

Citizen Sky Final Report

Rockman et al
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Introduction

The STARS project (i.e., Science Through Astronomical Research of Stars), more commonly known to its participants as “Citizen Sky” was a citizen science project that not only asked its citizen participants to collect data, but went a step beyond and invited much deeper levels of participation in data analysis and publication phases of the scientific process.

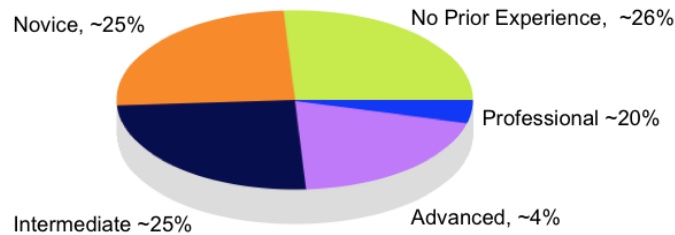
Rockman Et Al, an independent evaluation firm that specializes in evaluations of informal science learning programs, conducted a comprehensive evaluation of the Citizen Sky project. Evaluation efforts included comprehensive data gathering initiatives to determine outcomes from three face-to-face conferences, interviews with program participants, analysis of online discussions and interactions (asynchronous communication), and surveys and observations geared toward understanding outcomes of synchronous online events. Specifically, our evaluation sought to determine the impact on participants across a spectrum of knowledge and interest in astronomy, including:

- The extent to which interest in science was stimulated among participants from a variety of different backgrounds and skill levels.
- The extent to which forum discussions generated engagement and involvement from participants with different interest and skill levels – i.e., helping them to progress along a continuum from novice to expert.
- The extent to which participants of all ability levels were able to learn new skills and knowledge.

Participant Demographics

Based on participant intake surveys, Nearly equal quarters of the Citizen Sky population identified themselves as 1) No prior experience (26%), 2) Novice (25%), 3) Intermediate (25%) and 4) Advanced (4%) or Astronomy Professionals (20%).

Figure 1: Distribution of Citizen Sky Participants by Skill Level



Objectives

Based on the diverse nature of participants, we sought to determine the nature and extent of impacts in the following categories:

Awareness/Understanding:

- 1) Changes in participants' understanding the process of scientific inquiry
- 2) Increase in participants' knowledge/understanding of science, astronomy, variable stars, and epsilon Aurigae specifically
- 3) Awareness of the ability of all citizens to contribute to the scientific process

Engagement/Interest:

- 4) Changes in participants' interest in science/Astronomy
- 5) Changes in participants' level of engagement as they become more involved in a citizen science initiative

Behavior:

- 6) Sustained/active participant involvement in scientific inquiry process
- 7) Team-based collaboration/participation in a research community including posting/commenting, contributing data and other contributions
- 8) Opportunities for citizens to work collaboratively with actual scientists and do real scientific work (e.g. analysis and publication)

Skills:

- 9) Scientific Inquiry Skills: Collecting data, analyzing data, discussing results, publishing findings
- 10) Technology-based strategies for collecting, sharing data, analyzing data and collaborating with peers
- 11) Facilitating diverse teams of participants
- 12) Supporting and encouraging the participation of participants at all levels within the continuum of knowledge/experience

Other Impacts:

- 13) Contribution to the scientific community's understanding of epsilon Aurigae
- 14) Greater public awareness of the importance of epsilon Aurigae and the study of variable stars

Section 1: Workshops

1.1 Chicago Workshop

The initial workshop was held at the Adler Planetarium in Chicago, Illinois from August 4th through August 7th, 2009. Sixty-five participants were listed on the attendee roster, including project staff and partners. Participants included a wide range of astronomers (professional academic researchers, advanced hobbyists, and amateurs), educators from K-12 and higher educations, and college students.

Table 1: Workshop 1 Participants' level of Astronomy Experience

Level	%
Have never participated in an astronomy program before	4.76%
Novice, with very basic astronomy program experience	4.76%
Intermediate Level	29.19%
Advanced level experience in astronomy, but not in a professional capacity	38.10%
Professional astronomer, astrophysicist, etc.	26.19%

*Data based on responses to post-workshop evaluation survey, N=38.

The workshop provided an opportunity to connect and engage participants from all over the country, provide an overview of the project goals, background information about the epsilon Aurigae eclipse—the astronomical phenomena being studied, and presentations and hands-on tutorials about the scientific methods that are used to study epsilon Aurigae.

The overall tone of the workshop was one of interest and excitement. Participants were eager to start on the multi-year effort to study Epsilon Aurigae and felt that the workshop provided the right mix of tools, resources, and opportunities to network with fellow participants. Likewise, the project leadership team was looking forward to capitalizing on all of the skills that different people would bring to the experience.

Table 2: Participants' Ratings of the First Workshop

Question	Average*
Overall, this workshop was a good introduction to the Citizen Sky project	4.61
Overall, this workshop was engaging	4.50
Overall this workshop was informative	4.55
Overall, this workshop helped prepare me for my role in the Citizen Sky project	4.28

*Respondents were given a 5-point scale, where 1 was lowest and 5 was highest. n=38

All participants whose attendance at the conference was subsidized agreed to organize an educational or public outreach event. Some participants had already planned or launched

their outreach efforts—others were still exploring different opportunities. Resources, such as PowerPoint templates and publicity materials to help facilitate educational and public outreach activities were provided via the Citizen Sky website. Participants were also invited to make observations and contribute their data, analyze data, help to write articles about findings, and join online teams designed to facilitate collaboration among participants. The table below reflects participants’ responses to a series of questions about post-workshop activities and ongoing participation in the Citizen Sky project.

Table 3: How Participants Planned to Participate in the Citizen Sky Project

Activity	%
Make visual observations of Epsilon Aurigae	55%
Promote the project within my community	97%
Implement the project with a class/group of students	55%
Gather/submit data about Epsilon Aurigae using photometry	47%
Gather/submit data about Epsilon Aurigae using spectroscopy	24%
Review and analyze data collected as part of this project	53%
Write, or collaborate to write, articles about Epsilon Aurigae	63%
Join an online team and collaborate with other participants	47%

N=38

1.2 San Francisco Workshop

The second Citizen Sky Workshop took place September 2nd through 5th, just over a year after the first workshop, and was held at the California Academy of Sciences in San Francisco. The second workshop was designed to help participants focus on data analysis and reporting tasks that are the focus of the grant’s second and third years.

Our post-workshop evaluation asked participants to share how they had first learned about the Citizen Sky Project. Their responses are summarized in the table below.

Table 4: How Workshop 2 Participants Had Heard About Citizen Sky

Level	%
Citizen Sky website	29%
Citizen Sky email or newsletter	6%
AAVSO website	12%
AAVSO email or newsletter	18%
Other astronomy website	6%
Other astronomy group email or newsletter	18%
From someone involved with the project	35%

N=17

We also asked survey respondents to indicate their level of Astronomy Experience. Responses are summarized in the table below.

Table 5: Workshop 2 Participant’s level of Astronomy Experience

Level	%
Have never participated in an astronomy program before	6%
Novice, with very basic astronomy program experience	12%
Intermediate Level	24%
Advanced level experience in astronomy, but not in a professional capacity	35%
Professional astronomer, astrophysicist, etc.	24%

N=17

In addition to variation in participants’ level of astronomy experience, participants’ level and types of engagement with the Citizen Sky project also varied greatly – including participants who had been involved since the beginning as well as participants who were relatively new to the Citizen Sky project. The later had not yet participated in many project activities but were overwhelmingly positive about doing so in upcoming months. Survey data about participants’ past experiences with Citizen Sky was similar to that shared by participants at the workshop itself. Among survey respondents, 59% of respondents to the post-workshop survey had not attended the first workshop—indicating a fairly balanced mix of new and continuing participants.

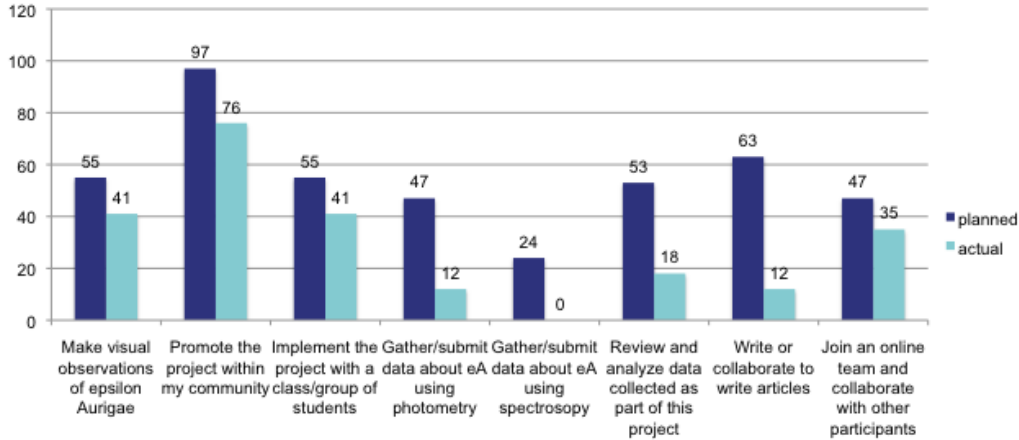
Continuing participants’ responses to a question about how they had participated in the Citizen Sky project over the past year provides some sense of the project activities that participants had been engaged in during the project’s first year.

Table 6: Workshop 2 Participants’ Involvement with Citizen Sky During the First Year

Activity	#
Made visual observations of Epsilon Aurigae	41%
Promoted the project within my community	76%
Implemented the project with a class/group of students	41%
Gathered/submitted data about Epsilon Aurigae using photometry	12%
Gathered/submitted data about Epsilon Aurigae using spectroscopy	0%
Reviewed and analyzed data collected as part of this project	18%
Wrote, or collaborated to write, articles about Epsilon Aurigae	12%
Joined an online team and collaborate with other participants	35%
Was not involved in the Citizen Sky Project this past year	24%

N=17

Figure 2: Percentage of Planned vs. Actual First-Year Activities



(Planned N=38, Actual N=17, 24% of whom had not participated in year 1)

For the most part, in the project’s first year participants did what they said they planned to do at the start of the project (with the exception of spectroscopy data – and fewer written papers since that was something that came later in the project).

