

Learning Based on Shared Experience: A Proof of Concept at the SAGI summer school in Observational Astronomy

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Abstract

The SAGI summer school 2023 (3S23) in observational astronomy is organized in the Summer 2023, at the International Center for Interdisciplinary Science and Education (ICISE) in Quy Nhon, Viet Nam. The goal of 3S23 is to promote astronomy research in Viet Nam and to teach astronomy to students. We report the activities of the school and also highlight its pedagogical approach. Using narrative and observational analysis of participants' own words, we analyze the impacts of the school on participants and on astronomy in Viet Nam. From these results, we propose a new form of teaching, namely Learning Based on Shared Experience (LBSE). LBSE takes into account the diversities in students' backgrounds, languages, analytical, mathematical, abilities, and experiences and create an environment where learners learn and share from each others' experience. This approach is likely effective in teaching subjects that requires collaborations such as sciences and technologies.

Key words: optical astronomy — astronomy education — science development – experiential learning

1. Introduction

The SAGI summer school 2023 (3S23) in Observational Astronomy was organized from 17th to 28th July, 2023 in Quy Nhon, Viet Nam. The school aims at promoting astronomy research in Viet Nam and teaching astronomy to students. Annual summer school is an activity of the Simons Astrophysics Group at the International Center

for Interdisciplinary Science and Education (ICISE) in Quy Nhon, Viet Nam (SAGI).

SAGI is founded to provide opportunities for overseas Vietnamese astronomers to collaborate with astronomers working in Viet Nam, and to teach astronomical techniques, observations, theories and instrumentation to students from Viet Nam and the Southeast Asia region. SAGI's key members are Nguyen Trong Hien (PI,

Caltech/JPL, instrumentation), Hoang Chi Thiem (KASI, theoretical astrophysics), and Nguyen Luong Quang (AUP/CEA, observations/instrumentation). SAGI is hosted by the Institute For Interdisciplinary Research in Science and Education (IFIRSE), which belongs to ICISE. IFIRSE/ICISE is located in Ghenh Rang, Quy Nhon, Binh Dinh, Viet Nam. The main mission of IFIRSE is to conduct fundamental research, driven by curiosity, at an international level. There are currently four research groups: neutrino Group, SAGI, environmental sciences, and theoretical physics.

Since its inception almost a decade ago, ICISE has been the place to meet in Southeast Asia for international researchers across disciplines, including physics, astrophysics, and mathematics. ICISE is a non-profit, non-organization entity founded by Prof. Jean Tran Thanh Van and Prof. Le Kim Ngoc, who left Viet Nam in the 1950s to study in France.

3S23 is a two-week summer school that brings together astronomers and students to work on observational aspects of astronomy. The school focuses on practical hands-on skills in observation, operation, and instrumentation development. Our goal is to demonstrate how astronomy is not only an interesting subject but also critical for both technological and scientific development. We aim to address commonly asked questions about the relevance of astronomy, such as “Why should we study it, or why should the government invest in it?”

In this paper, we report the activities of the school, highlight its pedagogical approach and its impacts on participants careers and on astronomy in Viet Nam.

2. The school organization

2.1. The philosophical approach of the school

This school was organized with the vision of giving students experiences in astronomical research and giving students opportunities to share their own experiences with others through a shared-experience-based method. Since 1938, the infamous philosopher of education John Dewey has summarized the important of experience in education in his book “Experience and Education” (Dewey 1938). Dewey suggested that students actively organize fact-based comprehension through meta-cognition, or by building onto prior experiences, preconceptions, and knowledge. Therefore, the educator’s role is in creating an educative experience, not just dictating knowledge.

The argument that education should become more evidence-based was put forward in Davis (1999). Evidence-based education, if done right, would provide a set of principles and practices for enhancing educational policy and practice (Davis 1999). Therefore, we assess the efficacy and impact of the school via two evidences: the students’ attitude toward science and also the research reports that they produce at the end of the school.

We also focus on creating more human contacts between participants of the school by providing more occurrences of meeting and discussing topics out of the scope of the school. This is done via frequent science discussions, so-

cial gatherings, and a weekend hiking and camping trip to the Yok Don National Park. The National Parks located about 300 km to the West of Quy Nhon in a mountainous province named Daklak. Dak Lak province is the largest province in the HighLand region in Viet Nam. This province is in one of the mountain region of Viet Nam which has an average high of 400–800 m above the sea level and mountains peak up to 1500–2400 m. The highest mountain is Chu Yang Sin, peaks at 2442 m. Dak Lak is about 200 km far from the sea. The dry season begins from November to April each year with quite dry weather and many clear nights. It is here that we are planning to build another astronomical observatory in collaboration with Tay Nguyen University (Le-Minh et al. 2018).

