‘AstroPhotoArt’
Program Trial Report

Prepared by: Pete Wheeler, Outreach, Education & Communications Manager at the International Centre for Radio Astronomy Research (ICRAR) - UWA.

Name of Initiative/Project: AstroPhotoArt

Project Co-ordinators: Pete Wheeler (ICRAR - UWA) & Rick Tonello (Astronomy Education Services)

Project Collaborators: ICRAR, Aspire, UWA School of Indigenous Studies, Lockridge Senior High School and Derby District High School.

Contents

Background

This report relates to the development and trial of an astrophotography themed learning experience for high school students attending schools in low-socio economic locations, one metropolitan and one regional. As well as teaching the basics of photography and astronomy and have students successfully image the night sky, the overarching objectives of the program were to:

1. Increase interest in science through a technology, art and science based learning experience;
2. Raise awareness of astronomical research happening in Western Australia;
3. Highlight the benefits of further education;
4. Instil new skills and knowledge that relate to digital photography, astronomy and image processing; and
5. Highlight the cultural connections Indigenous Western Australians have with the night sky.

Outreach and education programs delivered to schools, especially those delivered to regional students by metropolitan based providers, often target large numbers of students in a short space of time. This model limits the achievable outcomes for individual students so it is important to also deliver programs that work intensively with small numbers of students in an effort to build strong relationships, deliver a robust learning experience and achieve the desired outcomes.

Astronomy is an emerging field in Western Australia, one that is experiencing enormous growth as world-class telescopes like the Australian SKA Pathfinder (ASKAP) and the Murchison Widefield Array (MWA) begin operations in the state’s Mid West. In the years to come Australia’s participation in even larger international projects, such as the Square Kilometre Array (SKA) radio telescope, will continue to fuel our involvement in this new and exciting area of scientific research.

It’s important to recognise that students, like people, have a broad gamut of interests that may or may not include science. By delivering a program like AstroPhotoArt, which has strong cross curricula themes of art, photography, technology and computing, it’s possible to attract students who wouldn't ordinarily volunteer for a science themed activity to participate.

Program Development

There were several phases involved in the design and delivery of this program. These were:

1. Equipment research, selection, purchase and development;
2. Lesson planning;
3. Delivery to the metropolitan trial school;
4. Assessment and modifications;
5. Delivery to the regional trial school;
6. Assessment and modifications; and
7. Future planning.

The Equipment

Until recently astrophotography was the domain of experienced photographers who could afford and operate expensive and complex equipment. Recently however, with advances in technology, the equipment has become affordable and easier to use, and therefore accessible to anyone.

The key to astrophotography is the ability to achieve results in extremely low levels of light. This is accomplished by pointing a camera at the sky and exposing the camera’s sensor for much longer periods of time than you would during ‘normal’ daytime photography. However, for a single image of the sky taken over several minutes, the stars in the image would appear to ‘trail’ due to the rotation of the Earth – for the same reason the Sun appears to rise in the east and set in the west.

So, to image the sky and achieve ‘pinpoint’ stars a technological solution to precisely counter the rotation of the Earth is required.

Having investigated several options, we decided to go with the iOptron Sky Tracker system and a type of digital SLR was specifically made by Canon for astrophotography.

The iOptron Sky Tracker:

See the following website for a detailed review of the iOptron Sky Tracker system.

http://media.skyandtelescope.com/documents/SKYTRACKER.pdf

The Canon EOS 60Da

http://www.canon.com.au/en-AU/Personal/Products/Cameras-and-Accessories/EOS-Digital-SLR-Cameras/EOS-60Da

With these decisions made, we populated the rest of the kit with the lenses and peripherals needed to capture multiple images easily at night. We produced three stand-alone 'kits' with a view to them being used by one student or two students working together. Here's what one of the kits looks like.

Lesson Planning

Having decided upon the equipment we would use, the next challenge was to design several lessons that would engage students, teach the fundamentals of photography (how to operate a digital SLR camera and how to process images using specialised software) and grow knowledge of astronomy and the night sky.

Given the demands already placed upon students in years 9 and 10, our target years, it was also especially important to deliver all of this with the least possible impact upon their other studies.

We decided upon the following core content areas and set about designing a sequence of lessons around this framework.

- Equipment training (digital cameras, iOptron mounts and telescopes)
- Photographic composition
- The night sky
- Shutter speed, aperture and ISO
- Image Processing
- The Square Kilometre Array
- Indigenous astronomy

Initially, we determined that to adequately cover the content and image the sky at night, we would require 12 hours of contact time spread across 4 school days, plus at least 2 evening imaging sessions, with the first taking place at the school and the second located at a dark sky site.

Note that by the time we delivered this program to the regional trial school, we had adjusted this requirement to 8 hours of contact time spread over 4 days, plus at least 2 imaging sessions.

Lockridge Senior High School
(Metropolitan School Trial)

For Lockridge SHS, we delivered the program over the course of several weeks working with six year 10 students, four boys and two girls.

AstroPhotoArt students from Lockridge SHS

After introducing ourselves, giving the students a run down of what to expect and showing them some of the equipment they would be using, we let the students get 'hands-on' with the digital cameras.

Having previously discussed this approach in the lesson planning stage, we hoped that giving them this technological and tactile experience early on would serve to affirm trust, build confidence and plant a firm 'hook' that would translate early interest and increase the chances of a student's continued involvement in the program. As hoped, this approach worked perfectly.

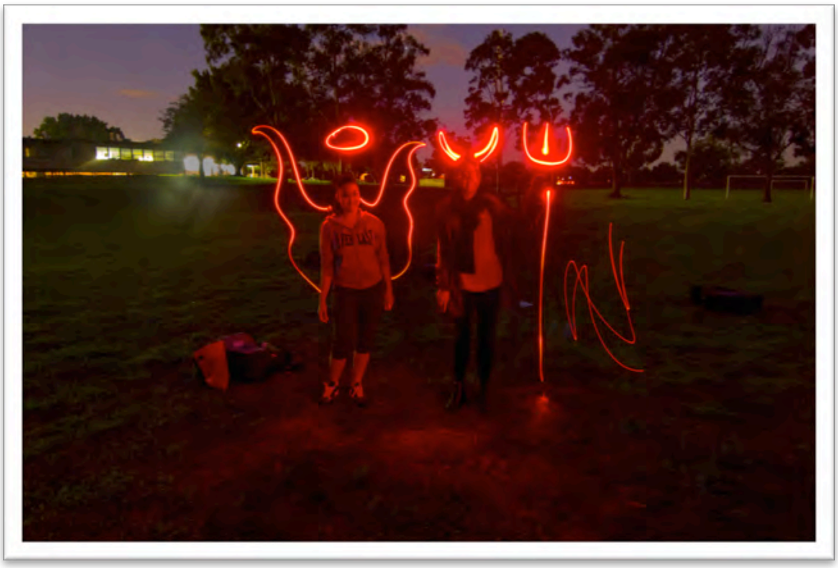
After an hour or two of teaching time the students began bursting at the seams with questions about the cosmos. As such, we consistently found ourselves drawn off track and in danger of not covering the subject matter we had aimed to deliver ahead of the lesson. But rather than dampening their enthusiasm we allowed the students to ask their questions and direct the lesson, with us injecting the content we needed to cover where possible.

Over the course of the lessons we adjusted our style and got to know and cater for the students' individual strengths and weaknesses. We continued to be flexible rather than dictatorial when it came to the extra-curricula imaging sessions, which each required a commitment of several hours from each of the students, along with a commitment from the parents to drop them off and pick up them up quite late at night.