Participants were positive about the workshops and generally felt that it prepared them to participate in the Citizen Sky project. A summary of specific ratings is presented in the table below.

Table 7: Workshop 2 Participants’ Ratings of the Workshop

Question	Average*
Overall, this workshop was engaging	4.71
Overall this workshop was informative	4.65
Overall, this workshop helped prepare me for my role in the Citizen Sky project	4.53

*Respondents were given a 5-point scale, where 1 was lowest and 5 was highest. N=17

In general participants thought that the second workshop was just as helpful, if not more helpful, than the first workshop. Of the participants who had attended both workshops, twice as many participants thought the second workshop was “much better” than those who thought it was “not as good.”

Since the second workshop sought to prepare participants for their role with the project in the months to come, we also asked participants what they planned to do as part of the Citizen Sky Project in the coming year. Their responses are summarized in the following table.

Table 8: Workshop 2 Participants' Plan for Participation in the Citizen Sky Project Over the Coming Year

Activity	#
Make visual observations of Epsilon Aurigae	47%
Promote the project within my community	88%
Implement the project with a class/group of students	53%
Gather/submit data about Epsilon Aurigae using photometry	12%
Gather/submit data about Epsilon Aurigae using spectroscopy	6%
Review and analyze data collected as part of this project	35%
Write, or collaborate to write, articles about Epsilon Aurigae	24%
Join an online team and collaborate with other participants	47%

N=17

Participants were also asked to share their personal goals for participation in the Citizen Sky Project. A sample of participants' responses are summarized below.

Share Love of Astronomy

- *Make astronomy friendlier and approachable to people. Introduce my work to engage and hook the curious.*
- *To share my love of astronomy and variable stars with the public.*
- *I plan to get others interested in joining the Citizen Sky Project.*
- *To interest young people in science, showing them that by using programs like Citizen Sky they too can contribute to scientific discoveries.*
- *My goal is see how scientific capacities can be cultivated in a general community.*
- *I am recharged and my enthusiasm for working with high school students in astronomy is rekindled by events like this.*

To Contribute to Science

- *To write a paper on a variable star topic that has scientific merit.*
- *To observe epsilon Aurigae and the stars on the 10 star tutorial and input data.*
- *To help untangle one of astronomy's long standing mysteries.*
- *To continue observing stars like zeta Phe and eta Aql, contributing to the AAVSO International Database.*
- *I get personal satisfaction from contributing to science on an active level.*
- *I'm interested in following up on the observing projects discussed on semi-regular variables and other seldom observed objects.*

To Learn Science/Improve Scientific Skill Level

- *To learn and understand the history of the theories and how we arrived at our current understanding of the system.*
- *I hope to learn how to analyze variable stars using VStar.*
- *To learn more about photometric techniques with small telescope.*
- *Learn more about variable stars within the context of an international observing campaign.*

Collaborative Experiences

- *To work on another project with the Southern Gems team.*
- *I will continue to mentor other visual observers through the 20/20 Vision Team.*
- *To participate as a team member in teams such as the Mira Fourier Coefficients Team.*

We also asked respondents what the term “citizen scientist” meant to them. Responses included the following examples and themes.

Making real contributions to science

- *Non-scientist participants making a valuable contribution to science through observation, analysis, research or experimentation.*
- *Citizen Science is where anybody, PHD or tenth grader can contribute to science. People who are not professional scientists can contribute to scientific understanding. There are cases in which a range of observations are needed to understand a phenomena, citizens can help.*

Collaborations between scientists and lay people

- *Citizen Science means ordinary citizens doing actual science projects under the guidance of professionals.*
- *Training non-scientist citizens to participate in scientific observations and submit data to scientists.*
- *Collaboration between amateurs, professionals, and educators is a key feature.*
- *Citizen Science is a means of getting the general public involved in collecting (or analyzing) real science data, and connecting professional scientists and the public. Citizen science means recognizing that we all can learn from each other, and everyone can contribute to the progress of human knowledge.*
- *The active participation of non-professional individuals in scientific research as observers, data evaluators, or educators.*

The evaluator attending the second workshop also had opportunities to meet with several participants and learn more about their reasons and goals for participation, including a

graduate student from Florida State College interested in finding ways to encourage her students to do observations, a couple building their own telescope who are interested in hosting star parties to get people excited about conducting observations, and an astronomy club leader interested in developing a challenge for participants to build eclipsing binary models with Legos.

1.3 Boston Workshop

The goal of the final workshop, held in Boston March 22nd-24th, 2013 at the AAVSO Headquarters near Boston, was the creation of a DSLR Photometry Handbook. Specifically, the workshop came about in response to a lack of support resources for entry-level users who were interested in giving photometry a try.

About 20 participants, of varying ability levels participated in the three-day workshop. Participants were assigned to three to five-member working groups. Each team worked efficiently toward the goal of creating their portion of the DSLR Photometry Handbook. Floating team leaders helped to coordinate efforts across the multiple work-groups.

Interviews indicated that the workshop was well done and contributed greatly to the field of photometry by merging amateur and expert photometrists to create a usable manual that would improve the quality and quantity of photometric images for AAVSO research and the science of photometry at large.

The inclusion of amateur photometrists and educators was very well received. Additionally, in seeking to develop a handbook for novice users with little to no prior experience with DSLR photometry, Citizen Sky created an opportunity wherein amateurs were not only welcome, but also had a central role to play in the development of the resulting handbook. While there was a sense that they slowed down work marginally with questions experts knew well, interviews and observations suggested that they helped keep the project vision in perspective by pointing out areas of photometry where an amateur astronomer would need more explanation.

Experienced Astronomers were attracted by the opportunity to work with other professionals and contribute to the science at large. When asked, most responded that they felt more excited and enthusiastic about photometry than they had in some time. This excitement resulted partially from meeting other experts who wrote published work they had read, partially from creating a meaningful manual that they were all really proud of and felt would improve the research quality and volume of photometric images.

The workshop also proved beneficial for more amateur attendees. Amateurs indicated they were eager to learn more from experts and get ideas for their own research or educational practices as teachers.

Section 2: Forum Participation

In evaluating a website, it is often easy to just depend on web analytics to determine its performance. However data such as ‘hit rates’ and ‘number of views’ are often superficial or meaningless, if the context and objectives behind each website are not being considered (Plaza, 2010). In the case of Citizen Sky, we discovered that the activity on the online discussion forums only told a small part of the story about participants’ involvement with the project. Whereas there was a relatively modest amount of forum-based communication, participants explained that a significant amount of communication was taking place outside of the forums via email, instant messaging or chat rooms.

Participants mentioned the quality of interaction found in the online community to be one of the greatest strengths for the project. In interviews, participants shared the following comments:

One of the key strengths is the opportunity to meet and interact (virtually and in person) with many very keen people.

I did meet a lot of people that were very interesting ... scientists, astronomers and other people who were interested in stars.

Likewise, the team-based experience played an important role in participants’ overall impression of the program. Participants expressed the greatest satisfaction and personal growth in knowledge in instances where they were members of teams where group members made more significant connections with one another, as well as teams where participants felt their skill sets and the assets they brought to the group were useful and valued by other group members.

Figure 3: Screen Cap from the Citizen Sky Website Showing “Popular Teams”

The screenshot displays a website interface for Citizen Sky teams. At the top, a yellow box contains introductory text: "Scientific collaboration is an important part of any scientific project. Citizen Sky teams are designed to bring participants with like interests and complimentary skill sets together to work toward a common goal. You can create your own team or become a member of an existing team. For more information on the Citizen Sky team concept please visit the team overview page." Below this is a "Popular Teams" section with a "See all" link. It features six team cards, each with a representative image, a title, a brief description, and a member count. To the right of the "Popular Teams" section are two orange-bordered boxes: "Explore Teams" with a bulleted list of options (Find Teams, Start a Team, My Teams, Popular Teams) and "New Teams" with a bulleted list of team names (Kepler Variables, AF And, Mira Fourier Coefficient Team, Historical Perspectives, DARK at Dudley, GEOGAs, Southern Gems, DSLR Documentation and Reduction, PEA Observers, AstroMan). At the bottom right is a "My Teams" box with the text "Not a member of any groups."

Teams

Scientific collaboration is an important part of any scientific project. Citizen Sky teams are designed to bring participants with like interests and complimentary skill sets together to work toward a common goal. You can create your own team or become a member of an existing team. For more information on the Citizen Sky team concept please visit the team overview page.

Popular Teams See all

- VStar Software Development**
Variable star data visualization and analysis software development team.
35 members
- DSLR Documentation and Reduction**
To discuss various reduction and analysis techniques suitable for DSLR cameras and create...
73 members
- The 20/20 Vision Team**
To assist and encourage visual observing of 10 other variable stars and 10 other night sky...
52 members
- The Mark I Eyeball Team**
To determine the precision of visual variable star estimates according to a large number of...
11 members
- Southern Gems**
This group is working on identifying 10 bright variable stars viewable from the Southern...
19 members
- Aesthetic Solutions**
Visual understanding, analysis, development, and application.
7 members

Explore Teams

- Find Teams
- Start a Team
- My Teams
- Popular Teams

New Teams

- Kepler Variables
- AF And
- Mira Fourier Coefficient Team
- Historical Perspectives
- DARK at Dudley
- GEOGAs
- Southern Gems
- DSLR Documentation and Reduction
- PEA Observers
- AstroMan

My Teams

Not a member of any groups.

Facilitating Learning

For the purposes of this evaluation effort, learning was defined as “changing patterns of participation in specific social practices within communities of practice” (Lave, 1988, 1996; Lave & Wenger, 1991). Specifically, we sought to see if there was a gradual evolution among participants, i.e., progressing from being more novice to more advanced in their knowledge of and experience with astronomy. Bong & Zhang’s (2008) R2D2 model suggests that online users generally make progress in their involvement levels as they learn something from the online environment. Alternatively, Gee & Green (1998) employed the MASS (Materials, Activities, Semiotics and Socio-cultural aspects) system to categorize content for discourse analysis. Taking inspiration from the aforementioned models, a simplified model was developed and adapted for use in evaluating the Citizen Sky online forums.