To enhance the students’ learning experience, they also visited the Explora Science Museum and the planetarium located near the school campus. This provide an additional avenue for students to explore and deepen their understanding of astronomy and astrophysics beyond what is covered in the classroom and during observational sessions.

2.2. The participation body of the school

The school participants includes 15 lecturers from Viet Nam, Japan, France, USA, Germany and 32 students from Viet Nam, UK, Japan, France (figure 1). There is still an strong gender imbalance among lecturer, only 1 female out of a total of 15 lecturers (figure 2). However, the distribution of genders among students are more uniform.

Distribution of working countries of lecturers and students

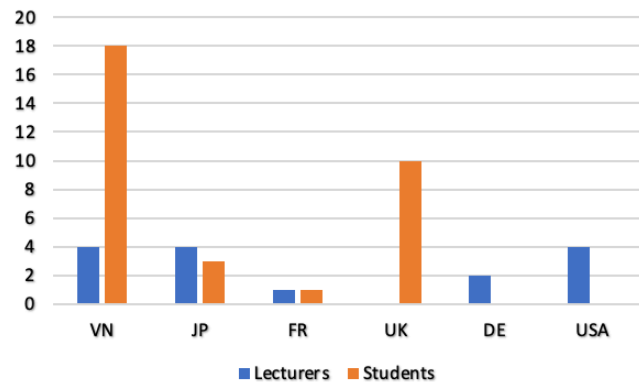


Fig. 1. Distribution of working countries of lecturers and students.

2.3. The organization of the school

Throughout the program, students learnt about astronomy and astrophysics during lectures and while working on observational projects that focus on research questions, both scientifically and experimentally. They also learnt how to operate telescopes, design and test scientific instruments, and conducted observations in groups, similar as professional astronomers. Students experienced the full spectrum of the observational process, from the frustra-

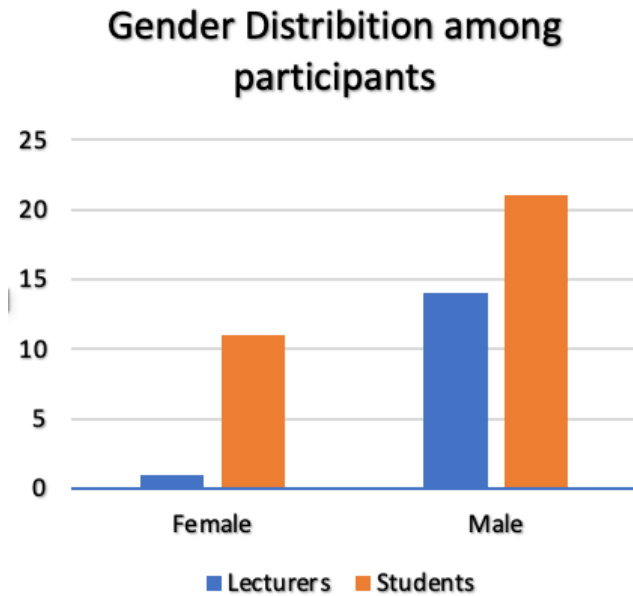


Fig. 2. Distribution of genders among lecturers and students.

tion of operating the telescope to the joy of capturing celestial images, the confusion of the data, and the power of analytical thinking and data analysis. Actually, the sky was clear on only 3 out of 15 nights so observations was done mostly on these 3 nights. The other nights students gathered at the observatory to work on the data analysis and the report.

We expected to provide students with a comprehensive learning experience that equip them with practical skills and knowledge to pursue their passion in astronomy and astrophysics. The visit to the Explora Science Museum and the planetarium located on the Quy Nhon Observatory (QNO) campus provided an additional avenue for students to explore and deepen their understanding of astronomy and astrophysics.

2.4. The lecturing and project programs

The program of the school cover a range of topics, including telescope optics and practical astronomy, and observations of fundamental astronomy. Lectures are given in the morning and three first afternoons. In the evening, students carried out observation and data analysis projects.