Painting with light

Students setting up at Lockridge SHS

Students light painting during a long exposure



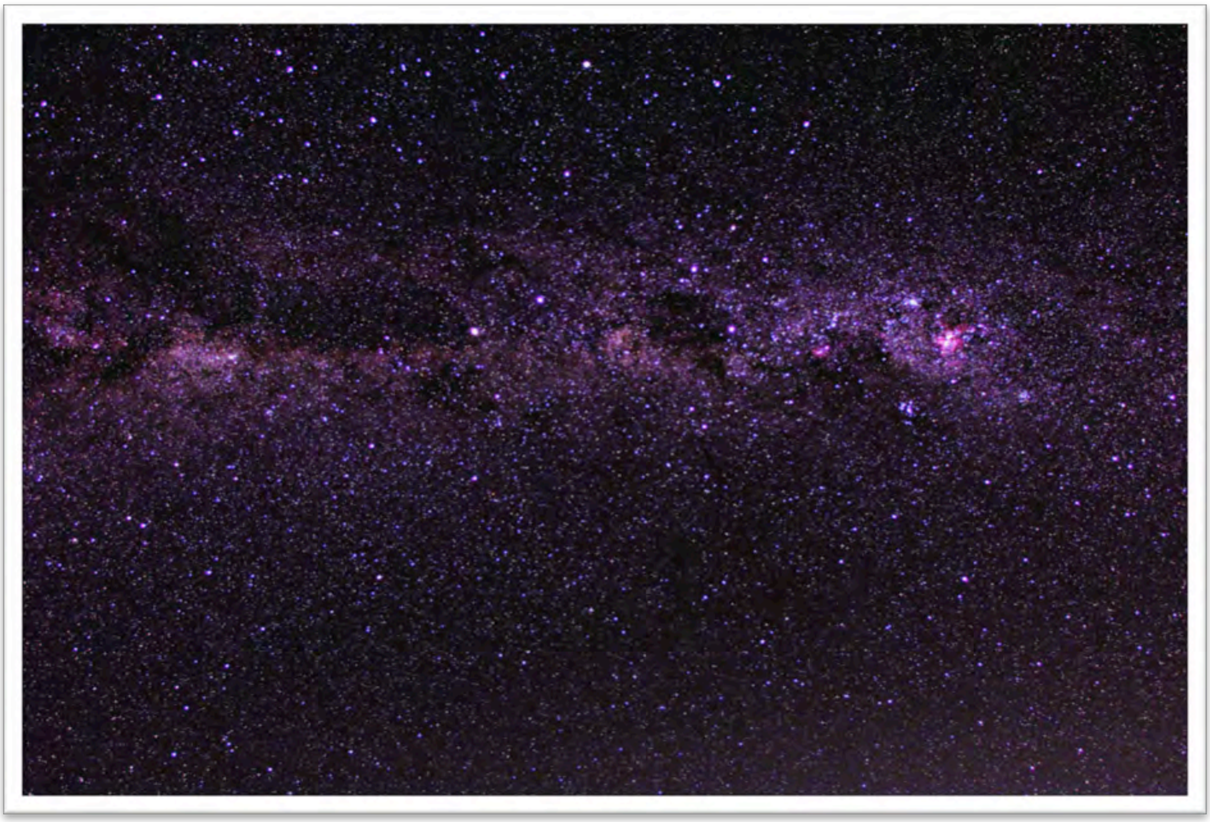
Light painting with Lockridge SHS students, Anika and Parniyan

Milky Way and light painted tree, by Jayden Game of Lockridge SHS

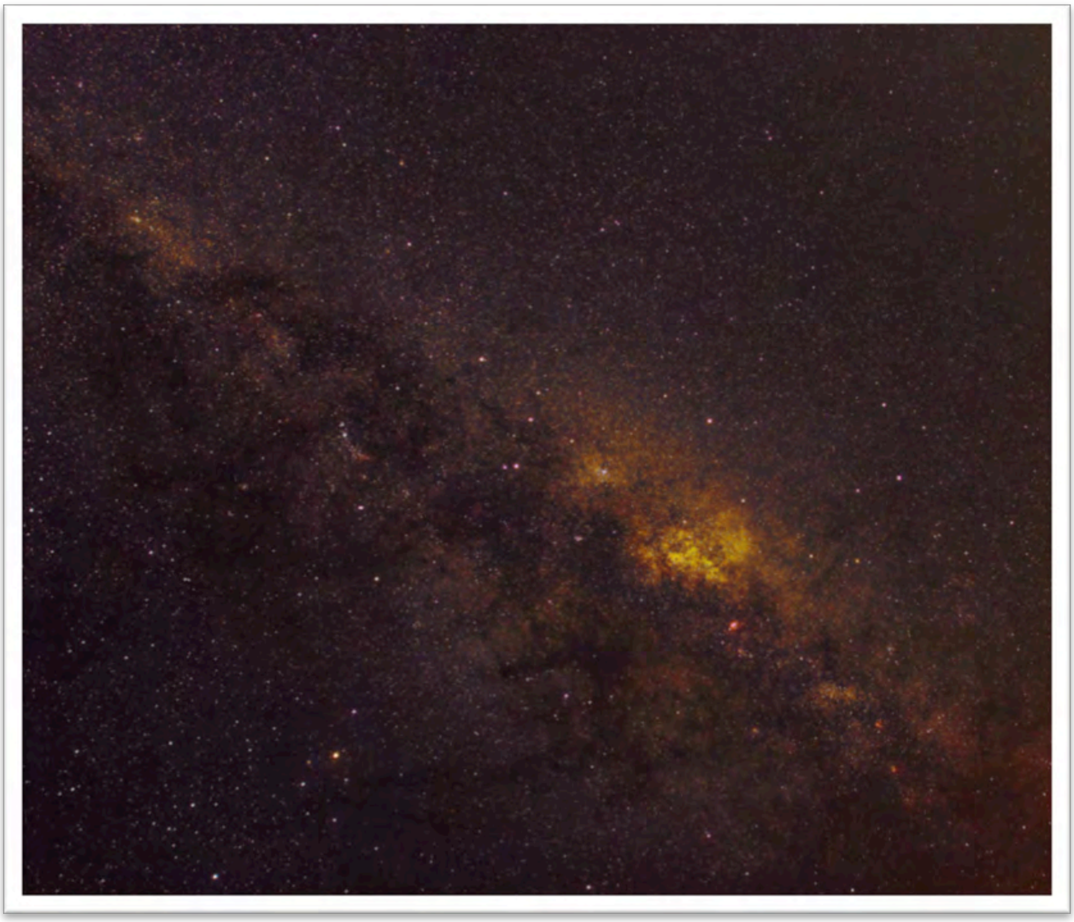
The Moon, Jayden Game of Lockridge SHS

The Trifid Nebula (left) and the Lagoon Nebula (right), by Parniyan Pakniyat of Lockridge SHS

Eta Carina Nebula, by Jayden Mulcahy of Lockridge SHS



The head of the Emu and Southern Cross by Anika Omidzadeh of Lockridge SHS



Milky Way by Andrei Patton of Lockridge SHS

Lockridge SHS - Evaluation & Feedback Summary

See appendix for evaluation templates.

Students

Before the program:

- 4 out of 6 students indicated they wanted to go to university, with 2 unsure.
- 1 student wanted to study law, 1 medicine, and the other didn't know yet.
- Responses to, 'What are you most looking forward to doing in this program?" included a mixture of stargazing, photography and imaging the sky.

Having participated in this program:

- Half the students thought they were better at science.
- All students indicated their understanding of science had increased between a little and a lot.
- 5 out of 6 students said their understanding of astronomy had improved a lot.
- 5 out of 6 students said their understanding of photography had improved a lot.
- 3 students (2 boys and 1 girl) indicated they were more likely to study science at university.
- Most students highlighted the processing of the photos and the night sky as the things they would remember the most.
- Most students highlighted the cold temperatures during the imaging sessions as the thing that challenged them the most.

In other comment students said:

- Thanks for the fun. I will be proud to show the photos I took over the past few weeks for the rest of my life (when I'm 80 a phone camera will be able to take those images :( )
- I loved this course and I hope we can do it again!
- It was really fun!
- Thanks Pete and Rick for everything it's been an amazing experience. I've enjoyed absolutely every second of it.

This last comment was sent by Jayden Mulcahy via an unsolicited email after the program had ended.

Teacher

Lockridge SHS's Head of Science, Mr Chedid provided the following feedback.

- Other year 10's were talking about the program after the presentations at the all-school assembly. The students effectively became advocates for studying science in school.
- Flexibility and easy going attitude were very important. This was picked up early by the kids and made accepting you a lot easier.
- Flexibility in delivery – doing things on the fly – was great. Would be hard to do with a big group, small groups works for this program in general.
- Hands-on from Day 1 was good. Put the SLR straight into their hands as soon as possible.
- Good positivity on shots straight away, kept them going and gave them early confidence.
- No handouts was a good way to go. They just end up on the floor or in the bin.
- Email communication with students worked well. Some schools may demand you use their department email addresses, which the students never check. If this is the case use both departmental and personal.
- The presentations went really well. The school got to see the work and the pictures and certificates for the students was great.
- Dark sky imaging sessions went well but you could be more prescriptive with this. Set a task and a time limit (15 mins?) rather than letting the students manage themselves. Too many options make the students dither and move off task.

- The difficulty of this course is high and challenging. Having a small group, with high tech equipment and doing something relating to astronomy was key to succeeding for this reason.
- 20-30 students would probably express interest if we did this again with Lockridge in the future.
- School laptops caused a problem. If using school comps, load the programs on all systems in case we end up having different machines available.
- If possible, streamline lessons to 2 hours per day rather than 3 as this would be easier to accommodate for the school.
- Warmth - Can't over emphasise enough.
- The most important key outcomes were:
    - Enhancing the interest of science. Students came to Mr Chedid asking about their science options having done this program and the students advocated studying science to their peers.
    - Creating a practical extension of science
    - Creating opportunities for productive after school activities.

Response to feedback from first school

In response to the feedback and the experience of delivering this program for Lockridge SHS we made several modifications, including:

- Refining and removing content that could be removed with little impact overall;
- Purchasing a dedicated set of laptops to avoid the issues created by trying to work with school owned computers; and
- Purchasing some reusable hand warmers.

Derby District High School
(Regional School Trial)

The model for Derby was different to Lockridge in that we had to deliver the entire course within a single school week. For this reason we reduced the length of each lesson from 3 to 2 hours in an effort to minimise the impact on the students' timetable.

Brooke Mandziac of Derby DHS practicing her camera skills

Uncharacteristically for a science themed program targeting high school students, our group of 4 students comprised of 3 girls and 1 boy, all from year 10.

The first lesson went well with the students relishing the opportunity to get their hands on the equipment, take some photos, look at the Sun through a solar telescope and learn about the night sky.