Five different categories of content type were being proposed with L1 being the entry level and L5 requiring the highest involvement and subsequent learning outcomes:

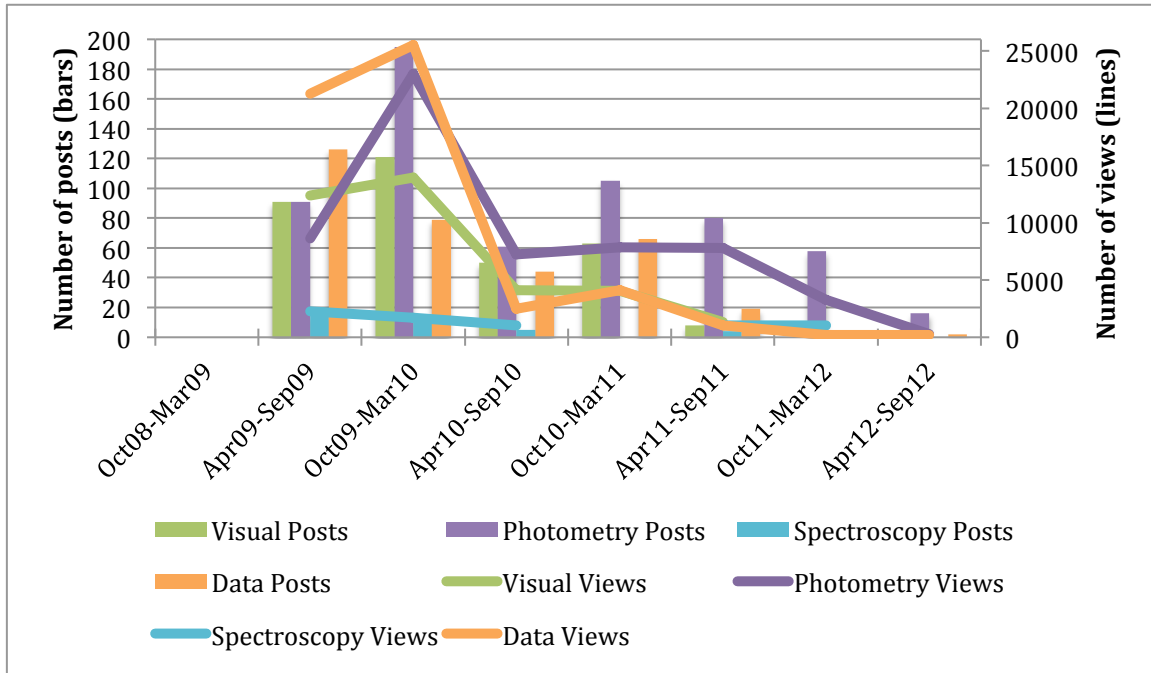
- (L1): Making a statement or expressing an interest (interest).
- (L2): Asking questions or requesting for help (interest).
- (L3): Reporting or sharing of results, experience, offering an answer or what they think the answer to be (engagement / involvement).
- (L4): Encouraging others, taking on pseudo administrator/leadership roles (engagement / involvement).
- (L5): Responding to questions - authoritative, advising, sharing of experience (learning).

The evaluation performed a comprehensive analysis of discussion forum posts in the summer of 2013—i.e., before the final workshop, but after most of the data collection, analysis and publishing efforts of the project. Our analysis included “counts” of posts and replies in each forum thread, but also delved deeper into a handful of threads to perform more qualitative analysis.

In terms of activity, the “Science” and “General Discussion” forums were the busiest and attracted the majority of forum activity. Hence, these were the two groups selected for deeper analysis of specific threads.

The figure on the following page illustrates findings within the “Science” category on the discussion forum.

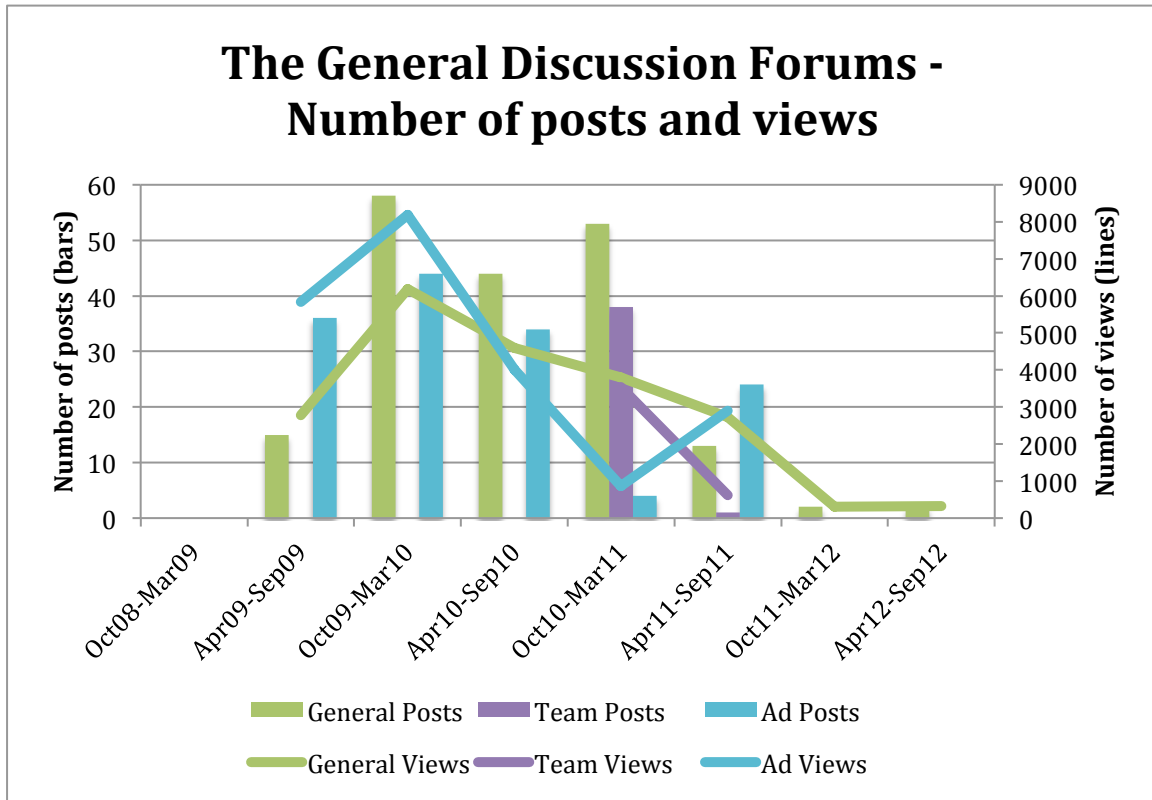
Figure 4: A Summary of Posts and Views within the Discussion Threads in the “Science” Category of the Online Forum



From the chart above, it was clear that the “Photometry” sub-forum generated the highest numbers of posts and views. At its peak (Oct 09 to Mar 10), there were close to 200 posts and 25000 views for that period. It was also the only sub-forum that was relatively more consistent over time, generating posts and views beyond the period of the star eclipse into the post project period (beyond Oct 2011). This could possibly suggest that the interest of the people involved in the “Photometry” sub-forum were extended beyond the scope of just the project’s star eclipse. Hence the sub-forum continued to thrive beyond that.

The “Visual Observing” sub-forum was more active during the initial two years of the project and tapered when the focus went into data analysis and producing journal papers to report on respective project findings. Likewise, the “Data Analysis” sub-forum displayed similar trends, tapering off towards the end, however sustaining a little longer than the “Visual Observation” sub-forum. In all, the “Spectroscopy” sub-forum registered the lowest numbers of posts and views, highlighting an area that generated the least interest and involvement, perhaps due to its more specialized nature.

Figure 5: A Summary of Posts and Views within the Discussion Threads in the “General Discussions” Category of the Online Forum



The General Discussion Forums had three sub-forums, comprising of “General Discussions,” “Team Organization” and “Ad Infinitum.” It was interesting to note that these forums were not generating the same level of online activity compared to the Science forums, registering lower on average total number of posts and views. This probably highlighted the focus on the online community, being more of a scientific and professional rather than a social interest.

It was also significant to note that the “Team Organization” sub-forum was rather restricted in use. This further suggests that the various teams probably preferred and utilized other means of communications for their team projects instead of through this dedicated sub-forum.

On a more positive note, the number of posts and views for the “General Discussion” and “Ad Infinitum” sub-forums were significant and consistent throughout the project years, showing a balanced interest and presence of a common identity within the online community.

Section 3: Live Events

In April of 2013, Citizen Sky hosted a series of live webinars for project participants and other interested parties. The “Astro April” schedule is summarized below.

- April 4th: Robert Naeye Behind the Scenes at Sky & Telescope
- April 12th: Kevin Marvel & Bethany Johns The American Astronomical Society and the Status of Astronomy in the U.S.
- April 13th: Robert Stencel Results of the Citizen Sky Campaign and What's Next?
- April 17th: John Martin Supernova Impostors
- April 18th: Steve Howell Variable Stars/Kepler Data
- April 23rd: Kristine Larsen Astronomy of Middle-earth
- April 24th: Grant Foster Uncertainty in Finding Maxima and Minima
- April 26th: Paul Shankland A naval aviator's astronomical journey - from amateur joys, to ATM, to airborne astronomy, to the VLA.
- April 27th: Doug Welch Introduction to Cepheid Variables.
- April 27th: Sebastian Otero Proyectos para el observador visual y el astrónomo de escritorio. Colaborando con VSX (en Español)
- April 28th: Brian Kloppenborg Writing a dissertation about epsilon Aurigae and experience with Citizen Sky
- April 28th: Arfon Smith Zooniverse & other citizen science projects

Though geared toward Citizen Sky participants, the webinars were open to the general public as well. Of the webinar participants who responded to post-program surveys, 66.67% were also participants in Citizen Sky. There was a nice distribution of attendees Astronomy interest-levels: 19.05% indicated that they were novices, 33.33% were amateurs at an intermediate level, 42.86% were amateurs at an advanced level, and 4.76% were Astronomy students or those studying to pursue Astronomy in a professional capacity.