2.4.1. Lectures

The lectures comprised of the following topics:

- Observational astronomy (Mikio Kurita, Kyoto University)
- Development of Seimei 3.8 m segmented telescope (Mikio Kurita, Kyoto University)
- Spectroscopic observations of stars and planetary atmosphere (Dinh Van Trung, Institute of Physics, Viet Nam)
- Molecules in stars and planets (Dinh Van Trung, Institute of physics, Viet Nam)

- Python and optimisation algorithms crash course (Tran Quang Vinh, MIT, USA)
- James Webb Space Telescope (JWST) and how to prepare a JWST proposal (Nguyen Tung Lam, Paris Observatory, France)
- Super star cluster (Nguyen Tung Lam, Paris Observatory, France)
- Asteroids and exoplanets (Yoichi Itoh, Nishi Harima astronomical observatory, University of Hyogo)
- Observations of exoplanet transits (Yuya Hirano, Nishi Harima Astronomical Observatory, University of Hyogo, Japan)
- Machine learning application in classifying exoplanets/gamma-ray images (John Hoang, University of California Berkeley, USA)
- Cherenkov Telescopes: high energies gamma-ray astronomy and beyond (John Hoang, University of California Berkeley, USA)
- SETI: How to scientifically hunt for aliens? (John Hoang, University of California Berkeley, USA)
- Interstellar Dust: Measurement of extinction by star count (Kazuhito Dobashi, Tokyo Gakugei University, Japan)
- Observing techniques: Photometry and spectroscopy (Nguyen Thi Thao, Nha Trang Observatory, Viet Nam)
- Solar activity and its effects on the ionosphere and Very Low Frequency array (Le Minh Tan, Tay Nguyen University, Viet Nam)
- Spectroscopy for Photon Dominated Regions (Le Ngoc Tram, Max-Planck Institute for Radio Astronomy, Germany)
- Grain alignment and magnetic field in star-forming regions (Le Ngoc Tram, Max-Planck Institute for Radio Astronomy, Germany)
- Definition of galaxies (Binh Nguyen, University of Washington, USA)
- A brief introduction to radio interferometry: from visibility to sky brightness (Hoang Ngoc Duy, Hamburg University, USA)
- A low-frequency view of galaxy clusters (Hoang Ngoc Duy, Hamburg University, USA)

2.4.2. Research projects

Each group had two to three observation nights to conduct observations with telescopes at QNO. QNO has a Planewave CDK600 telescope with a 600 mm mirror diameter, as well as additional smaller telescopes, solar telescope, and a 3 m radio 21 cm wavelength dish. These are used to support the dissemination of scientific knowledge and research in the field of astronomy (see also Nguyen-Van et al. 2023). The project were led by one or two lecturers who are available for the duration of the schools as can be seen below.

- Earth team: Illuminating the night: probing atmospheric extinction and night sky brightness of Quy Nhon (supervisors: Nguyen Thi Thao, Tran Quang Vinh)



Fig. 3. The group photo taken on the first day of the school, Monday, 17th July, 2023.

- Moon team: Attempt to take a stereo-image of the Moon using two telescopes in Quy Nhon and Tokyo (supervisor: Kazuhito Dobashi)
- Exoplanet team: First observations of Exoplanet transit in Vietnam (supervisors: Yoichi Itoh, Yuya Hirano)
- Sun team: Observing the Sun using optical telescopes and Very Low Frequency instruments (supervisors: Le Minh Tan, Binh Nguyen)
- Satellite team: Hunting satellites with QNO's telescopes (supervisors: John Hoang, Duong Tuan Anh)
- ISM team: Spectroscopy for Photon Dominated Regions of the M17 H II region (supervisor: Le Ngoc Tram)
- Cluster team: Analysis of super star cluster with JWST images and Simulation of JWST MIRI observation with MIRISim (supervisors: Nguyen Tung Lam, Nguyen Luong Quang)
- Galaxy team: Multi-wavelength observations of a nearby radio galaxy M106 (supervisor: Duy Hoang)

2.5. Shared experiences

From our observations and students' narrative (see Section 3.1), the school is an excellent opportunity for students to share experiences along their learning process. Several aspects of experiences that were shared during the school:

- Observations and experiments: Experiment design and observation procedures made during observing sessions.
- Research findings and discoveries: Intriguing personal discoveries that have not discovered by themselves before which can spark curiosity and discussions among peers.
- Data analysis and interpretation: Collaborative data analysis and interpretation of astronomical data sets collected during observations and astronomical data archives which can trigger peer collaboration and discussion.
- Personal learning experiences: Experiences at different cultural backgrounds were discuss which can offer diverse perspectives to fellow students.
- Problem-solving strategies and challenges: Students work together and share their problem-solving strategies for complex astronomy-related problems or challenges encountered during research projects.
- Peer teaching and tutoring: Because of the different in student levels, peer teaching was encouraged so that students share their expertise or understanding of specific astronomical topics with their peers.
- Multilingual exploration: Students from diverse linguistic backgrounds can contribute by sharing astronomical terms, facts, or stories related to space in their native languages. This practice not only enhances their understanding but also exposes others to different linguistic perspectives.
- Cultural astronomy: Sharing cultural narratives or stories related to constellations, eclipses, or celestial events from different cultures can broaden students' cultural awareness while learning about astronomy.
- Diverse perspectives in interpretation: Encouraging discussions about how different cultures interpret and view astronomical events or celestial bodies can lead to diverse interpretations and foster critical thinking among students.
- Cultural celebrations and festivals: Sharing experiences or participating in cultural activities related to astronomy-based celebrations from different cultures can create a sense of inclusivity and respect

for diverse cultural practices.

3. Impacts of the school

3.1. Testimonials of students and lecturers

One of the goals of the school is of course to teach students astronomical techniques and help students enhance their interest in astronomy. Besides that we also aim to cultivate friendship and future collaborations between different countries. As a matter of fact, modern astronomy always relies on collaborative effort in an increasingly international environment. Using the traditional narrative analysis in psychology, it is much easier to understand the impacts of the SAGI summer school on students based on the narrative that they have written on the testimonial book. We provide a few excerpts here below.

3.1.1. Testimonials from students

“Life feels so surreal right now - no words will ever express how lucky and privileged I received the education I receive, and the opportunities that come along with it.” (Nicole Bates, 1st year bachelor in physics, Cardiff University, UK)

“I’ve never really considered myself a particularly adventurous person, but this school has taught me there is a lot more to life than sitting at home watching TV. Viet Nam is an amazing country, with so much to explore and see, not to mention delicious food and drinks. I feel so privileged to have had the opportunity to visit such a beautiful country and study physics with professional astronomers. I feel more excited than ever to pursue a career in astronomy.” (Felix Wood, 1st year bachelor in physics, Cardiff University, UK)

“I am happy to have met all these wonderful people. I will never forget every night in Quy Nhon. We sang, socialized and studied hard. I think we had a really good time. Before I went to Viet Nam, I wanted to be an elementary teacher next year. But thanks to this summer school and to you all, I’m wondering about a master’s degree in astronomy.” (Satoshi Horiguchi, 4th year bachelor in science education, Tokyo Gakugei University, Japan). And Satoshi actually enrolls in a master program at Tokyo Gakugei university after the SAGI summer school.

“The first foreign country I visited, Quy Nhon, Viet Nam. It was a scorching hot place with beautiful blue sky and sea. Everyone I met was kind. The astronomy lectures and projects in English were difficult. I felt what I knew was tiny. I need to study astronomy and English more. It was two weeks filled with such stimulation and fun. I’ll never forget the sights, the songs, and the foods. I’m glad that my first memory in a foreign country was at this school. Thank you so much. I will definitely see everyone again!” (Fu Sato, 4th year bachelor in science education, Tokyo Gakugei University, Japan)

“I gained a lot of knowledge, learned more about other cultures, and made great friends during this summer school. Although it was only two weeks, it was probably my most memorable summer.” (Ngo Ngoc Hai, 4th year bachelor in chemistry, University of Science, Viet Nam National University-HCMC, Viet Nam).

“Thanks for this meeting. To be honestly, this is my first time I have involved in a Summer school like this. In this school, I can learn more about astronomy and physics which I have never experienced before. Additionally, I am able to make new friends and understand how to working in an international environment. In short term, I cannot wait for saying that “ I love everyone, I love our memory, I love this schooling program ”. I am hopeful to see you in the future.” (Nguyen Thai Duy, final year, Nguyen Binh Khiem high school for the gifted, Vinh Long, Viet Nam)

“This trip was one of the best experiences of my life! I wholeheartedly encourage everybody to do something like this! I met so many amazing people and was given so many incredible opportunities like meeting wild elephants and operating the telescope at QNO. This trip really opened my eyes to the realities of being an astrophysicist and has made me want to do it even more! Thank you so much for a once in a lifetime opportunity, I will never forget it!!” (Kira Ward, , 1st year bachelor in physics, Cardiff University, UK)