Rather than delivering the first imaging session at the school, we decided to take advantage of the beautiful outback sky and pristine weather and head to a dark sky site we had scoped out earlier in the day, on some mud flats adjacent to the town.

The students arrived on time (early in fact) and were eager to get going. The light painting exercise served to consolidate how the theory taught during the day in an enjoyable way and kept the students engaged while dusk turned to night.

The students really enjoyed the opportunity to be doing something interesting at night, in what is a quiet regional town with little to do for young people of this age. We struggled at times to contain the male students enthusiasm, compounded by a short attention span and a propensity to distract others if he had the slightest opportunity. But with close supervision and help from the other students who were keen to get results, everyone worked hard to familiarise themselves with the equipment and capture their first images.

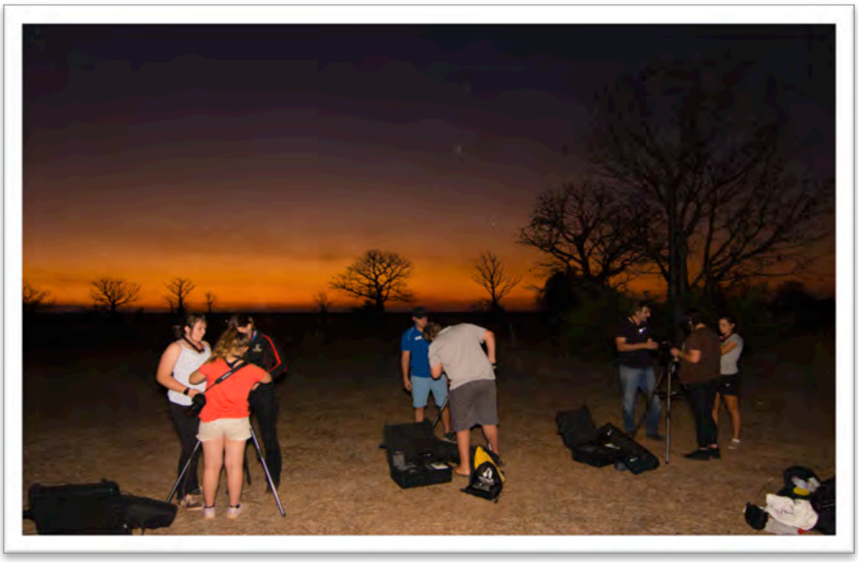
Ahead of the program Rick and I had hoped that we would be able to have two imaging sessions but recognised that this was entirely dependent on the students. The enthusiasm from the students meant that we imaged three consecutive nights and would have gone out for a fourth had the need to get some rest before a long drive the next day not been a factor.

All except one of the students attended all of the class work and each of the imaging sessions. The one student that didn't appeared to use their participation in this program as a way to avoid attending other lessons. We had previously recognised and discussed the potential for this to occur and had actively sought to avoid this through discussions with the school ahead of the program, but unfortunately in this instance that was not sufficient.

Students learning about the effects of shutter speed to freeze or blur movement

Sarah West from Derby DHS observing the Sun through a Coronado telescope

Sunset over the Derby mudflats



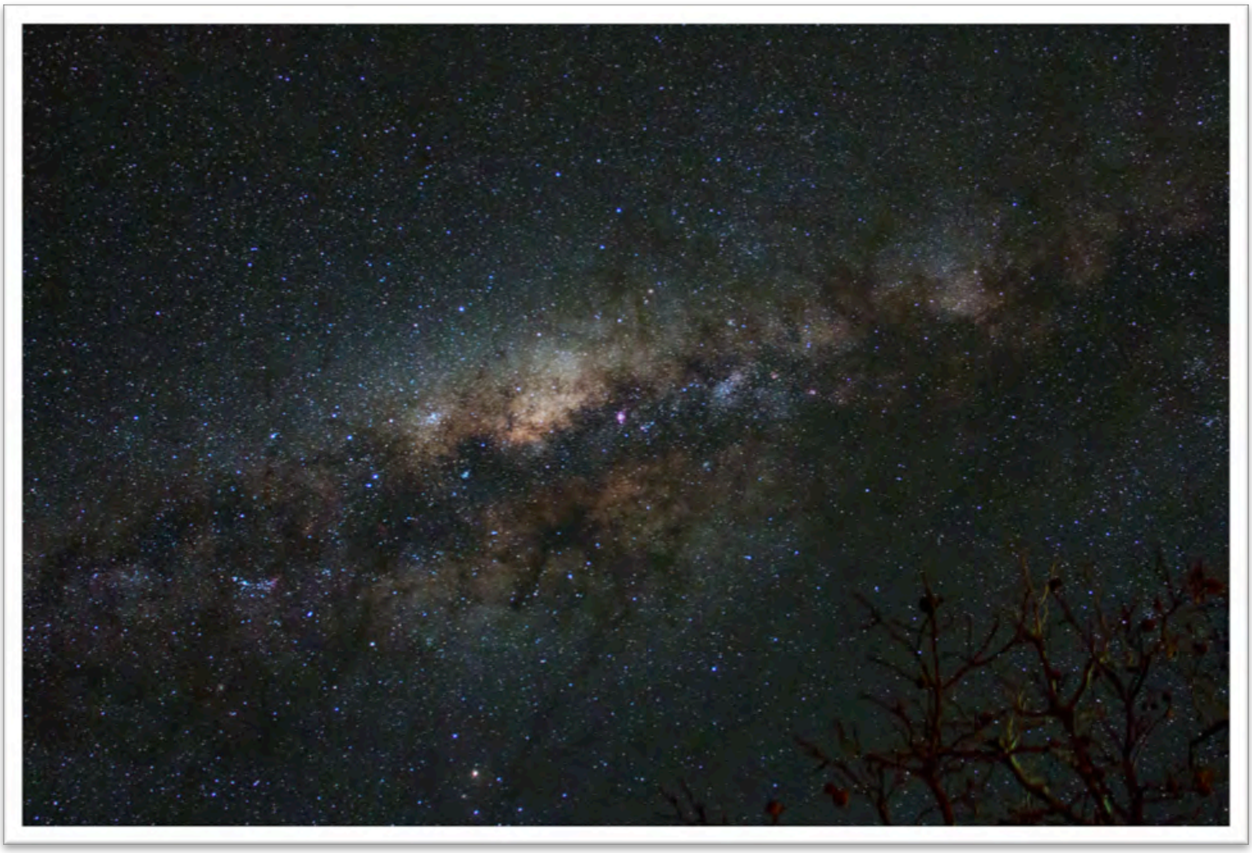
Setting up the AstroPhotoArt equipment

Brooke Mandziac (left) and Sarah West (right) of Derby DHS

Light painting with Derby student, Luc Petersen

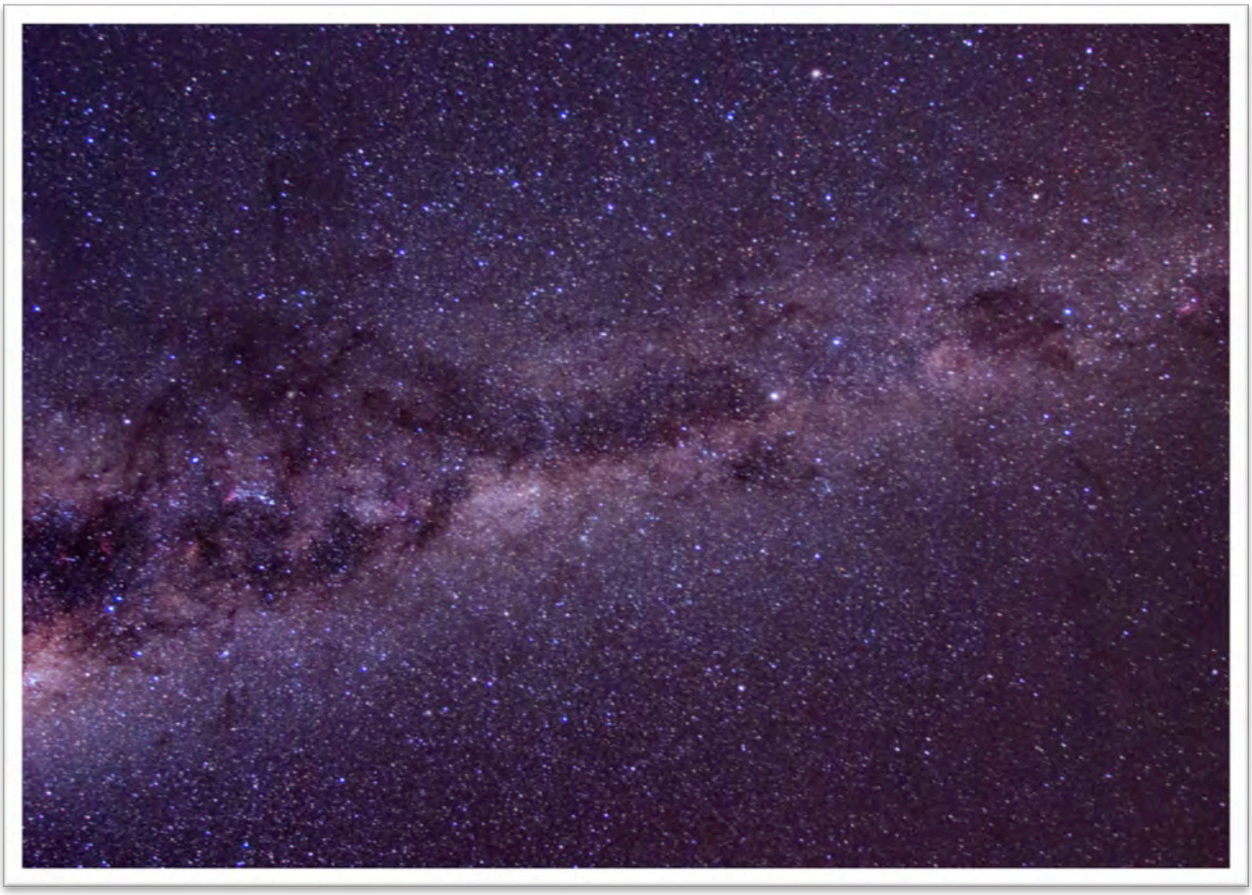
Light painting with Derby student, Brooke Mandziac