Participant satisfaction ranged from 7-10 on a ten-point satisfaction scale where 1 is “Not Satisfied at All,” and 10 is “Extremely Satisfied.” Among the things participants noted valuing most were the following:

Being able to share some valuable time with astronomy professionals and amateurs through these really interesting webinars is amazing! The fact that you can ask any question that comes to your mind and be answered in the moment is invaluable.

Lots of graphs and visual to help understand the topic.

Extremely knowledgeable speaker covering both the basics (Leavitt's P-L relation) but also covering numerous significant recent results. All put in context, i.e. the significance of those results nicely explained.

Section 4: Participant Feedback and Reflections

In this final section of the report we summarize findings from a series of in-depth participant interviews. A sample of participants were identified through the online discussion forums and initially contacted via email. Interviews were then conducted by phone with participants who responded to the email invitation.

Project Organization and Management

Participants asserted that Citizen Sky project was well managed and supported. They liked the three-stage approach whereby there was a clear focus for each year. At the same time, the participants expressed appreciation that the administrators of the project, on the onset, had planned with the participants' interests in mind instead of just focusing on achieving the project's scientific goals.

Citizen Sky was a lot more organized. There was a variety of ways that you could participate. It provided a lot of flexibility based on personal interests, just as well as levels of skills with astronomy research.

I like the fact that there can be different interest groups ... you can pick or choose what you like to be part of.

It was just so very easy, very well organized visually, very professionally done. I have seen other websites that just gives you a headache trying to navigate around it ... but it (Citizen Sky) was just so well conceived that it was effortless to participate on the online community.

Some of the interviewees felt that there could be stronger leadership and guidance offered to groups, especially at the beginning of the project. Similarly, others felt that there should be more supervision, support and oversight to help kick-start collaborative efforts. Regardless, all interviewees acknowledged that this area would always be challenging due to the voluntary nature and informal social basis that the groups were formed on.

Some guidance at least in the sense of giving directions is required from a Professional, at least for a first-time project.

I guess this happens everywhere ... we needed some help with how to collaborate. Sometimes people would take on the lead and then it felt like then it was their responsibility to make sure that everybody was participating.

I just thought that maybe the administrators could make a list of suggested ideas that could then be modified based on interests, to make the process of collaboration accelerate much more quickly.

Project Reach

One of the key strengths of the Citizen Sky project was the opportunity it afforded all participants to actively participate in scientific research. A majority of the interviewees echoed this feature as one of the main reasons attracting and drawing them onto the project.

Citizen Sky was actually quite different. We were actually participating in it on all levels – collecting the data, analyzing the data, publishing etc.

The whole concept was to involve people in scientific process and not just have people be passive observers, collecting data for others to analyze.

The idea of citizens making real contributions to science was electrifying me.

Nonetheless, the involvement of participants depended, to some extent, on their individual background and experience levels. While the project sought to be inclusive of peoples of all astronomy skill levels, participation by those with an intermediate level of experience and higher proved optimal.

The online community was generally welcoming, however, a small community of people with backgrounds outside of the target focus group (i.e. beginners with little experience, educators etc.) expressed difficulty in participating beyond the mere collection and submission of observation data.

I guess some of the groups were kind of keeping data to their chests for a while. In that regard, I didn't feel like I could participate (analysis). That surprised me ... that people with access to certain technology that I didn't have access to: they were doing their own things and then we learned about it afterwards.

In addition, some of the interviewees felt that the project could have spent a little more effort in advertising and making the project known to the public. Some of the members only chanced upon the project's website when they were searching online for other astronomy related matters. As a result, a number of members expressed regret that they had not joined earlier and missed some of the keynote activities i.e. the workshops.

I ran across it by chance, probably 70% through the period it was running. And I never saw anything in the major astronomy magazines or any of the Internet forums and stuff about the program.

I do know that AAVSO advertises but it seems that this project wasn't as well advertised.

As mentioned earlier in this report, data such as ‘hit rates’ and ‘number of views’ are not always the best criteria by which to measure a website’s success. In the case of Citizen Sky, the sole dependence on web analytics figures may on the surface lead one to believe that the forum was not very vibrant and thereby suggesting a level of effectiveness that belies its true worth.

I would have wished that the forum was a bit busier, but we did additional and very nice discussions internally in the team, also via online tools e.g. the AAVSO chat room.

Interviewees on the other hand expressed satisfaction with the activity level of the forums. In addition, they mentioned that informal channels of communications have been established outside of the official project website, especially by groups to facilitate their respective project work and take discussions offline. At the same time, the Citizen Sky project had a distinct focus for each of the three years. Hence it will be natural to expect the forums to be more vibrant during the first and second years where people are being drawn in to participate or forming teams for respective projects of their interests and choice.

I think I was primarily involved at the beginning when people were getting started and learning how to do things, and less involved towards the end ... so once everyone was kind of started, my work was essentially done.

There were like 2000 people who participated in Citizen Sky, maybe a few hundred of them were very active in it. I got to meet a lot of the people at the workshop and through Citizen Sky forums.

I guess it is as active as you typically find, if not more active than most environment like that.

Beyond the mere numbers, most interviewees mentioned the quality of interaction found in the online community to be one of the greatest strengths for the project.

One of the key strengths is the opportunity to meet and interact (virtually and in person) with many very keen people.

I did meet a lot of people that were very interesting ... scientists, astronomers and other people who were interested in stars.

Evidence of Learning

All of the interviewees mentioned that they had all learned a lot through the project, something they would not have accomplished on their own. Depending on their individual experience level when they joined the project, they had all made significant progression in learning, depending on their levels of involvement as well as the respective time and effort that each individual committed onto the cause.

I learned a whole lot of things about epsilon Aurigae ... that I probably wouldn't have learned any other way.

Mostly the naked eye estimates. In the past I had been telescopic, which I thought was easier but after this experience, the naked eye estimates were just as easy.

Quite minimal experience previously ... learned how to do visual estimates and feel comfortable doing so ... learned about light curve classification and different variables that produce such light curves ... realized anew that just how barely I've scratched the surface ... that amateurs don't just do observations; they can do data analysis.

Summary

The Citizen Sky project demonstrated both a desire and capacity within lay people to become more deeply engaged with rigorous scientific pursuits. In addition to producing evidence that it is possible to effectively engage citizens in scientific discovery in more meaningful ways, our evaluation of Citizen Sky also revealed a set of findings related to the more general practice of conducting citizen science projects.

The mystery behind epsilon Aurigae proved to be a good hook for pulling less experienced and more experienced participants. The time sensitive nature of the endeavor (i.e., it being decades before another opportunity to study epsilon Aurigae during eclipse) also lent itself to fostering interest and engagement with the project.

We found that participants could have successful experiences with a program like Citizen Sky despite their starting skill level, but it took the right characteristics (being life-long and uninhibited learners, for example), and right levels of motivation. Citizen Sky excelled in its ability to offer a variety of activities and tasks for all skill levels and a variety of different interest areas. However, ensuring participants found the right niche and a well-matched set of activities required proper facilitation and encouragement from team leaders and project facilitators.

That relative novices to Astronomy and variable star observation were able to actively contribute to scientific discovery through their observations (in a variety of different formats), make real contributions to the analysis process, and gain opportunities to be published within the field of Astronomy is a lasting impact of the Citizen Sky project and a true testament to the projects' ability to engage citizens across a wide spectrum of Astronomy knowledge and interest. Additionally, new communication skills and mentoring talents were fostered among the more advanced amateurs and science professionals that were a part of the Citizen Sky project.

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Appendices

Appendix A: Summary of All Evaluation Survey Responses for First Workshop

	Number of Respondents	%
What is your level of astronomy experience?		
Have never participated in an astronomy program before	2	4.76%
Novice, with very basic astronomy program experience	2	4.76%
Intermediate level	11	26.19%
Advanced level experience in astronomy, but not in a professional capacity	16	38.10%
Professional astronomer, astrophysicist, etc.	11	26.19%
Total	42	
Mean	3.76	
Standard Dev.	1.05	
Variance	1.11	

	Number of Respondents	%
How do you plan to participate in the Citizen Sky project? (check all that apply)		
Make visual observations of Epsilon Aurigae	21	11.60%
Promote the project within my community	37	20.44%
Implement the project with a class/group of students	21	11.60%
Gather/submit data about Epsilon Aurigae using photometry	18	9.94%
Gather/submit data about Epsilon Aurigae using spectroscopy	9	4.97%
Review and analyze data collected as part of this project	20	11.05%
Write, or collaborate to write, articles about Epsilon Aurigae	24	13.26%
Join an online team and collaborate with other participants	18	9.94%
Other	13	7.18%
Total	181	
Mean	4.55	
Standard Dev.	2.60	
Variance	6.78	

As a participant, what are your personal goals for participation in the Citizen Sky project? (what do you hope to get out of the project on a personal or professional level?)

- *I plan to incorporate Citizen Science (observation of Epsilon Aurigae) in my classroom, Science Olympiad and with our local astronomy club. Attending the conference refreshed my knowledge of variable stars.*
- *I want to get citizens and students excited about doing real science and a personal goal is to be able to contribute to science myself. I would like to learn to analyze data, but I have never*

had calculus or trigonometry and I wonder if I have the skills to do this. I would also like to contribute to the work on other variable stars.