“After this summer school, I have felt very happy to learn more about astronomy from teachers and scientists. Specifically, I had a lot friendly international friends. I hope there are more programs like this so that astronomers can gain more experience in their work and make international connections. Thank SAGI summer school very much.” (Pham Nhat Thuyet, Nha Trang Observatory, Viet Nam)

“The word “ incredible ” is simply not enough to describe the incredibility of this school. It drives us youngsters from being silent, introvert nerds into energetic and crazy about astrophysics. I think what makes this school so successful was not only from the undeniably amazing lectures, but also from the invaluable opportunity for students like us who coming from different countries, cultures and even lifestyles to work and have fun together, which definitely will benefit us immensely in the future. And if I’ll be given a chance to meet those young, intelligent and energetic minds again, I’ll not hesitate to say yes again.” (Nguyen Tat Thang, 3st year bachelor in space and applications, University of Science and Technology of Hanoi, Viet Nam)

“I would not have expected to have such an eye opening and incredible two weeks when I signed up for this back in January. I didn’t expect to learn so much and as well have the chance to get hands on with the facilities. As well as that everyone was extremely friendly and welcoming which only added to the amazing experience. I hope to return to Viet Nam one day and explore more and hopefully see a few familiar faces again.” (Ethan McCormick, 1st year bachelor in physics, Cardiff University, UK)

“Although the trip was only 2 weeks it was an incredible experience. I met so many incredible people and got to work with them. I got to see things I otherwise may have never seen and do things I wouldn’t normally do. I learnt new skills and more about astronomy. I loved travelling Viet Nam and working on the group project. I’d love to go back to Viet Nam and see some of the people I met again.” (Joel Buckeridge, 1st year bachelor in physics,

Cardiff University, UK)

“This trip to Viet Nam has seriously been one of the best things I’ve ever done. The science, the food, and of course the people I met have all been wonderful. Thank you everyone who made it possible for us to go. Camping in the jungle and meeting elephants was not something I expected to do on an astronomy summer school, but it was fantastic and I’ll never forget it. I’ll always remember all the new experiences: working with a 60cm telescope, trekking through the forest and social events! I had a great time in the moon group, and this was my first time presenting scientific findings to an audience which was nerve-wracking but really rewarding. I’m planning to come back to Viet Nam as soon as possible, see you all again one day! :)” (Ned Grandy, 1st year bachelor in physics, Cardiff University, UK)

“I really love the two-week time spent there in the summer school. The food was good, lecturers and friends were amazing and friendly. I learned a lot thanks to the lectures and the Moon group. I get more assurance about my astronomy career. Hope to see all of you again, in Viet Nam, Japan, UK, France, or anywhere. I love all of you.” (Ho Huy Ngoc Khue, 2nd year bachelor in physics, International university-Vietnam National University)

“Visiting Viet Nam was an amazing experience. The astronomy school has opened my eyes to so much that awaits me further down the road in my astrophysics career. It was everything I had wanted it to be. The people there are so friendly and I loved all the opportunities we were given.” (Jacob Allington, 1st year bachelor in physics, Cardiff University, UK)

“Hello friends, the first time coming to the astronomical observatory school is very exciting, this is the first time my husband and I have participated in such a wonderful class. It’s great to be directly involved in research activities with your companions. I hope that the students in my area will also have access to modern facilities like in Quy Nhon to be satisfied with their research. Thank you, teachers, for sharing a lot of information, this is a precious time. Thank you very much. Hope to be able to participate more.” (Trinh Le My & Kham Tran Anh Quan, master in physics, Tay Nguyen University, Viet Nam)

“After 2 weeks of taking classes on astronomy, I feel very excited. I love studying astronomy because it helps me understand the universe around me. The universe is a vast and mysterious place, and I have always been intrigued by it. I wanted to know more about all the things that were going on in the universe, and I knew that astronomy was a great way to learn. I’m glad I had SAGI Observational Astronomy School. I know that astronomy will be an important part of my life, and I look forward to continuing to learn about it in the future.” (Nguyen Truong My Duyen, Quy Nhon Observatory)

“Although we’ve only been friends for two weeks, I’m happy. I learned a lot from everyone in addition to playing. I hope I can see everyone again. I love all people.” (Vo Tran Thanh Mai, 4th year bachelor in physics education, Ho Chi Minh City University of Education, Viet Nam)

“Thank you SAGI Astronomical Observation School for creating conditions for everyone to learn together. Thank you for imparting interesting knowledge about astronomy. 2 weeks of studying and being with everyone is a beautiful memory for me, increasing my passion for astronomy.” (Huynh Duy Hoang, 4th bachelor in physics, Quy Nhon University, Viet Nam).