Light painting with Derby student, Rosie Rasmussen



The Milky Way, by Sarah West of Derby DHS

Milky Way amongst the Boabs by Rachael Atkins of Derby DHS



Milky Way and head of the Emu by Luc Petersen of Derby DHS

Boab reaching for the centre of the galaxy by Pete Wheeler - ICRAR

Students processing their images on the AstroPhotoArt Laptops

Brooke Mandziak of Derby DHS processing one of her astro images

Derby DHS - Evaluation & Feedback Summary

See appendix for evaluation templates.

Students

Before the program:

- 4 out of 5 students said they want to go to university, 1 was not sure.
- Out of those that want to go to university two indicated they would study science (zoology and biology).
- All students had looked through a telescope except for one.

Having participated in this program:

- 3 out of 5 students indicated a marginal gain in their assessment of how good at science they were.
- All indicated that their understanding of science had improved between a little and a lot.
- All indicated that their understanding of science had improved between a little and a lot.
- There was no impact to the decision to study science at university or not.
- 4 out of 5 students retained knowledge of what the Square Kilometre Array is.
- The students highlighted how to operate the cameras and how beautiful the Milky Way was as things they would remember the most.

Conclusion

The original objectives for the trial of this new program were to:

1. Increase interest in science through a technology, art and science based learning experience;
2. Raise awareness of astronomical research happening in Western Australia;
3. Highlight the benefits of further education;
4. Instil new skills and knowledge that relate to digital photography, astronomy and image processing; and
5. Highlight the cultural connections Indigenous Western Australians have with the night sky.

Based on my experience of the program as well as the pre and post evaluation and anecdotal feedback received from the students and teachers that participated, I believe that we have succeeded on a number of levels, particularly with objectives 1 to 4 as outlined above.

Regarding the fifth objective, this aspect featured prominently for the Lockridge students and for the Derby program we had arranged for several local elders to attend one of the imaging sessions and tell Indigenous stories about the night sky. Unfortunately this was cancelled at short notice, but it is something we hope to incorporate prominently as part of the future delivery of this program, especially to regional students.

Other outcomes from this program include the selection of Sarah West's image for the front cover of an art exhibition featuring indigenous art works from Western Australia and South Africa. The gallery was not aware that one the images we had provided for them to chose from was captured by a high school student, and were surprised to learn this once they had made their decision. Sarah's image was also projected prominently onto a wall as part of the exhibition.

All of the students were incredibly proud of what they achieved in a relatively short space of time, and all were keen to do more should the opportunity arise.

This program is resource intensive in that it requires a significant amount of time to be invested by those involved in its delivery. However, I believe, that the outcomes achieved for the students involved are significant and for the right students, worth the investment. As such ICRAR will continue this program to students from one metropolitan school and one regional school each year for the foreseeable future.

Thank you to the Diversity Initiatives Fund for their support and for making this program possible.

Appendix

iSENTIA
INFLUENCE • INFORM • INSIGHT

Broome Advertiser, Broome WA
04 Sep 2014, by Glenn Cordingley

General News, page 14 - 224.00 cm²
Regional - circulation 7,876 (---T---)

ID 307882440

THE UNIVERSITY OF WESTERN AUSTRALIA

Students given astro insight

Glenn Cordingley

Kimberley students were taught valuable lessons about the night sky during a visit from University of WA experts.

Boffins helped uncover the universe to promote awareness and study opportunities at UWA during a week-long trip to Derby, 2390km from Perth.

The Aspire UWA team, together with the UWA School of Indigenous Studies, partnered with the International Centre for Radio Astronomy Research and Rick Tonello from Astronomy Educational Services to deliver educational programs, including intensive sessions on AstroPhotoArt for selected students at Derby Senior High School.

Working in pairs sharing state-of-art equipment, six students had the opportunity to delve into the world of astronomy through photography.

Through daily two-hour lessons and two nighttime photo sessions, they learnt to use cameras and software, enabling them to produce high-quality images of the night sky.

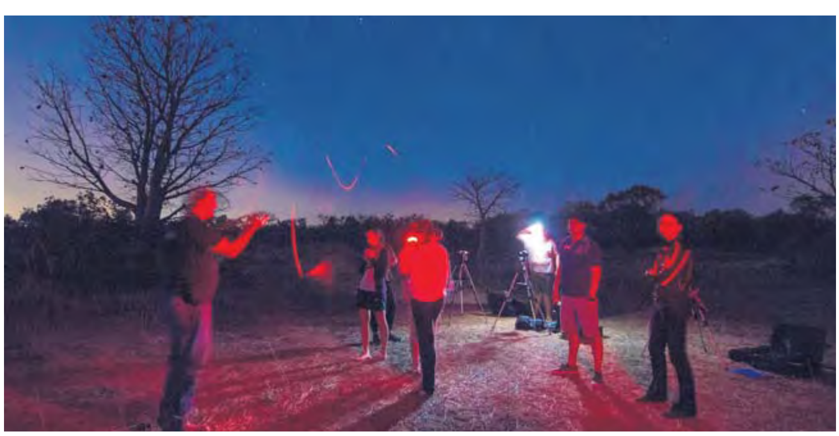
The program aims to inspire students to explore and develop a passion for education, science and astronomy that could lead them to a university education pathway.

By the end of the week, the students' achievements were captured through the production and framing of their best images, which will be presented to the school.

Aspire UWA has run the AstroPhotoArt sessions successfully at Lockridge Senior High School in Perth.

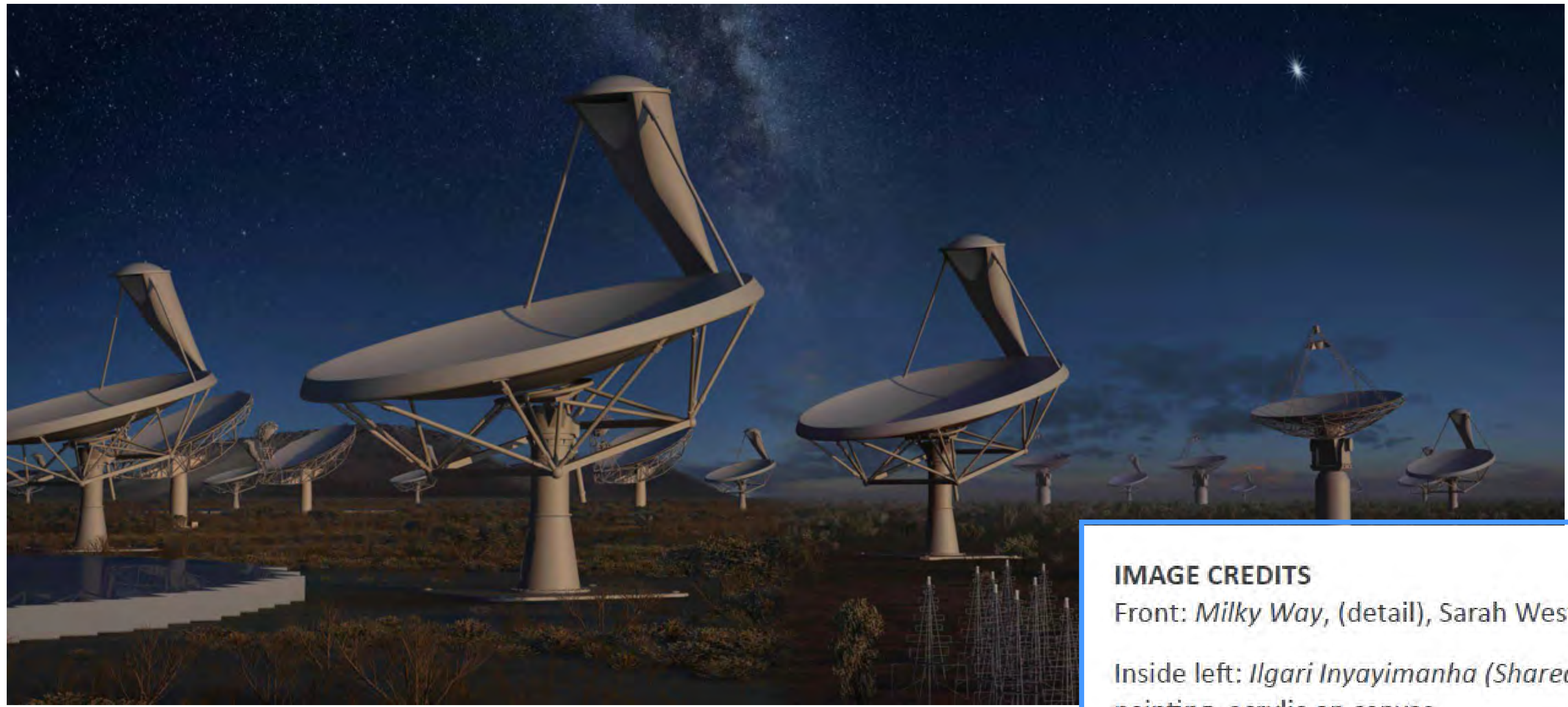
ICRAR hopes to improve students' awareness and understanding of astronomy through AstroPhotoArt and inspire participation in large-scale science projects such as the Square Kilometre Array in the Mid-West.