- *I hope to demystify the methods by which astrophysicists make decisions and interpret data to come to conclusions about the Eps Aur system.*
- *To better ground myself in variable star observing, a new area for me, and to find the resources available to me.*
- *To get others interested in astronomy*
- *Develop wide field photometry capability for brighter objects currently too bright for photometry on available objects.*
- *Satisfaction of engaging others in astronomy. I hope to improve upon my skills to do photometry and make contact with citizen astronomers who have more experience than I have. Learn about the science of Eps Aur.*
- *I am interested in promoting science and math education through variable star research. Astronomy, and variable stars in particular, can spark the imaginations of young and old alike. We get to use, and in some cases supply, real data being used to do real science. That's just cool...*
- *I probably will not continue with it, but will instead focus on the Epsilon Aurigae Campaign and web site.*
- *Learning firsthand the procedure and challenges for doing precise photometry with commodity color digital cameras.*
- *I plan on training student groups at Riverwoods Field Lab to make observations of Eps Aur*
- *More of an understanding of the universe :-)*
- *Experience working with both the professional and amateur community. We're working with a team led by SH of NOAO, to provided additional spectral data.*
- *Be part of something significant and possibly interest other younger people who will be taking my place observing variables one day*
- *A successful phased implementation of VStar and seeing its used for real. :) I also want to advance my understanding of variable stars and the analysis of light curves. I may observe Epsilon Aurigae if it is far enough above my suburban Adelaide horizon in November for practical observation. I am also considering initiating a project at my son and daughter's primary school to observe one or more of the stars on the 10-star list. The school has a very pro-active science teacher.*
- *Learn more about variable stars and connect with other interested people.*
- *On a professional level, I am in the process of preparing talks to be given at local clubs and at Harper College. I would hope that we can involve interested students at Harper to partake in an observing program. On a personal level, I hope to gather visual and photometric (CCD) data and analyze the same. I have already purchased AIP4WIN and FileMaker Pro, contacted JH and received his template in FileMaker Pro for analyzing and reporting photometric observations.*
- *Make an actual contribution to the data; get others (students, public) involved; help publish some results.*
- *To show people that science like this can be easy to do!*
- *Understand the data so I can create visualizations*
- *I want to both learn more and incorporate my students in the research.*
- *I want to use the citizen sky project to show my high school students that science is dynamic and help them understand the scientific method. Personally, I want to be involved in the discovery of this star system.*
- *an understanding of the eps Aur system, and a better handle on what draws people to such a project.*
- *My participation was focused on producing a documentary about the project.*
- *Contribute to my own understanding of the star system, per se, and to help students*

understand the science project more broadly.

- *experience in research, experience developing activities for students, a project for a high school students for a science faire.*
- *A better connection for the public and science, as well as a scientific understanding of Eps Aur*
- *I am interested in collecting and analyzing data to help determine the nature of the Epsilon Aurigae system.*
- *Personally, to be associated/involved with the understanding and facilitation of astronomy and nature. Professionally, don't know yet. Everything is connected somehow.*
- *I hope to be able to add to the data on this apparition, and to be able to ignite the spirit of discovery in local youngsters.*
- *Solve the mystery this time!*
- *Professional: Credit for development of undergraduate lab activities, Credit for outreach activities, Credit for contributing to research. Personal: Re-involvement in astronomy research*
- *I want to know that what I'm doing is meaningful beyond simply completing a task.*
- *BVRI photometry*
- *I will notice what aspects of this effort would translate to the LSST and work with the AAVSO to leverage those experiences.*
- *I hope to learn about the scientific process first-hand, conduct some basic but tangible research that would allow me to advance in my hobby of astronomy. If I personally contributed, to whatever extent, to solving the elusive problems of this star system, that would be a phenomenal feeling. Additionally, it is a great way to meet some new and very interesting people as I did at the first workshop.*
- *It's a chance to introduce a lot of people who never thought they could do anything scientific to real science they can contribute to. Also, I want to develop my own CCD/DSLR photometry skills and contribute as many observations as time permits.*

What does the term “Citizen Science” mean to you?

- *All citizens are scientists and all scientists are citizens. Observing the natural world is a skill and pleasure that needs to be encouraged in all citizens and the Epsilon Aurigae project is a good one to bring the importance of observing to the forefront.*
- *To me it means that ordinary citizens, who may not be trained as scientists, learn scientific techniques and methods to contribute real data to a project that benefits science.*
- *It is work being done by people who are (more than likely) not experts in the field, but have a wish to contribute to science in a meaningful way. Because they are not an expert in the field, it may be necessary for them to collaborate with others (for writing, data acquisition/analysis, etc.) to create the end product (ideally a published peer-reviewed paper).*
- *an opportunity to participate in a science-grade activity at the level of a novice*
- *Science that is done by people who are not professional scientists*
- *I'm not sure. 'Amateur' has a condescending connotation now, but it didn't used to. 'Amateur' Radio Operators have always been respected in the electronics and communications field for their technical innovation and skill. Most astronomers up to the 1900s were, in fact, amateurs since they did not get paid to do what they did - of course, most were independently wealthy. But 'Citizen' seems contrived to me. I have no other suggestions, of course! 'Non-professional' will end up 'Un-professional'. This issue has existed for many years, and no resolution is in sight.*
- *Getting citizens who are not professional scientists, but who have an interest in science involved with scientific work. Help others understand how the scientific process works and why critical thinking is required.*

- *In spite of the unfortunate 'Soviet' sound of it, it means that regular Joes can be involved and participate in real science.*
- *It appear to an attempt to get non-astronomers interested in astronomy.*
- *It means effective communication of how science is selected and executed and the ability to engage citizen participants in the background, standards, and outcomes of the science involved.*
- *The average non-professional scientist taking part in and submitting data to scientists.*
- *Sharing Astronomy , AAVSO and the eps_Aur project in an ecological sense with members of the professional, educational, amateur and community settings.*
- *People being involved with the scientific community, to learn, and even to contribute.*
- *It makes the person who is not being paid to do work on a scientific project sound smarter and possibly more patriotic than s/he would if they were called an 'amateur'*
- *A person who makes a real contribution to Science either directly or by the development of tools or techniques that assist scientists (citizen or professional). Such a contribution may take the form of raw observations or analysis thereof, and possibly hypothesis formation.*
- *Science any citizen who is educated about the project is able to participate in, and ideally requires input from many people from different locations due to the nature of the project. Thus, individual teams of professional scientists need an expanded team of citizen scientists to collect data.*
- *Science done by non-professionals in support of professional projects.*
- *It means you don't need an Ivy League Ph.D. (which I have, a long story) to make a real contribution to science, or to understand what you are doing!*
- *Getting the average Joe involved in simple scientific observation*
- *Science oriented organization made of meticulous people, sponsored by real scientists.*
- *I think of it as emphasizing that participation in the science community need not be limited to professionals or a small group of amateurs.*
- *everyone participates in science. I see no problem with the term 'amateur scientist'.*
- *actively participating in a science project without being paid for it.*
- *The rebirth of the renaissance woman/man. (Yes, that's rebirth twice.)*
- *Public participation in the *entire* scientific process: collecting, analyzing, publishing and sharing insights from science for broad audiences.*
- *All people (not just scientists) learning through experimentation and observation and sharing the experience through communication with others.*
- *Science done by persons who prior to the time, were not interested or experts in the field of study.*
- *It brings to mind professionals, amateurs, and the general public all coming together to solve a science mystery.*
- *Collaboration among different peoples who share the desire to achieve a scientific goal.*
- *Citizen science, to me, is reminiscent of the Gentleman scientist of previous ages, where the man with a normal job was noted more for his advancement of science on his own time than for the job he did on a daily basis.*
- *The opportunity for anyone to participate meaningfully regardless of background.*
- *members of the general public who are interested in the given topic collaborate/help the 'professional' scientists by gathering and interpreting data with guidelines from the professional*

community.

- To me, 'Citizen Science' means involving citizens in scientific research.
- It means that a member of the general public with limited training can play a meaningful role in an authentic scientific endeavor.
- Amateur astronomy
- A non-specialist who contributes to scientific research for the fun of it.
- It is the field that acts auxiliary to professional science. It gives a chance to the layman to conduct research and contribute to the vast ocean of knowledge which up until recently, was the domain of trained professionals. It introduces science to many people and allows them to work with the fascinating science problems that evade us today.
- Making participatory science activities available to anyone who wants to participate.

Wednesday, August 5th		Number of	
A) About epsilon Aurigae (Bob Stencel)		Respondents	Percentage
1 (low)		0	0.00%
2		1	2.63%
3		1	2.63%
4		13	34.21%
5 (high)		23	60.53%
Did not attend		0	0.00%
	Total	38	
	Mean	4.53	
	Standard Dev.	0.69	
	Variance	0.47	

B) How to use the Citizen Sky Website (Aaron Price)		Number of	
		Respondents	Percentage
1 (low)		0	0.00%
2		5	13.16%
3		8	21.05%
4		16	42.11%
5 (high)		9	23.68%
Did not attend		0	0.00%
	Total	38	
	Mean	3.76	
	Standard Dev.	0.97	
	Variance	0.94	

C) The Citizen Sky Team Concept (Rebecca Turner)		Number of	
		Respondents	Percentage
1 (low)		0	0.00%
2		1	2.63%
3		7	18.42%
4		17	44.74%
5 (high)		13	34.21%
Did not attend		0	0.00%
	Total	38	
	Mean	4.11	
	Standard Dev.	0.80	
	Variance	0.64	

D) Public Outreach Strategies (Mike Simonsen and Aaron Price)		Number of Respondents	Percentage
1 (low)		1	2.63%
2		1	2.63%
3		8	21.05%
4		11	28.95%
5 (high)		15	39.47%
Did not attend		2	5.26%
	Total	38	
	Mean	4.06	
	Standard Dev.	1.01	
	Variance	1.03	
Thursday, August 6thE) Variable Stars 101 (Arne Henden)		Number of Respondents	Percentage
1 (low)		0	0.00%
2		1	2.63%
3		2	5.26%
4		12	31.58%
5 (high)		18	47.37%
Did not attend		5	13.16%
	Total	38	
	Mean	4.42	
	Standard Dev.	0.75	
	Variance	0.56	
F) Binary Stars Overview (Steve Howell)		Number of Respondents	Percentage
1 (low)		1	2.63%
2		0	0.00%
3		5	13.16%
4		17	44.74%
5 (high)		13	34.21%
Did not attend		2	5.26%
	Total	38	
	Mean	4.14	
	Standard Dev.	0.87	
	Variance	0.75	
G) Supergiant Binary Stars, Worth Their Mass in Gold, (Doug Welch)		Number of Respondents	Percentage
1 (low)		0	0.00%
2		2	5.26%
3		8	21.05%
4		16	42.11%
5 (high)		9	23.68%
Did not attend		3	7.89%
	Total	38	
	Mean	3.91	
	Standard Dev.	0.85	
	Variance	0.73	

