank, September 12, 2010.

Acknowledgments

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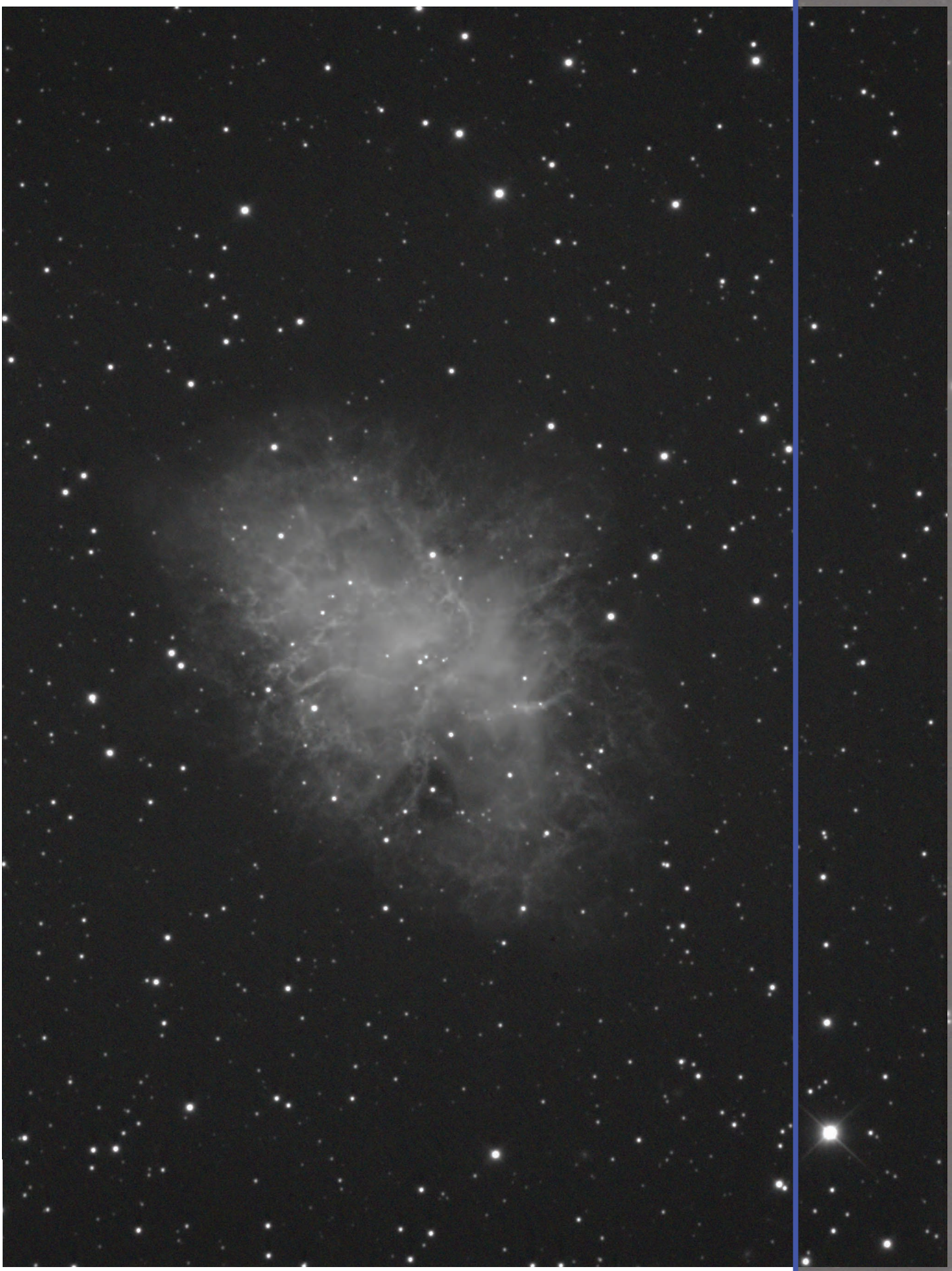
We are grateful for the enthusiastic support from Sandra Buendia, principal of Jackson Elementary, and Larry Madden, principal of Salt Lake Center for Science Education. We thank the sixth grade teachers who graciously agreed to let our proposed program into their classrooms: Machelle Dahl, Rose Miller, Britnie Powell, Tiffany Tueller, Glenda Woodring. Finally we are indebted to Ken O'Brien for his wisdom and willingness to teach our proposed course in the spring of 2012.

Astronomy Think Tank members: (from left) Gregory Varanese, Rosalie Griffin, Andrew Webb, Dustin Daugherty, Stephen Trimble, Paolo Gondolo, Kendall Fischer, Eliana Sanchez, Ashlynd Mikkelson, Richard Kimball.



HONORS 3400:
PLANETS, PEDAGOGY, AND PARTNERSHIPS:
SHEDDING LIGHT ON A DARK MATTER

Professionals with a broad knowledge of science are increasingly needed for economic and social development. The major issues of our time—climate change, a looming energy crisis, and genetic engineering—call for responsible citizens and leaders to have a basic knowledge of science. However, in the current school system, science is often misinterpreted as a mundane series of facts, failing to engage students in the creative scientific process.

For adults and children alike, astronomy can be used as a vehicle to spark interest in the other sciences. Astronomy appeals to people of all ages and may seem less intimidating than sciences such as mathematics or engineering. "Planets, Pedagogy, and Partnerships," the class created by the Honors Think Tank on Astronomy, will familiarize future students with the fundamentals of astronomy and equip them with the skills necessary to educate others. Students in the course will master teaching kits used by the Clark Planetarium and will take their new knowledge to Salt Lake City's elementary schools. Students in the course will work to eradicate misconceptions about astronomy while increasing their own scientific knowledge and serving their communities.

Everyone involved in the course, from University students to sixth-graders to public school teachers, will use astronomy to contribute effectively to 21st-century society as scientifically literate citizens. Students will gain experience in mentoring and sustaining partnerships, and through reciprocal learning, enhance community connections between the University, sixth-grade students, teachers, administrators, and parents.