Aspire UWA is an ongoing program to encourage students from communities under-represented in higher education to aspire to university study.



Derby Senior High School students during an intensive sessions on AstroPhotoArt.
Picture: Pete Wheeler

Shared Sky



This catalogue supports the exhibition:
Shared Sky
John Curtin Gallery
Curtin University, Perth, Australia
1 October – 2 November 2014

Shared Sky was developed in collaboration with Yamaji Art Centre, Geraldton, Western Australia and the First People Centre at the Bethesda Arts Centre, Nieu Bethesda, Eastern Cape, South Africa.

Yamaji Art Centre artists: Nerolie Bynder, Catherine Bynder, Gertrina Bynder, Barbara Comeagain, Marion Dingo, Charmaine Green, Jenny Green, Sherryl Green, Tracey Green, Jonaya Jones, Basil Jones, Wendy Jackamarra, Kevin Merritt, Barbara Merritt, Gemma Merritt, Susan Merry, Bianca McNeair, Gemma Maher, Debra Maher, Craig 'Chook' Pickett, Kyle Pickett and Margaret Whitehurst.

Bethesda Arts Centre artists: Sandra Sweers, Jeni Couzyn, Naasley Swiers, Julia Malgas, Gerald Mei, Yvonne Merrington, Maria Tamana, Frendoline Malgas, Felicity Tromp, Rentia Davidson, Esmerelda Tromp, Seraline Tromp, Merlyn Davidson, Rosie Jacobs, Angie Hendricks, Martin Lackay, Riaan Sweers, and James Hartlief.

Shared Sky is presented by the international Square Kilometre Array (SKA) Organisation, Manchester, UK; SKA South Africa, Johannesburg, South Africa; SKA Australia, Canberra, Australia in collaboration with Curtin University's Institute of Radio Astronomy and the John Curtin Gallery.

Shared Sky has been curated by Chris Malcolm, Director, John Curtin Gallery.

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ACKNOWLEDGEMENTS
The exhibition organisers wish t[illegible] world that have all contributed [illegible] all of them, including Jeni Couzyn and all the artists from the Bethesda Arts Centre; John Parkington from the University of Cape Town; Charmaine Green, Glenda Jackamarra and all the artists from the Yamaji Art Centre; Jerry Skinner from SKA Australia; William Garnier & Mathieu Isidro from the SKA Organisation, Lorenzo Raynard from SKA South Africa; as well as Professor Steven Tingay, Director of the Curtin Institute of Radio Astronomy. We wish to particularly thank the curator, Chris Malcolm, as well as Amanda Alderson, Samantha Smith, Patti Belletty & Brad Coleman from the John Curtin Gallery for their invaluable work in bringing this exhibition to life.

IMAGE CREDITS
Front: *Milky Way*, (detail), Sarah West, Derby District High School, photograph.

Inside left: *Ilgari Inyayimanha (Shared Sky)*, Yamaji Art Centre artists collaborative painting, acrylic on canvas.

Inside right: *Origin of Death*, First People Artists, Bethesda Arts Centre, collaborative art quilt.

Inside far right: *Creation of the Sun*, First People Artists, Bethesda Arts Centre, collaborative art quilt.

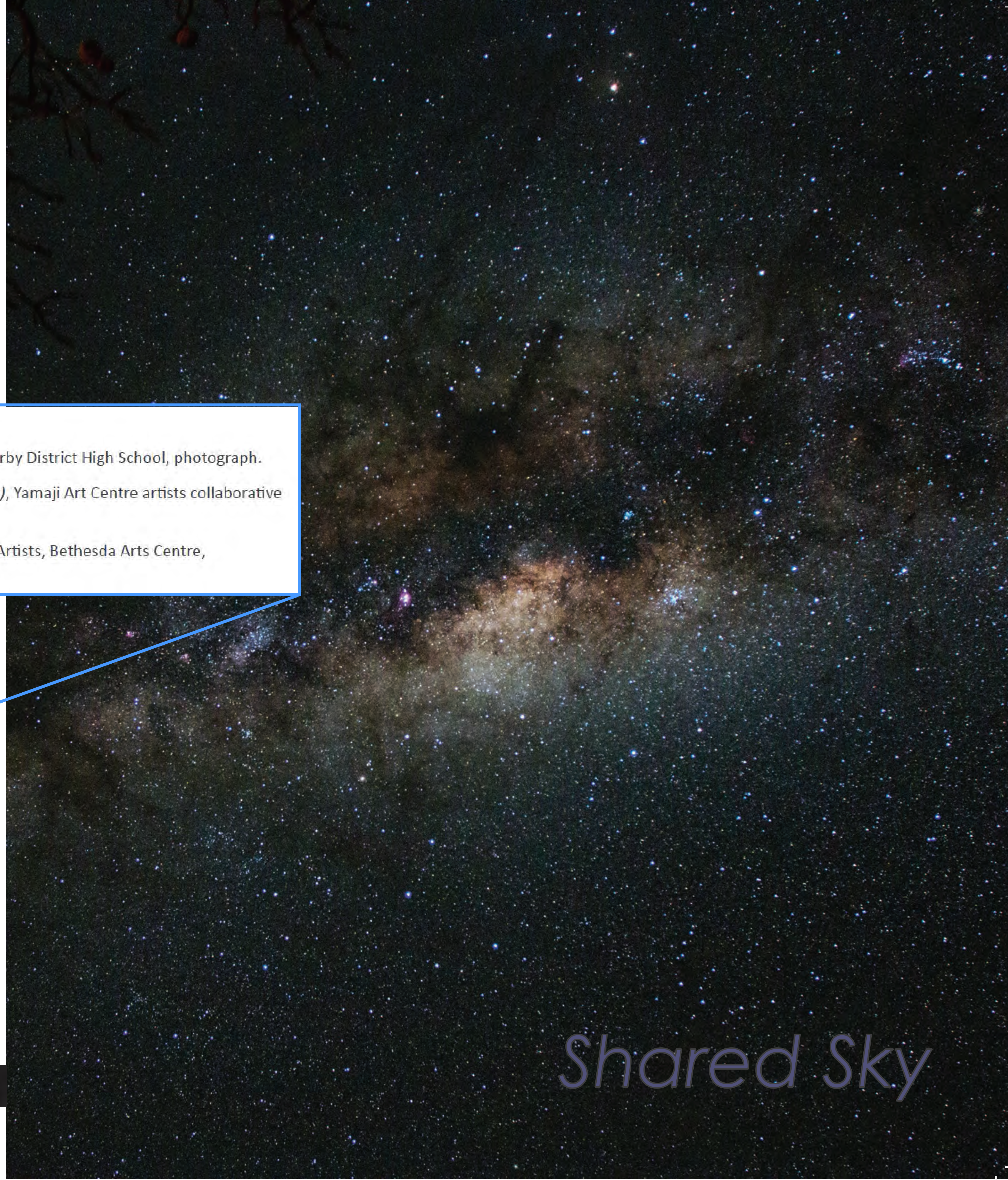
Above: *SKA at Night – Dishes Pointing towards the stars,* SKA Organisation.

IMAGE CREDITS
Front: *Milky Way*, (detail), Sarah West, Derby District High School, photograph.

Inside left: *Ilgari Inyayimanha (Shared Sky)*, Yamaji Art Centre artists collaborative painting, acrylic on canvas.

Inside right: *Origin of Death*, First People Artists, Bethesda Arts Centre, collaborative art quilt.

Curtin University



AstroPhotoArt

Congratulations!
to

Brooke Mandziak
of Derby District High School

for successfully completing the AstroPhotoArt course.

As an astrophotographer you can now use a Digital SLR Camera and apply your knowledge of astronomy and image processing to create amazing, awe inspiring images of the cosmos.