H) Disks in Astrophysics (Brian Kloppenborg)		Number of Respondents	Percentage
1 (low)		0	0.00%
2		3	7.89%
3		4	10.53%
4		15	39.47%
5 (high)		11	28.95%
Did not attend		5	13.16%
	Total	38	
	Mean	4.03	
	Standard Dev.	0.92	
	Variance	0.84	
I) Initial Results of Photometric Observations of eps Aur with Spitzer (Don Wolfgang Hoard)		Number of Respondents	Percentage
1 (low)		1	2.63%
2		0	0.00%
3		6	15.79%
4		9	23.68%
5 (high)		18	47.37%
Did not attend		4	10.53%
	Total	38	
	Mean	4.26	
	Standard Dev.	0.96	
	Variance	0.93	
J) Epsilon Aurigae – A Spectral Investigation (Darryl Stanford and Dean Drumheller)		Number of Respondents	Percentage
1 (low)		1	2.63%
2		3	7.89%
3		2	5.26%
4		13	34.21%
5 (high)		13	34.21%
Did not attend		6	15.79%
	Total	38	
	Mean	4.06	
	Standard Dev.	1.08	
	Variance	1.16	
K1) Visual Observing of epsilon Aurigae: the Art of Variable Star Observing (Chris Stephan)		Number of Respondents	Percentage
1 (low)		1	2.63%
2		2	5.26%
3		1	2.63%
4		6	15.79%
5 (high)		4	10.53%
Did not attend		24	63.16%
	Total	38	
	Mean	3.71	
	Standard Dev.	1.27	
	Variance	1.60	

K2) Bright Star Photometry (Arne Henden)		Number of Respondents	Percentage
1 (low)		0	0.00%
2		0	0.00%
3		2	5.26%
4		7	18.42%
5 (high)		14	36.84%
Did not attend		15	39.47%
	Total	38	
	Mean	4.52	
	Standard Dev.	0.67	
	Variance	0.44	
Friday, August 7th L) Intro to VSTAR and Basic Data Analysis (David Benn)		Number of Respondents	Percentage
1 (low)		1	2.63%
2		1	2.63%
3		12	31.58%
4		11	28.95%
5 (high)		8	21.05%
Did not attend		5	13.16%
	Total	38	
	Mean	3.73	
	Standard Dev.	0.98	
	Variance	0.95	
M) Town Hall Panel Discussion		Number of Respondents	Percentage
1 (low)		1	2.63%
2		2	5.26%
3		14	36.84%
4		10	26.32%
5 (high)		9	23.68%
Did not attend		2	5.26%
	Total	38	
	Mean	3.67	
	Standard Dev.	1.01	
	Variance	1.03	
N1) Education Workshop: Spectra in the Classroom (Sally Seebode)		Number of Respondents	Percentage
1 (low)		0	0.00%
2		1	2.63%
3		2	5.26%
4		10	26.32%
5 (high)		8	21.05%
Did not attend		17	44.74%
	Total	38	
	Mean	4.19	
	Standard Dev.	0.81	
	Variance	0.66	

N2) Education Workshop: How to Use Citizen sky in a Science Class or Lab (Claudine Kavanagh)		Number of Respondents	Percentage
1 (low)		1	2.63%
2		2	5.26%
3		5	13.16%
4		7	18.42%
5 (high)		5	13.16%
Did not attend		18	47.37%
	Total	38	
	Mean	3.65	
	Standard Dev.	1.14	
	Variance	1.29	
N3) Spectroscopy (Jeff Hopkins)		Number of Respondents	Percentage
1 (low)		0	0.00%
2		0	0.00%
3		3	7.89%
4		6	15.79%
5 (high)		8	21.05%
Did not attend		21	55.26%
	Total	38	
	Mean	4.29	
	Standard Dev.	0.77	
	Variance	0.60	
O1) Visualizing epsilon Aurigae (Ryan Wyatt)		Number of Respondents	Percentage
1 (low)		0	0.00%
2		1	2.63%
3		3	7.89%
4		9	23.68%
5 (high)		5	13.16%
Did not attend		20	52.63%
	Total	38	
	Mean	4.00	
	Standard Dev.	0.84	
	Variance	0.71	
O2) DSLR Photometry (Jeff Hopkins)		Number of Respondents	Percentage
1 (low)		0	0.00%
2		1	2.63%
3		2	5.26%
4		5	13.16%
5 (high)		8	21.05%
Did not attend		22	57.89%
	Total	38	
	Mean	4.25	
	Standard Dev.	0.93	
	Variance	0.87	

Other Events: P) Opening Reception	Number of Respondents	Percentage
1 (low)	0	0.00%
2	1	2.63%
3	5	13.16%
4	11	28.95%
5 (high)	14	36.84%
Did not attend	7	18.42%
Total	38	
Mean	4.23	
Standard Dev.	0.84	
Variance	0.71	
Q) Cosmic Collisions	Number of Respondents	Percentage
1 (low)	1	2.63%
2	2	5.26%
3	8	21.05%
4	9	23.68%
5 (high)	9	23.68%
Did not attend	9	23.68%
Total	38	
Mean	3.79	
Standard Dev.	1.08	
Variance	1.17	
R) Thursday Night Observing Session	Number of Respondents	Percentage
1 (low)	0	0.00%
2	0	0.00%
3	2	5.26%
4	2	5.26%
5 (high)	4	10.53%
Did not attend	30	78.95%
Total	38	
Mean	4.25	
Standard Dev.	0.89	
Variance	0.79	

Please note any additional questions or comments you have about any of the workshop sessions (if applicable, please note the specific workshop title or letter from the list above)

- *L was difficult to following. I think David Benn was not ready to demonstrate exactly how VSTAR would work. If he had more time to prepare I think it may have been more interesting.*
- *As the presenter (for talk H as labeled above), preparation for the talk was crucial in my understanding of the evidence for the disk in Epsilon Aurigae.*
- *Claudine did a great job facilitating the education section which had tense moments as did Aaron with website section. I appreciate how gracefully Aaron, Rebecca and Claudine handle every situation. The Thursday night viewing session was a wonderful way to continue conversations from the day's workshop I'm just sorry more people didn't attend*
- *In general, I would of appreciated much more technical detail, rather than the vague goals*

and objectives of the EPO program. But, I appreciate that there was an eclectic mix of people, and neither scientific or EPO data would be appreciated by all. However, at the same time, I find people describing what is on a given web site to be very tedious. I can go to the site myself and explore it. What would be of interest would be understanding why the web site was designed the way it was, and what it's goals and objectives are.

- *Superb event overall. Met lots of interesting people and learned a lot of interesting information. (Also enjoyed Chicago.) Thanks for inviting me. DSLR photography session very helpful to me!*
- *I thought that the mix of time spent in sessions and time available to interact with other participants was perfect!*
- *well organized*
- *Met a lot of great people. I was there to learn more about photometry, and didn't really. Probably my fault. Made a couple contacts that may lead to collaboration. That's worth it right there. All the presentations were helpful and informative.*
- *I wish they'd done a run-through of some programs for getting magnitudes from DSLR RAW images*
- *It was a wonderful week. Corridor and lunch/breakfast conversations were also of great benefit.*
- *I would have liked to have attended all of the observing session but they were given concurrently. The classroom session were of interest, but, again, choices had to be made. I thought that the Town Hall session was strongly geared to 'lower level' participants and not to those who could improve their level of participation and provide significant data.*
- *Technical sessions were excellent and very helpful to me, having no prior variable-star experience.*
- *Although some of the sessions were difficult for me to comprehend, it was invaluable to be part of the scientific process. Chris Stephan's presentation took me from Undergraduate level to middle school level. This didn't work.*
- *A lot of it was over my head, but still very interesting.*
- *Many of the discussions seemed valuable, but I had to make some tough decisions when things split into two tracks. I hope videos will be available soon so I can see what I missed.*
- *Very well done.*
- *I thought it was well designed. A good mix of time to talk to others and structured presentations.*
- *It would be a good idea to attract a more varied demographic, particularly more youth, college students, grad students etc. The students of today may become the professionals that work on the next eclipse 27 years later.*
- *I was able to get most of my questions answered at the Workshop thanks to adequate time in both the sessions and breaks.*

Please indicate your level of agreement with each of the following statements:

A) Overall, this workshop was a good introduction to the Citizen Sky program.		
	Number of Respondents	Percentage
Strongly Disagree	1	2.63%
Disagree	0	0.00%
Neutral	1	2.63%
Agree	9	23.68%
Strongly Agree	27	71.05%
Total	38	
Mean	4.61	
Standard Dev.	0.79	
Variance	0.62	
B) Overall, this workshop was engaging.		
	Number of Respondents	Percentage
Strongly Disagree	1	2.63%
Disagree	1	2.63%
Neutral	1	2.63%
Agree	10	26.32%
Strongly Agree	25	65.79%
Total	38	
Mean	4.50	
Standard Dev.	0.89	
Variance	0.80	
C) Overall, this workshop was informative.		
	Number of Respondents	Percentage
Strongly Disagree	1	2.63%
Disagree	1	2.63%
Neutral	1	2.63%
Agree	8	21.05%
Strongly Agree	27	71.05%
Total	38	
Mean	4.55	
Standard Dev.	0.89	
Variance	0.79	
D) Overall, this workshop helped prepare me for my role in the Citizen Sky Project.		
	Number of Respondents	Percentage
Strongly Disagree	1	2.78%
Disagree	1	2.78%
Neutral	3	8.33%
Agree	13	36.11%
Strongly Agree	18	50.00%
Total	36	
Mean	4.28	
Standard Dev.	0.94	
Variance	0.89	

What can the Citizen Sky project team do to help you succeed as a participant in the coming months?