“It’s my mission to learn as much as possible and travel as much as possible so SAGI was a perfect opportunity. This was my first time doing observational astronomy, which was a lot of fun and gave me insight into my potential future career. Everybody I met was lovely and, although I am now 90% tofu, I will cherish these memories for life. Thank you all.” (Bonnie Collins, 1st year bachelor in physics, Cardiff University, UK)

“This summer school was such an incredible opportunity and I am so grateful to have been able to spend two weeks learning so much about a subject I am very passionate about with such like minded people! It was also so much fun being able to explore a new country, meet so many incredible people and make new friends :) I hope to be able to do something similar in the future and hope I will have the opportunity to visit Viet Nam again!” (Amy Matthews, 1st year bachelor in physics, Cardiff University, UK)

“The words do not come out.” (Nguyen Duc Nguyen, 3rd year bachelor in space and applications, university of Science and Technology of Hanoi, Viet Nam)

“This trip went light-years beyond my expectations! The schedule was full and didn’t waste a second. I learnt so much during my time here - about operating large telescopes/ an observatory, optics, python/machine learning and the extinction coefficient (it’s hard to forget my presentation on that). But Ultimately, it was the people I met here which made the trip so unforgettable. I never could have expected to find myself so surrounded by such caring and wholesome people, from so many backgrounds/demographics. This truly was a melting pot of good vibes which culminated in special moments like the feast on the camping trip.” (Harvy Davies, 1st year bachelor in physics, Cardiff University, UK)

3.1.2. Testimonial from lecturers

“Spending two weeks with bright, hopeful, and ambitious young students like you was a very precious and enjoyable experience for me. I would like to express my thankfulness to all of you. Forty years ago, when I was at your age, I visited England as my first trip to foreign countries. At that time, it was not easy (at least for me) to go abroad and I had only seen what was happening in foreign countries on TV, so I was very surprised to actually see the cultural differences in many aspects, and sometimes I didn’t know what I should talk to the people. In contrast, everyone in the summer school was openly and naturally communicating with students from other countries and with the local people. I was very much impressed and was very happy. I sincerely hope that your future is full of such friendship and benevolence. I am looking forward to seeing you again somewhere.” (Kazuhiro Dobashi, professor, Tokyo Gakugei University, Japan)

“I am very happy to join this school and to see how international friendship gradually developed among the participating students. I am also very impressed with the QNO telescope. Its pointing and tracking are very accurate and the observatory staff are so enthusiastic. We will continue our observational collaboration on exoplanet science. Xin Cam On.” (Yoichi Itoh, professor, Nishi Harima Astronomical Observatory, University of Hyogo, Japan)

“It is my honor to come back to Quy Nhon and join the school as a lecturer (and a student too!). Everyone is amazing and enthusiastic. The food and drinks are yummy. The places and scenes are fascinating. It was a pity that I could only spend one week here. Thank you for all the great memories and see you soon!” (Nguyen Tung Lam, adjunct researcher, Paris Observatory, France)

“I am very happy to meet everyone in Quy Nhon during the 2 weeks of classes. The class has helped me have more interesting experiences, make many new friends and learn a lot from teachers and scientists. I hope to see you all again soon. Wish all the best to you.” (Nguyen Van Tue, telescope operator at Quy Nhon Observatory, Viet Nam)

“It’s been a pleasure and honor to be a lecturer and participant of this summer school. From the very first day, it was clear that the summer school was not just a collection of courses and observation activities, but a meticulously crafted tapestry of knowledge, friendship, and personal growth. The dedication of the organizers, instructors, and staff was extraordinary, creating an environment where curiosity thrived and possibilities seemed limitless. The impact of this experience will undoubtedly extend far beyond the summer, as the knowledge gained and the collaboration formed will continue to shape my academic and personal journey.” (John Hoang, researcher, University of California Berkeley, USA)

“Many thanks the SAGI group for inviting me to give lectures at the school. I am glad to meet and learn from the enthusiastic students as well as from the other lecturers. This short two-week summer school is a great journey which is like no others that I have participated. It is where everyone including the students and lecturers learns new things and has fun together despite of the fact that many of us are from different continents and meet for the first time. This shows that there is no boundary for us to learn and work together to achieve common goals. More schools like this should be organised in future.” (Duy Hoang, researcher, Hamburg University, Germany)