Pete Wheeler
International Centre for
Radio Astronomy Research

Richard Tonello
Astronomy Education Services

Aug 29th, 2014

ICRAR
International
Centre for
Radio
Astronomy
Research

AES
ASTRONOMY EDUCATION SERVICES
PERTH, WESTERN AUSTRALIA

Curtin University

The University of Western Australia

AstroPhotoArt Lesson Plan - Lesson 1.1 and 1.2

Year Level: Year 9-10

Key Learning Areas: Science & History

Overarching Learning Outcomes

- Access to high tech equipment such as Digital SLR's and telescopes will inspire an interest in science as a means of expanding students' curiosity and willingness to explore, ask questions about and speculate on the changing world in which they live.
- Students will gain an understanding of the vision that science provides of the nature of living things, of the Earth and its place in the cosmos, and of the physical and chemical processes that explain the behaviour of all material things.
- Students will gain an understanding of historical and cultural contributions to science as well as contemporary science issues and activities and an understanding of the diversity of careers related to science.
- Students will acquire knowledge, understanding and appreciation of the past and the forces that shape societies, including Australian society.

Specific Scope and Sequence Outcomes (as per the Australia Curriculum)

Year 8:

Science as a Human Endeavour: Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people's understanding of the world. ACSHE134

Historical Knowledge and Understanding: The role and achievements of significant individuals such as Lucrezia Borgia, Galileo, Leonardo da Vinci, Niccolo Machiavelli. ACDSEH058

Year 9:

Physical sciences: Energy transfer through different mediums can be explained using wave and particle models. ACSSU182

Science as a Human Endeavour: People can use scientific knowledge to evaluate whether they should accept claims, explanations or predictions. ACSHE160

Science as a Human Endeavour: Advances in science and emerging sciences and technologies can significantly affect people's lives, including generating new career opportunities. ACSHE161

Science as a Human Endeavour: The values and needs of contemporary society can influence the focus of scientific researchACSHE228

Historical Knowledge and Understanding: The role of an individual or group in the promotion of ONE of these key ideas, and the responses to it from, for example, workers, entrepreneurs, land owners, religious groups. (Year 9) ACDSEH087

Year 10:

Science as a Human Endeavour: Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community. ACSHE157

Science as a Human Endeavour: Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries. ACSHE158

Science Understanding: The universe contains features including galaxies, stars and solar systems and the Big Bang theory can be used to explain the origin the universe. ACSSU188

Science Understanding: The motion of objects can be described and predicted using the laws of physics. ACSSU229

Equipment – Setup

- Digital SLR kits x 3 (inc. SD cards, charged batteries)
- Solar telescope (Ideally a Coronado and a Dobsonian with a filter)
- A PowerPoint presentation including images of celestial objects and the work of astrophotographers around the world.
- Laptop for displaying the student captured photos.
- Evaluation and photo talent release forms.

Lesson 1.1: Digital SLR's & Photography (~120 minutes)

Introduction

1. Talk to students about what we're going to be doing on this course and what expectations there are for their participation and what outcomes we're hoping to achieve by the end. Reinforce the fact that this is the first time we've done something like this so this is a 2 way learning experience for us and them. For this reason they should expect some things not to work, but this is ok as this will allow us to learning and do things better. As such their feedback during and after this short course is essential.

Main Body

2. Start things off with a look at the equipment – this will serve to immediately engage the students in a tactile way, and quickly establish that we're going to be playing with some pretty cool technology that will allow them to gain new skills and insights into photography, astronomy and science.
3. Show some examples of old cameras and discuss 'photography through the ages.'
4. Sit around a table and talk about the different parts of the cameras we'll be using and how modern SLR's work in general.

Note: This sort of group discussion will hopefully be a more engaging model than the traditional 'chalk and talk' approach. The whole learning experience should be seen as a collaborative, student driven experience with guidance from those supervising. If the students want to take the experience off down other paths this should be permitted to some extent before supervisors bring things back to the core themes.

5. Let students explore the cameras to allow the new information to sink in and take root. Let them take a couple of pictures.
6. Tips and tricks for composing a photograph. (Rule of thirds, lines and perspectives, points of interest).
7. Set students the task of now taking some photos that do and don't feature the rules for composition. Let them take some pictures in-doors and outdoors and save these for review at the end of the course to demonstrate how far the students have come.
8. Using a pre-prepared evaluation form conduct evaluation of students to establish prior knowledge and level of interest. This will be repeated during the course to assess impact and whether the defined learning objectives have been achieved.
9. Put the photos the students have taken up on screen, then compare and discuss them. Discuss which images the students think are good and not so good, and why.

Conclusion

10. Summarise what we've covered so far, ask questions, take questions and encourage discussion.

Lesson 1.2: Astronomy & Astrophotography (~60 minutes)

Introduction

1. Remind students what we did in the first lesson; take any questions they might have and summarise what we're going to do in this lesson before proceeding.

Main Body

2. Use a solar telescope to observe the Sun. Show students the insides of the telescope, get them to build it and take it apart and then see how quickly they can put it together again. Capture some images of the Sun if possible.
3. As part of the outdoor scope work discuss:
    a. How a telescope works and the history of the telescope (i.e. Galileo)
    b. Observing the Sun safely
    c. What is astronomy?
    d. Why do we do astronomy?
    e. What does it teach us about the world/Universe we live in?
    f. Is science important? Why? What do we gain from doing science?
4. Back in the classroom, talk about what students have just seen and done - the fact that we've done this activity makes astronomy and observing the sky relevant to the students, which should mean they are more likely to be engage as we introduce astronomy to them.
5. Introduce the Square Kilometre Array as a next generation telescope partly being built in Western Australia and an instrument that will allow us to see all the way through the Universe to not long after the Big Bang.
6. *Were there astronomers before Galileo?* Use this question to lead to an opportunity to talk about Aboriginal culture and use of the sky. Ideally have an expert/authority on this subject that can participate at this point and help with this important component.
7. Look at some dot paintings that depict the night sky, particularly the seven sisters and Milky Way. Use this to discuss the role of art in astronomy and science, and in turn use this to lead on to astrophotography.
8. Show some pictures of the Sun and objects in space (nebula, globular clusters, planets, galaxies, star clusters etc. and then show some images captured by astrophotographers from around the world. In each case describe in simple terms what's being shown in each image and the science that underpins the content of each image, tying the art and the science together.

Conclusion

9. Ask some questions about what we've done today to remind and reinforce and ensure learning objectives have been achieved. *Make anecdotal notes of students' level of understanding.*
10. Take questions and encourage the students to drive the discussion.
11. Convey that next week we'll be looking at how the night sky works and the equipment we'll be using with the SLR cameras to help us image it. Set the students the task of finding out more about anything from today to share next week and to do some research so that they can explain in detail the reasons why stars and planets in the night sky appear to move, and why planets and stars differ in the way they move.

Summarise, acknowledge the students' efforts and wrap up.

Note: In the first night sky session we'll do some night sky observing with a couple of different telescopes and have a laser tour of what we can see. This will probably take place in close proximity to the school on the school playing fields.

AstroPhotoArt Lesson Plan - Lesson 2.1 and 2.2

Year Level: Year 9-10

Key Learning Areas: Science & History

Overarching Learning Outcomes

- Access to high tech equipment such as Digital SLR's and telescopes will inspire an interest in science as a means of expanding students' curiosity and willingness to explore, ask questions about and speculate on the changing world in which they live.
- Students will gain an understanding of the vision that science provides of the nature of living things, of the Earth and its place in the cosmos, and of the physical and chemical processes that explain the behaviour of all material things.
- Students will gain an understanding of historical and cultural contributions to science as well as contemporary science issues and activities and an understanding of the diversity of careers related to science.
- Students will acquire knowledge, understanding and appreciation of the past and the forces that shape societies, including Australian society.

Specific Scope and Sequence Outcomes (as per the Australia Curriculum)

Year 8:

Science as a Human Endeavour: Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people's understanding of the world. ACSHE134

Year 9:

Physical sciences: Energy transfer through different mediums can be explained using wave and particle models. ACSSU182

Science as a Human Endeavour: Advances in science and emerging sciences and technologies can significantly affect people's lives, including generating new career opportunities. ACSHE161

Science as a Human Endeavour: The values and needs of contemporary society can influence the focus of scientific research. ACSHE228

Year 10:

Science as a Human Endeavour: Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community. ACSHE157

Science as a Human Endeavour: Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries. ACSHE158

Science Understanding: The universe contains features including galaxies, stars and solar systems and the Big Bang theory can be used to explain the origin the universe. ACSSU188

Science Understanding: The motion of objects can be described and predicted using the laws of physics. ACSSU229

Equipment – Setup

- Lollies for answering quiz questions.
- Digital SLR kits x 3 (inc. SD cards, charged batteries)
- iOptron Mounts x 3
- Mac book pro with SD card slot, presenters friend, and VGA adapter
- A PowerPoint presentation
- 200mm lens
- Student laptops (enough for one each) with Stellarium pre-installed.
- Stellarium workshop booklets x 9.

Lesson 2.1: The SKA, Indigenous Astronomy, Shutter Speed & ISO (~120 minutes)

Introduction

1. Remind students what we did in the first lesson and take any questions they might have. Ask some open questions to remind them about some of the things we covered last week and to jog their brains into action.
   a. What is astronomy?
   b. Who invented the telescope?
   c. Who was the first person to use the telescope to observe the night sky?
   d. Describe the main parts of a telescope and how it works?
   e. Why do we need to observe the Sun safely? How do we observe it safely?
   f. Why do stars in the night sky appear to move as the minutes/hours go by?
   g. Why don't the planets and stars in our night sky move in the same way?
   h. Is science important? Why? What do we gain from doing science?
   i. Why do we do astronomy?
   j. What does astronomy teach us about the world/Universe we live in?
2. Summarise what we're going to do today before proceeding. The main themes will be introducing the iOptron mounts, navigating the night sky and planning for the nightsky session.