- *I wish I would have picked up some brochures, but I bet I can find them on the website. I plan to use the 10 Star Id as a lab for my students and especially my Science Olympiad team.*
- *Keep in touch*
- *Although I have everything I need at the moment, but I have a couple of suggestions that are more general:*
 - 1) *Create a video on how to do DSLR photometry along with a how-to guide on the website. This guide should emphasize the things mentioned in the workshops and present a quick-and-dirty data analysis method for pre-workshop comparison.*
 - 2) *Encourage data acquisition by doing follow-up chats on what people have done (a video chat would be nice, but a simple chatroom would suffice).*
- *Get the powerpoints and videos up from the meeting reasonable soon. Help funnel all the different EPOs to the website, and keep up the contact!*
- *Not sure at this point.*
- *Keep the information stream coming! the Web site is excellent for this. I want to know what others are doing so I can leverage their ideas.*
- *Nothing*
- *Keep me informed and engaged. Let me know what other people are doing and what they are learning. Let me know when new observations make a difference.*
- *Keep up the good work*
- *Collaboration and support already in place.*
- *More of the same. Relevant speakers, presentations.*
- *I'd like to say money, but perhaps some kind of printed credentials, or business cards with the groovy logo on them as well as one's personal connection data. I've found that a good business card can open doors and get people's attention*
- *Get the Team Forums up and running (if not already), put the session videos up in the Media Room, and be as responsive via email as they have been already. :)*
- *I am following the site regularly and will contact people if I need help.*
- *Not sure at this time.*
- *Keep after us! Gentle reminder emails are very much in order, many of us are busy enough to need reminding of our good intentions to take action.*
- *Still pondering that question.*
- *Keep us posted on new developments. Update the site often.*
- *I cant think of anything beyond the reworked Website.*
- *send emails*
- *cookbook of how to do dslr photometry. Get team blogs up and teams formed.*
- *The AAVSO has been very helpful with the documentary. A continuation of that would help a lot.*
- *I'd like a dedicated space for an education forum on the CS site. I'd volunteer to moderate this discussion.*

- *Sending updates, or blurbs about what is going on, any exciting or interesting tid bits.*
- *Once started, provide feedback on the Web sites and Spectroscopy information we are developing.*
- *Continue to provide an avenue of communication through the web site, etc. so that questions, answers and ideas can be exchanged.*
- *Be patient with me on answering questions I may have while illustrating the system.*
- *Keep the updates coming! I will be especially interested seeing how people disseminate the information acquired to-date.*
- *Keep the information flowing.*
- *It gave me an overall understanding of the project*
- *Keep posting techniques on the Citizen Sky website*
- *Maintain communication among groups.*
- *Any chance on getting a group rate for AIP4Windows? :-)*

12. Do you plan to attend the workshop in California this spring?	Number of Respondents	Percentage
Yes	26	68.42%
No	1	2.63%
Unsure	11	28.95%
Total	38	
Mean	1.61	
Standard Dev.	0.92	
Variance	0.84	

Appendix B: Summary of All Evaluation Survey Responses for Second Workshop

1. What is your level of astronomy experience?

#	Answer	Response	%
1	Have never participated in an astronomy program before	1	6%
2	Novice, with very basic astronomy program experience	2	12%
3	Intermediate level	4	24%
4	Advanced level experience in astronomy, but not in a professional capacity	6	35%
5	Professional astronomer, astrophysicist, etc.	4	24%
Total		17	100%









Statistic	Value
Min Value	1
Max Value	5
Mean	3.59
Variance	1.38
Standard Deviation	1.18
Total Responses	17

2. Did you attend the 2009 Citizen Sky Workshop in Chicago as well?

#	Answer	Response	%
1	Yes	7	41%
2	No	10	59%
Total		17	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.59
Variance	0.26
Standard Deviation	0.51
Total Responses	17

3. How did you hear about the Citizen Sky Project/Workshop?

#	Answer		Response	%
1	Citizen Sky website		5	29%
2	Citizen Sky email or newsletter		1	6%
3	AAVSO website		2	12%
4	AAVSO email or newsletter		3	18%
5	Other astronomy website		1	6%
6	Other astronomy group email or newsletter		3	18%
7	From someone involved with the project		6	35%
8	Other		1	6%

Statistic	Value
Min Value	1
Max Value	8
Total Responses	17

4. If you selected "Other," Please explain below:

No responses to this question.

5. Friday, September 3rd - Please rate each of the following sessions in terms of how helpful they were to you on a 1-5 scale, where one is low/unhelpful and 5 is high/most helpful (if you did not attend the session, please select "did not attend")

#	Question	Did not attend	1 - low	2	3	4	5 - high	Responses	Mean
1	Project Update (Rebecca Turner)	0	0	1	4	2	10	17	5.24
2	Update on the eA eclipse (Dr. Bob)	0	0	0	1	5	11	17	5.59
3	Evolutionary status of the binary (Brian Kloppenborg)	0	0	0	3	3	11	17	5.47
4	What can we learn from SED/Disks in Astrophysical Objects (Steve Howell)	0	0	0	1	6	10	17	5.53
5	VStar Workshop (David Benn)	0	1	0	4	6	6	17	4.94
7	What's a Light Curve? (Tim Slater)	0	0	2	3	4	8	17	5.06
6	Team Reports	0	2	2	4	5	4	17	4.41

Statistic	Project Update (Rebecca Turner)	Update on the eA eclipse (Dr. Bob)	Evolutionary status of the binary (Brian Kloppenborg)	What can we learn from SED/Disks in Astrophysical Objects (Steve Howell)	VStar Workshop (David Benn)	What's a Light Curve? (Tim Slater)	Team Reports
Min Value	3	4	4	4	2	3	2
Max Value	6	6	6	6	6	6	6
Mean	5.24	5.59	5.47	5.53	4.94	5.06	4.41
Variance	1.07	0.38	0.64	0.39	1.18	1.18	1.76
Standard Deviation	1.03	0.62	0.80	0.62	1.09	1.09	1.33
Total Responses	17	17	17	17	17	17	17

6. Saturday, September 4th - Please rate each of the following sessions in terms of how helpful they were to you on a 1-5 scale, where one is low/unhelpful and 5 is high/most helpful (if you did not attend the session, please select “did not attend”

#	Question	Did not attend	1 - low	2	3	4	5 - high	Responses	Mean
1	The AAVSO International Database (Aaron Price)	0	1	2	4	5	5	17	4.65
2	Precision, Accuracy and Uncertainty in Data (Mike Koppelman)	0	0	1	5	4	7	17	5.00
3	Introduction to Variable Stars through their Light Curves (Arne Henden)	0	0	1	6	3	7	17	4.94
5	Basic Time Series Analysis (Grant Foster)	0	1	3	2	1	10	17	4.94
4	Poster Session	2	1	2	5	5	2	17	3.94

Statistic	The AAVSO International Database (Aaron Price)	Precision, Accuracy and Uncertainty in Data (Mike Koppelman)	Introduction to Variable Stars through their Light Curves (Arne Henden)	Basic Time Series Analysis (Grant Foster)	Poster Session
Min Value	2	3	3	2	1
Max Value	6	6	6	6	6
Mean	4.65	5.00	4.94	4.94	3.94
Variance	1.49	1.00	1.06	2.06	2.31
Standard Deviation	1.22	1.00	1.03	1.43	1.52
Total Responses	17	17	17	17	17

7. Concurrent Sessions

#	Question	Did not attend	1 - low	2	3	4	5 - high	Responses	Mean
1	Intermediate Time Series Analysis (Grant Foster)	4	0	1	3	0	9	17	4.29
2	Using Variable Star Data in Education/Science Olympiad (Donna Young & Douglas Lombardi)	8	0	0	3	2	1	14	2.57

Statistic	Intermediate Time Series Analysis (Grant Foster)	Using Variable Star Data in Education/Science Olympiad (Donna Young & Douglas Lombardi)
Min Value	1	1
Max Value	6	6
Mean	4.29	2.57
Variance	4.47	3.80
Standard Deviation	2.11	1.95
Total Responses	17	14

8. Sunday, September 5th - Please rate each of the following sessions in terms of how helpful they were to you on a 1-5 scale, where one is low/unhelpful and 5 is high/most helpful (if you did not attend the session, please select “did not attend.”

#	Question	Did not attend	1 - low	2	3	4	5 - high	Responses	Mean
1	Picking Topics for Scientific investigation (Doug Welch)	1	0	2	3	7	4	17	4.59
2	Introduction to Writing Science Papers (Doug Welch)	1	1	3	1	5	6	17	4.53
3	Team Planning Session	3	2	2	3	4	3	17	3.71
4	Analysis of Spectrum Monitoring (San Mateo College/Sally Seebode)	4	2	2	6	1	2	17	3.24
5	NVO Inside: Multi-Wavelength Astronomy (Jordan Raddick)	4	0	2	5	4	2	17	3.65
6	Using ADS and SIMBAD for Astronomical Research (Brian Kloppenborg)	3	0	3	3	4	4	17	4.00

Statistic	Picking Topics for Scientific investigation (Doug Welch)	Introduction to Writing Science Papers (Doug Welch)	Team Planning Session	Analysis of Spectrum Monitoring (San Mateo College/Sally Seebode)	NVO Inside: Multi-Wavelength Astronomy (Jordan Raddick)	Using ADS and SIMBAD for Astronomical Research (Brian Kloppenborg)
Min Value	1	1	1	1	1	1
Max Value	6	6	6	6	6	6
Mean	4.59	4.53	3.71	3.24	3.65	4.00
Variance	1.76	2.51	3.22	2.82	2.99	3.13
Standard Deviation	1.33	1.59	1.79	1.68	1.73	1.77
Total Responses	17	17	17	17	17	17

9. Other Events - Please rate each of the following events in terms of how helpful they were to you on a 1-5 scale, where one is low/unhelpful and 5 is high/most helpful (if you did not attend the session, please select "did not attend")

#	Question	Did not attend	1-low	2	3	4	5-high	Responses	Mean
1	Welcome Reception (Thursday)	3	0	0	5	4	5	17	3.47
2	NightLife Event (Thursday)	7	0	1	0	4	5	17	3.24
3	Group Tour of California Academy of Sciences (Friday)	4	0	0	1	3	9	17	3.76
4	World Premiere of Planetarium Trailer (Friday)	3	0	0	1	4	9	17	3.94

Statistic	Welcome Reception (Thursday)	NightLife Event (Thursday)	Group Tour of California Academy of Sciences (Friday)	World Premiere of Planetarium Trailer (Friday)
Min Value	1	1	1	1
Max Value	5	7	5	5
Mean	3.47	3.24	3.76	3.94
Variance	2.01	4.19	2.82	2.31
Standard Deviation	1.42	2.05	1.68	1.52
Total Responses	17	17	17	17

10. Throughout the workshop there was time built in for participants to talk and network with one another (e.g., breakfast, lunch and coffee breaks). Did you feel that there was ample time to meet with other participants and did you find those opportunities to be helpful?