“During the SAGI astronomical observation school at ICISE, Viet Nam, I were strongly impressed by the intelligence and agility of the students, the thoughtful and professional organization of the organizers. I am proud that we are able to operate the observatory with the largest telescope in my country. I was amazed with the beautiful results of photos of the sun, galaxies and exoplanets, etc. School format combines theory and experiences that helps both lecturers and learners have more interaction. School helps students have many skills such as teamwork skills, research and talk skills as well.” (Le Minh Tan, lecturer, Tay Nguyen University, Viet Nam)

“There was not a single moment when the mood was

down, from the nights within the telescope’s dome, analyzing signals under the stars, to late talks next to the waves, glasses in hands. It was a pleasure meeting, working, and having fun with so many people across backgrounds, countries, and generations. There was absolutely no barrier stopping people from coming together to share and learn - across nationality; between students and lecturers; between the olders, youngers. I was ecstatic to meet so many curious people eagering to discover and so many knowledgeable seniors eagering to share. I’m extremely grateful for what I had learned from everyone and the friendships I had been able to forged here in Quy Nhon.” (Tran Quang Vinh, lecturer, Massachusetts Institute of Technology, USA)

“I am grateful to the Organizing Committee for giving me the opportunity to participate in this excellent school. The school has brought together a diverse group of Vietnamese individuals working in the field of astronomy, both domestically and internationally, allowing me the chance to reconnect with old friends I haven’t seen in over 10 years and to meet new, intriguing colleagues. We’ve engaged in endless conversations about future collaborations, and I truly hope that these collaborative projects will soon become a reality. Furthermore, I am captivated by the potential of applying machine learning in astronomical data processing. I now realize more than ever that the combination of astronomy and the rapid advancement of technology is an exciting blend. This synergy makes the journey of “exploring the universe” more fascinating and enticing than ever before.” (Nguyen Thi Thao, astronomer, Nha Trang Observatory, Viet Nam)

“Thank you for giving me a great opportunity to join the excellent summer school and to meet energetic young students from all over the world. I received hope from them and learned many things. After three years of hibernating due to the crisis of Covid-19, we were able to spend and share fruitful time and place in Viet Nam. I hope that the students will take advantage of the wonderful experiences, as I once did.” (Mikio Kurita, professor, Kyoto University, Japan)

“I stayed as a speaker for a week, and it was really enjoyable and educational. It was my first overseas trip, but I was able to have a comfortable time with the help of everyone in the school and the local people I met. The observation project for exoplanets in Viet Nam is still ongoing. I’m determined to work hard in order to achieve many wonderful results.” (Yuya Hirano, researcher, Nishi Harima Astronomical Observatory, University of Hyogo, Japan)

3.2. *Impacts on future collaborations and astronomy in Viet Nam*

Astronomy, often referred to as the “gateway science”, has the power to inspire, educate, and unite people across the globe. This hands-on astronomical summer school in Viet Nam has shown that it could contribute to catalyzing the growth of astronomy in the country and stimulate future international collaborations.

The school allows for the identification and nurturing

of local talents in the field of astronomy, which otherwise is hidden. Through lectures, workshops, and hands-on activities, young Vietnamese students and researchers can receive a solid foundation in astronomy, ensuring that the country has a pool of homegrown talent to fuel its scientific progress. After the school, a few students have pursued further studies in astronomical research.

By providing access to state-of-the-art equipment and observational opportunities, participants can deepen their understanding of astronomy in a more interactive and practical way. This, in turn, can inspire them to pursue careers in science and engineering, contributing to a more robust and diversified scientific workforce in Viet Nam.

As a result of the school several collaborative projects have been set up. For example, researchers of QNO are working with researchers from Tay Nguyen university, and researchers from the University of Hyogo Nishi Harima Astronomical Observatory on an exoplanet monitoring project (see also Nguyen-Van et al. 2023). Tay Nguyen University also collaborates with Kyoto University to set up an optical observatory that hosts a 40 cm newly-designed telescope in Daklak (Le-Minh et al. 2018). Not only professional collaborations have been set up, the inter-cultural activities that we had during the school was also an opportunity for participants to exchange their own unique cultures. Participants and lecturers from different countries have learnt from each other, shares their perspectives, and built lasting friendship connections as several participants have already mentioned.