Main Body

Italics = unfinished from lesson 1.2

3. *Introduce the Square Kilometre Array as a next generation telescope partly being built in Western Australia and an instrument that will allow us to see all the way through the Universe to not long after the Big Bang.*
4. *Were there astronomers before Galileo? Use this question to lead to an opportunity to talk about Aboriginal culture and use of the sky. If possible, have an expert/authority on this subject that can participate at this point and help with this important component. Otherwise watch the Message Stick episode "Before Galileo" and talk about it afterwards.*
5. *Give students the cameras and talk about shutter speed. Show some examples on screen of what happens with images taken with different shutter speeds.*
6. *Introduce the shutter priority mode (Tv) and demonstrate how to adjust shutter speed. Let student practice in the* classroom before letting them loose to take some pictures involving different shutter speeds; some quick, slow; where possible incorporating the rules of composition that they learned last week.
7. Review their efforts and discuss.
8. Show the iOptron mounts and get students assembling them with the cameras whilst taking extreme care not to drop the cameras.
9. Get them to do this several times so that students build muscle memory and are familiar with what goes where for when they have to do it in low light conditions.
10. Plan for the evening observing/imaging session. Inform students what to bring and where to meet, what to expect and what to aim for. Set expectations and emphasise that this is the first outing, that things will go wrong, and patience and realistic expectations are important.

Students will be set the task of making at least 3 different images - those that want to, can do more. This first attempt should be strongly supported in terms of help and supervision.

If there's time…

11. *Introduce the concept of ISO – where this comes from i.e. what it used to mean in film cameras compared to what it means for modern digital cameras. Show the affects of high and low ISO's on an image taken in the classroom.*
12. *Show students how to adjust their ISO and get them to take some shots around the classroom to see the affects for themselves.*
13. *Discuss what a lens is, how it works and how it affects the image. Talk about the lenses we'll mostly be using on the cameras, what properties this lens has and why we're using it.*
14. *Introduce the 200mm lens and get the students used to swapping lens.*

Conclusion - Summarise what we've covered so far, ask questions, take questions and encourage discussion.

Lesson 2.2: iOptron Mounts & Stellarium (59 minutes)

Introduction

1. Remind students what we did in the morning; take any questions they might have, and summarise what we're going to do in this lesson.

Main Body

2. Deliver the Stellarium workshop.

Note: Students can carry on at home if they don't get through it all.

Conclusion

3. Ask some questions about what we've done today to remind and reinforce and ensure learning objectives have been achieved. *Make anecdotal notes of students' level of understanding.*
4. Take questions and encourage the students to drive the discussion.
5. Convey that next week we'll:
   - **a.** Have a debrief relating to the observing/imaging session to discuss any problems and iron them out.
   - **b.** Begin learning how to process an image to get the most out of it.
   - **c.** Have time for some student directed learning into areas that they want to explore more of (maybe looking at the other functions and buttons of the Digital SLR's).
   - **d.** Need to plan for the next imaging session, which will be conducted in a dark sky site.

Summarise, acknowledge the students' efforts and wrap up.

AstroPhotoArt Lesson Plan - Lesson 3.1 and 3.2

Year Level: Year 9-10

Key Learning Areas: Science & History

Overarching Learning Outcomes

- Access to high tech equipment such as Digital SLR's and telescopes will inspire an interest in science as a means of expanding students' curiosity and willingness to explore, ask questions about and speculate on the changing world in which they live.
- Students will gain an understanding of the vision that science provides of the nature of living things, of the Earth and its place in the cosmos, and of the physical and chemical processes that explain the behaviour of all material things.
- Students will gain an understanding of historical and cultural contributions to science as well as contemporary science issues and activities and an understanding of the diversity of careers related to science.
- Students will acquire knowledge, understanding and appreciation of the past and the forces that shape societies, including Australian society.

Specific Scope and Sequence Outcomes (as per the Australia Curriculum)

Year 8:

Science as a Human Endeavour: Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people's understanding of the world. ACSHE134

Year 9:

Physical sciences: Energy transfer through different mediums can be explained using wave and particle models. ACSSU182

Science as a Human Endeavour: Advances in science and emerging sciences and technologies can significantly affect people's lives, including generating new career opportunities. ACSHE161

Science as a Human Endeavour: The values and needs of contemporary society can influence the focus of scientific research. ACSHE228

Year 10:

Science as a Human Endeavour: Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community. ACSHE157

Science as a Human Endeavour: Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries. ACSHE158

Science Understanding: The universe contains features including galaxies, stars and solar systems and the Big Bang theory can be used to explain the origin the universe. ACSSU188

Science Understanding: The motion of objects can be described and predicted using the laws of physics. ACSSU229

Equipment – Setup

- Milkyway chocolate bars.
- Digital SLR kits x 3 (inc. SD cards, charged batteries)
- iOptron Mounts x 3
- Mac book pro with SD card slot, presenters friend, and VGA adapter
- PowerPoint slides
- 200mm lens
- Student laptops (enough for one each) with Stellarium and GIMP pre-installed.
- Spare Stellarium workshop booklets x 6.
- 6 USB thumb drives
- Image Processing 'Step-by-step guide' x 6 plus spares.

Lesson 3.1: Image Processing (120 minutes)

Introduction

1. Ask some specific recall questions to remind students of the things covered last week and to jog their brains into gear.
    a. What is ‘shutter speed’? And how does it affect the images we take?
    b. What is ISO? And how does it affect the images we take?
    c. What do we align the iOptron Mounts to when we’re imaging the sky? What is the South Celestial Pole?
    d. What is the SKA? Where is it being built?
    e. What do Indigenous constellations often use that European constellations don't?
2. Ask if anyone has spent time looking at the program Stellarium at home. What did they do and find? Get them to share their experiences and thoughts on the program.
3. Highlight what practical use we have for this program and that we’ll be using it later to plan for the dark sky observing session.
4. Summarise what we’re going to do this morning. The main themes will be an introduction to image processing, processing of the images from the first imaging session, more time with the cameras and iOptron mounts and planning for the dark sky imaging session.

Main Body

5. Take some comments regarding the first imaging session. Find out how the students went, whether there were any issues that need to be addressed and make some notes for any adjustments that need to be considered for the dark sky imaging session.
6. Talk about focusing and focus control, and get students practising with the cameras to refine their skills and reinforce understanding.
7. Introduce the students to the world of image processing. Describe what image processing is, why we do it and what we do and don't want to end up with.
8. Introduce the GIMP software. Walk the students through the different features that are useful for what we’ll be doing. *Important: avoid overloading the students with info by only showing them what they need to know.*
9. Get each student to process the same image in a step-by-step PowerPoint driven tutorial. Describe each step in detail. *Important: Go very slowly and ensure everyone is keeping up i.e. that they understand what’s going on and why, at the end of each step.*
10. Review the results.
11. Provide a selection of images for the students to choose from to process and set them going with the help of a Image Processing ‘cheat sheet’ to guide them.
12. Make available the images captured at the first imaging session and get the students to process these. *Set clear expectations of what we want by the end of this lesson. For example: Three full processed images ready to show to the class after lunch.*

If there’s time…

13. *Discuss what a lens is, how it works and how it affects the image. Talk about the lenses we’ll mostly be using on the cameras, what properties this lens has and why we’re using it.*
14. *Introduce the 200mm lens and get the students used to swapping lens.*

Conclusion

15. Summarise what we’ve covered so far, ask questions, take questions and encourage discussion.

Lesson 3.2: Stellarium / Camera Practice / iOptron Mounts Setup Practice (60 minutes)

Introduction

1. Remind students of what we worked through that morning and take questions.

Main Body

2. Review the processed images from the morning lesson Look at the images and critique constructively to give each student something to focus on during the next imaging session. *Make a note of these for later use.*
3. Look at each image again and focus in on the science being revealed in each image. What do these images teach us about the Universe?
4. Discuss the details of the dark sky imaging session the following week. Inform students what to bring and where to meet, what to expect and what to aim for. Set expectations and emphasise that things may go wrong and that we need to problem solve, be patient and take our time.
5. Allow students to choose what they would like to focus on for the remainder of the afternoon. They have a choice between working with the laptops (not playing) to develop their skills and familiarity with GIMP or Stellarium, practising with the camera and exploring different settings (with our assistance) and/or assembling and better understanding the iOptron mounts.

Conclusion

6. Ask some questions about what we've done today to remind and reinforce and ensure learning objectives have been achieved. *Make anecdotal notes of students' level of understanding.*
7. Take questions and encourage the students to drive the discussion.
8. Convey that next week we'll:
    a. Be reviewing our dark sky imaging session and processing the results.
    b. Be looking at the science behind our images.
    c. Have time for some student directed learning into areas that they want to explore more of (maybe looking at the other functions and buttons of the Digital SLR's).
    d. Discuss the future and anything more the students wish to do beyond the end of this short course.

Summarise, acknowledge the students' efforts and wrap up.