- *Yes; perfect.*
- *Yes.*
- *Yes, it is always good to be able to network with other people to get new ideas and discuss projects informally. The amount of time was just right.*
- *Yes to both parts.*
- *Yes there was ample time but what was lacking was a formal introduction where attendees introduce themselves and let everyone know what their interests were.*
- *They were very helpful. I was able to arrange some telescope time for a project using an AAVSO telescope.*
- *Yes, I think there was ample time and that there appeared to be more mixing of professional, amateur, and educators than in the first workshop. This is critical to the success of citizen science projects.*
- *It was a wonderful workshop. There was plenty of time to talk in lunchbreaks, in coffee breaks, and at evening dinner sessions. I have ongoing collaboration with people like Doug Welch on VStar as a result. Thank you for the workshop, thank you for inviting me to present at the VStar workshop. Both workshops were a wonderful experience. The second definitely was even better than the first. See here for my recollection of the event:
<http://dbenn.wordpress.com/2010/09/12/second-citizen-sky-workshop-and-asv-talk/>*
- *Yes there was ample time - in fact, maybe more than really necessary. I did find these opportunities to be helpful.*
- *yes, there was ample time to meet people, and structured and unstructured social opportunities facilitated this. everyone seemed quite nice!*
- *That was one of the best parts of the workshop- meeting other passionate people! It was great to talk shop with professional astronomers, amateur astronomers, and educators! I had some great conversations, some wonderful brainstorming sessions, and met some really amazing people. The workshop was great for mingling when you felt like it, but also not feeling like you always had to be up and talking to others.*
- *Yes, it was almost the most important aspect of the meeting.*
- *The chatting and networking time is always helpful. Some imaging conferences I've been to always have 30 minute breaks, but in these cases they are also catering to the vendors who want a shot at the attendees I guess. But the time to stroll around and chat can be very informative.*
- *I was unable to network in the evenings due to lack of close lodging; I had to stay across town and due to parking limitations in the area, didn't feel I could hang out after the meeting. Annoying.*

11. Please indicate your level of agreement with each of the following statements:

#	Question	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Responses	Mean
1	Overall this workshop was engaging.	0	0	0	5	12	17	4.71
2	Overall this workshop was informative.	0	0	0	6	11	17	4.65
3	Overall this workshop helped prepare me for my role in the Citizen Sky Project.	0	0	1	6	10	17	4.53

Statistic	Overall this workshop was engaging.	Overall this workshop was informative.	Overall this workshop helped prepare me for my role in the Citizen Sky Project.
Min Value	4	4	3
Max Value	5	5	5
Mean	4.71	4.65	4.53
Variance	0.22	0.24	0.39
Standard Deviation	0.47	0.49	0.62
Total Responses	17	17	17

12. Please use the space below to share any other comments or suggestions about the workshop that you have.










- *I would like to have been able to practice the VStar program but there wasn't really time to practice it and there weren't enough internet connections. I loved the workshop and I got a lot out of it!*
- *<http://dbenn.wordpress.com/2010/09/12/second-citizen-sky-workshop-and-asv-talk/> :)*
- *Very well done, thank you!*
- *One of the best I've attended.*
- *While I appreciate that the meeting facilities were free or low cost, and were very nice, the lack of enough lodging in a central location were detrimental to networking and social opportunities. Additionally, perhaps to those from Boston, San Francisco parking, traffic, and other negatives are of little concern, but they are significant for me. At least in Chicago, there was one hotel large enough for everyone, even if there was quite a hike or public transit needed to get to the Adler. I appreciate that cost is a key factor for AAVSO; that has always been the case, and it will remain the case. But I felt the SF meeting would of been a better experience for all if it had not been in SF. However, thanks for putting it on - I look forward to another opportunity at some point.*

13. How did this year's workshop compare to the 2009 workshop in Chicago.

#	Answer		Response	%
1	Not as good		2	29%
2	About the same		1	14%
3	A little better		0	0%
4	Much better		4	57%
	Total		7	100%

Statistic	Value
Min Value	1
Max Value	4
Mean	2.86
Variance	2.14
Standard Deviation	1.46
Total Responses	7










14. Participation in Citizen Sky Over the past year, how have you participated in the Citizen Sky project? (check all that apply)

#	Answer		Response	%
1	Made visual observations of Epsilon Aurigae		7	41%
2	Promoted the project within my community		13	76%
3	Implemented the project with a class/group of students		7	41%
4	Gathered/submitted data about Epsilon Aurigae using photometry		2	12%
5	Gathered/submitted data about Epsilon Aurigae using spectroscopy		0	0%
6	Reviewed and analyzed data collected as part of this project		3	18%
7	Wrote, or collaborated to write, articles about Epsilon Aurigae		2	12%
8	Joined an online team and collaborated with other participants		6	35%
9	Other		5	29%
10	I was not involved in the Citizen Sky Project this past year		4	24%

15. If you selected "Other," Please explain below:

- *Got people in the international community involved in observing Epsilon Aurigae.*
- *Part of Mystery In The Sky documentary*
- *Promoted the project at national science education conference and national teacher workshops.*
- *Continued with VStar development*
- *Tutor community college students in making observations or using data for extra credit points in undergraduate GE classes.*

16. In the coming year, how do you plan to participate in the Citizen Sky project? (check all that apply)

#	Answer		Response	%
1	Make visual observations of Epsilon Aurigae		8	47%
2	Promote the project within my community		15	88%
3	Implement the project with a class/group of students		9	53%
4	Gather/submit data about Epsilon Aurigae using photometry		2	12%
5	Gather/submit data about Epsilon Aurigae using spectroscopy		1	6%
6	Review and analyze data collected as part of this project		6	35%
7	Write, or collaborate to write, articles about Epsilon Aurigae		4	24%
8	Join an online team and collaborate with other participants		8	47%
9	Other		5	29%

Statistic	Value
Min Value	1
Max Value	9
Total Responses	17

17. If you selected "Other," Please explain below:

- *Continue working with project leaders to improve the visual aspect of the whole program.*
- *Until I complete my observatory, I cannot participate....*
- *Analyze data on Mira variables with the Mira Fourier Coefficient Team continue to lead Southern Gems team.*
- *VStar*
- *work with Aaron!*

**18. As a participant, what are your personal goals for participation in the Citizen Sky project?
(What do you hope to get out of the project on a personal or professional level?)**

- *Make astronomy friendlier and approachable to people. Introduce my work to engage and hook the curios.*
- *To help untangle one of astronomy's long standing mysteries; to learn and understand the history of the theories and how we arrived at our current understanding of the system, to write a paper on a variable star topic that has scientific merit; to share my love of astronomy and variable stars with the public.*
- *I hope to learn how to analyze variable stars using VStar, to work on another project with the Southern Gems team, and to observe epsilon Aurigae and the stars on the 10 star tutorial and input data. I also plan to get others interested in joining the Citizen Sky Project.*
- *I will continue to mentor other visual observers through the 20/20 Vision Team.*
- *To interest young people in science, showing them that by using program like Citizen Sky they too can contribute to scientific discoveries.*
- *To learn more about photometric techniques with small telescope.*
- *Learn more about variable stars within the context of an international observing campaign.*
- *To continue to develop VStar to make it as useful for variable star work as possible. To participate as a team member in teams such as the Mira Fourier Coefficients Team. To continue observing stars like zeta Phe and eta Aql, contributing to the AAVSO International Database. To continue to learn more about variable stars.*
- *Just to popularize it via Slacker Astronomy.*
- *my goal is see how scientific capacities can be cultivated in a general community. i hope to also learn some astronomy and contribute to the project.*
- *The Citizen Sky project provides me, as a professional, a way to get the public involved in what I do on a regular basis, which can often be difficult for astronomers. As an educator, I am very interested in the ways science and the public can better partner, and Citizen Sky is a wonderful archetype.*
- *I get personal satisfaction from contributing to science on an active level. I am recharged and my enthusiasm for working with high school students in astronomy is rekindled by events like this.*
- *I'm interested in following up on the observing projects discussed on semi-regular variables and other seldom observed objects.*
- *Use it to help students take part in an active research program if they wish.*

19. What does the term "Citizen Science" mean to you?

- *A smart, important, efficient, and productive way to "waste" time on a hobby.*
- *Non-scientist participants making a valuable contribution to science through observation, analysis, research or experimentation.*
- *Citizen Science means ordinary citizens doing actual science projects under the guidance of professionals.*
- *Training non-scientist citizens to participate in scientific observations and submit data to scientists.*
- *Citizen Science is where anybody, PHD or tenth grader can contribute to science.*
- *To engage in scientific studies on my free time.*
- *People who are not professional scientists can contribute to scientific understanding. There are cases in which a range of observations are needed to understand a phenomena, citizens can help.*
- *Direct participation in helping to understand some aspect of the work via the Scientific Method. Often this involves basic data collection, but increasingly data analysis. Collaboration between amateurs, professionals, and educators is also a key feature.*
- *Science performed by non-science-professionals.*
- *i think a meaningful definition of community development is when its members arise to generate and apply their own knowledge. citizen science calls to mind the ability, privilege and duty of responsible members of the community to participate, in whatever way moves them, in the community development process.*
- *Citizen Science is a means of getting the general public involved in collecting (or analyzing) real science data, and connecting professional scientists and the public. Citizen science means recognizing that we all can learn from each other, and everyone can contribute to the progress of human knowledge.*
- *Citizen Science is real science done by average people. The average Joe doesn't have much chance to participate or have an impact in real research, except in astronomy.*
- *Citizens participating in observing facets of the world around us and working with others to collect the observations and understand something about what it means.*
- *The active participation of non-professional individuals in scientific research as observers, data evaluators, or educators.*