The organization of a summer school also identifies the necessity of acquiring cutting-edge astronomical equipment, such as telescopes, cameras, polarimeters, and spectrographs. In addition, a telescope on a better site such as a mountain should also be considered. We hope that the impact of a summer school extends beyond the field of astronomy alone. By emphasizing science, technology, engineering, and mathematics (STEM) education, it can contribute to the development of a scientifically literate workforce. Through the school, students are also exposed to engineering, physics, and computer sciences. They will understand better how different fields can be welded to understand the universe better.

4. Discussion: From Experiential Learning to Shared-Experienced-based Education

In his book, Kolb (1984) promoted a form of learning from experiences in which he considers that learning begins at the moment when the students interact and have clear experiences with the environment. Gorghiu and Santi (2016) summarized the process of experiential learning in a four-stage cycle (figure 4): starting from the concrete experience, then observation and reflection on that experience, which leads to the formation of abstract concepts (analysis) and generalization (conclusions), which are then used to test the hypothesis in future situations, the result being concretized in a new experience.

This approach has been implemented in various stages of human learning and development, and has been partic-

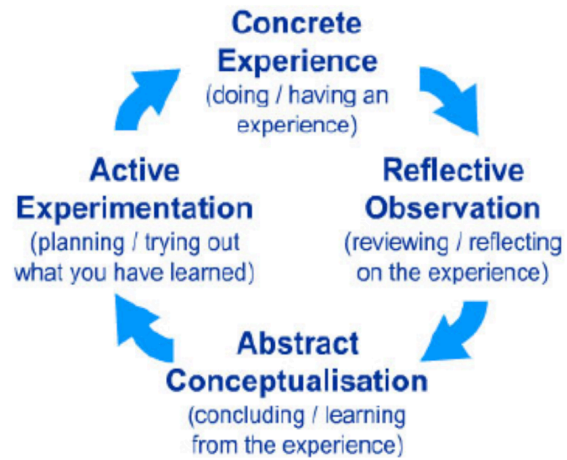


Fig. 4. Kolb's Experiential Learning Cycle. Figure taken from Gorghiu and Santi (2016).

ularly successful in STEM subject (i. e. Weinberg et al. 2011). However, in our school, the participants' characteristics are particularly different:

- Background diversity: participants' prior-training background ranging from first undergraduate year to PhD and professor levels.
- Language divergence: the main official language is English. However, there are group of native English speakers, group of non-native good English speakers, group of non-native beginner English speakers. The group is certainly multilingual. There is also a linguistic minority in the language distribution, i. e. Ede language.
- Cultural difference: participants come from different geographical and cultural regions (see Section 2.2).
- Age spread: participants are aged from post-highschool level to professor level.
- Spread in analytical reasoning and problem-solving skills: participants come from different background so their analytical reasoning abilities are also diverse.

In order to appreciate the differences and create an efficient learning process, we propose a Learning Based on Shared Experience (LBSE) approach for a diverse groups of learners. This approach is a modified combination of the two existing frameworks Experiential Learning of Kolb (1984) and the Cooperative Learning of Johnson and Johnson (2009). The main characteristics of this approach are:

- Create a supportive environment for participants to feel relaxed and embedded in the subject matter.
- Increase social interaction by hosting participants in the same location, preferably same residence, and create more social gathering opportunities.
- Create learning groups with stratified participants' characteristics.
- Create hands-on projects for each learning group. Note that because of the diversities of participants'

backgrounds, these problems do not have to be at the lowest level to facilitate the non-experienced participants.

- Deliver theoretical classes to bring the similar background materials to students, not necessarily at the same levels.
- Encourage more senior participants to explain the difficult concepts to junior participants in the group, thus, create more peer teaching and learning.

We will explore further LBSE approach in a more detailed analysis in coming papers.

5. Concluding remarks

In this paper, we report the activities of the SAGI summer school 2023 (3S23) in Observational Astronomy. We propose a Learning Based on Shared Experience (LBSE) approach that can be used to educate groups of students with diversified backgrounds in subjects such as sciences and technologies. This approach takes advantage of the diversities in students' backgrounds, languages, analytical, mathematical, abilities, and experiences and create an environment where learners learn and share from each others' experiences. By using narrative analysis, it seems that participants have positive experiences after completing school. We expect that their positive experiences will have impact of their future career and also possible on astronomy in Viet Nam. However, additional studies still need to be done to examine long-term efficacy of this approach.

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