International Centre for Radio Astronomy Research

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16 December 2014

Re: AstroPhotoArt Program

Dear Parent,

For the past few weeks your son or daughter has been involved in a new program called AstroPhotoArt along with five other students from Lockridge SHS. By participating in this special program these students are learning how to use digital SLR cameras whilst applying and building upon their knowledge of science and astronomy. By the end of the short course it's hoped that each student will be able to use the equipment provided to capture images of the night sky and demonstrate a greater understanding and appreciation for the underlying science.

During the next week or two we would like to undertake at least two night-sky imaging sessions with the students. Weather permitting we hope that the first of these will take place on school grounds this Thursday (May 29th) from 6pm to 8pm.

For the second imaging session we would request your permission to take your son or daughter to a location outside of Perth and away from the light pollution caused by the city and suburban lights. This location will be on the grounds of GinGin Observatory approximately 1.5 hours from Lockridge SHS. We will provide transport in the form of a minibus and this will depart from the school gates at 4:45pm on Wednesday the 4th of June and return at 10pm that night.

Toilet facilities are available at GinGin Observatory and students are required to bring:

- Warm Clothing (jackets, beanies etc)
- Covered shoes/ runners/ boots (no soft, slip-on shoes or open sandal/ flip-flop types allowed)
- Food and water (e.g. a sandwiches)
- Mozzie repellent (if available)

Mr Chedid from Lockridge SHS will be present for both imaging sessions and there is mobile coverage at GinGin Observatory, so students will be able to make and receive calls at any time.

If you would like more information about this program or have any issues that we can help to address, then please don't hesitate to contact me via phone or email. My details can be found at the top of this letter.

Thank you for allowing your son or daughter to participate in this program, we hope they learn a lot from the experience.

Yours sincerely

P. Wheeler

Pete Wheeler, Manager Outreach and Education

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16 December 2014

Re. AstroPhotoArt Astrophotography Program for Yr 10's

Dear Principal Anne Robinson,

I wanted to thank you for allowing us to work with your school in the trial of our astrophotography program. This has been a tremendously valuable and rewarding experience for us and we couldn't have asked for more help and support along the way from Lockridge SHS.

Mastering digital SLR camera's and high tech tracking mounts in just a few weeks, while acquiring the knowledge and skill to image the night sky, is a considerable challenge. Throughout the course we've been very impressed with the ability of your students and what they've accomplished. They've also been a lot of fun to work with and I have no doubt they'll each go on to achieve great things.

As for Mr Chedid, without him this program could not have succeeded. Several late nights were required, including two visits to a regional location. Mr Chedid gave his time freely, and his positive, friendly attitude and willingness to let us experiment allowed us to work unencumbered. Throughout the course he helped us to craft the delivery of the program to get the best outcomes for the Lockridge students involved, and his advice and wealth of expertise means that the schools and students we work with in the future will get the most out of the program.

Thank you once again. If there's anything we can do for Lockridge SHS in the future, please let me know.

Yours sincerely

P. Wheeler

Pete Wheeler - Outreach, Education & Communications Manager

AstroPhotoArt Pre-Evaluation

Year Level: ________

Name: ____

1. How good at science are you on a scale of 1 to 10? ________

2. Do you think science is?

☐	☐	☐	☐	☐
Boring		Ok		Interesting

3. Do you think space is?

☐	☐	☐	☐	☐
Boring		Ok		Interesting

4. Do you think photography is?

☐	☐	☐	☐	☐
Boring		Ok		Interesting

5. Do you or a member of your family own a digital SLR camera that you can use? ____________

6. Would you like to go to University when you finish school?

☐ Yes ☐ No ☐ Unsure

If yes, what do you think you might like to study? _________________

7. How likely are you to study science at university on a scale of 1-10? _________________

8. Before today how likely is that you would tell somebody something you knew about space?

☐	☐	☐	☐	☐
Very unlikely		Maybe		Definitely

9. What are you most looking forward to doing in this program? *(Write as little or as much as you like)*

____

____

____

10. Have you ever looked through a telescope before?

☐ Yes ☐ No ☐ Unsure

11. Have you heard of the Square Kilometre Array radio telescope before?

☐ Yes ☐ No ☐ Unsure

12. Have you used a Digital SLR camera before?

☐ Yes ☐ No ☐ Unsure

AstroPhotoArt Post Evaluation

Year Level: _________

Name: ____

About You

1. How good at science are you on a scale of 1 to 10? _________

2. Do you think science is?

☐	☐	☐	☐	☐
Boring		Ok		Interesting

3. Do you think astronomy and space is?

☐	☐	☐	☐	☐
Boring		Ok		Interesting

4. Do you think photography is?

☐	☐	☐	☐	☐
Boring		Ok		Interesting

5. How likely are you to study science at university on a scale of 1-10? ____________________

6. Have you enjoyed this course?

☐	☐	☐	☐	☐
No, not at all		Unsure		Yes, very much

7. How likely is that you would tell someone something you know about space?

☐	☐	☐	☐	☐
Very unlikely		Maybe		Very likely

8. What is the Square Kilometre Array?

____

____

____

____

____

____

About The Course

Course Content Reminder:

Monday	Introduction to digital SLR's, rule of third's, composition, shutter speed, an exploding Orange C carton (!), observing the Sun with a solar telescope.
Imaging Session 1 - Pond #1	Equipment set up practice, sunset shots, light painting, first astro shots.
Tuesday	Indigenous astronomy, introduction to the tracking mounts shutter speed shots, exploding water filled glove.
Imaging Session 2 – Dinner Tree	By the Diner Tree. Milky Way, land and sky shots.
Wednesday	Intro to image processing and processing of astro images.
Imaging Session 3 – Pond #2	By the pond for final images and light painting.
Thursday	Final processing of images.

1. Are you glad you had a chance to do this course? Be honest!

☐ ☐ ☐ ☐ ☐
Not at all A little Yes, lots

2. How would you rank the difficulty of each day and imaging session? See above for a reminder.

Monday	☐ Very easy	☐	☐ Ok	☐	☐ Very hard
Imaging 1 (Pond #1)	☐ Very easy	☐	☐ Ok	☐	☐ Very hard
Tuesday	☐ Very easy	☐	☐ Ok	☐	☐ Very hard
Imaging 2 (Dinner Tree)	☐ Very easy	☐	☐ Ok	☐	☐ Very hard
Wednesday	☐ Very easy	☐	☐ Ok	☐	☐ Very hard
Imaging 3 (Pond #2)	☐ Very easy	☐	☐ Ok	☐	☐ Very hard
Thursday	☐ Very easy	☐	☐ Ok	☐	☐ Very hard

3. How would you rank your enjoyment of each week or component? See above for a reminder.

Monday	☐ Boring	☐	☐ Ok	☐	☐ Awesome
Imaging 1 (Pond #1)	☐ Boring	☐	☐ Ok	☐	☐ Awesome
Tuesday	☐ Boring	☐	☐ Ok	☐	☐ Awesome
Imaging 2 (Dinner Tree)	☐ Boring	☐	☐ Ok	☐	☐ Awesome

Wednesday	☐ Boring	☐	☐ Ok	☐	☐ Awesome
Imaging 3 (Pond #2)	☐ Boring	☐	☐ Ok	☐	☐ Awesome
Thursday	☐ Boring	☐	☐ Ok	☐	☐ Awesome

4. What do you think you will remember most from this experience?

___

___

___

5. Has this course improved your understanding of science?

☐ Not at all	☐	☐ A little	☐	☐ Yes, lots

6. Has this course improved your understanding of astronomy?

☐ Not at all	☐	☐ A little	☐	☐ Yes, lots

7. Has this course improved your understanding of photography?

☐ Not at all	☐	☐ A little	☐	☐ Yes, lots

8. How confident are you with using a digital SLR camera now?

☐ Not at all	☐	☐ Ok	☐	☐ Very

9. What part challenged you the most during this program?

___

10. Is there anything that you think could improve this program for our future students?

___

___

___

11. Do you plan on doing more astronomy in the future?

☐	☐	☐	☐	☐
No		Maybe		Definitely

12. Do you plan on doing more astrophotography in the future?

☐	☐	☐	☐	☐
No		Maybe		Definitely

13. Do you have any other comments that you'd like to give us?

____

____

Thanks for being a part of AstroPhotoArt 2014!

TALENT RELEASE FORM

Aspire UWA and ICRAR Astrophotography workshops

Aspire UWA and ICRAR are conducting an astrophotography workshop at Lockridge SHS in which your child is participating.

Photographs will be taken at these workshops, which become the property of The University of Western Australia (UWA) and the International Centre for Radio Astronomy Research (ICRAR) and may be used in their publications and websites, and may be passed on to media and partners to use only in conjunction with stories, articles and advertising that directly promotes Aspire UWA, The University and ICRAR.

Please indicate your permission below for usage of photographs of your child.

☐ I give permission for my child's image to be used by UWA, Aspire UWA and ICRAR on their websites, and by media selected by UWA and ICRAR to promote UWA, Aspire UWA and ICRAR

Signed (Parent/Guardian): ______________________________

Name (please print): ______________________________

Child's Name: ______________________________

Contact email address OR phone number ______________________________

Date ______________________________

NOTE: Signatories must be 18 years or over

Thank you very much for your involvement in this project!