

ASP 2022 Teachers and Learners Overview – Benard Mulilo (UNZA)

The following is my overview of the ASP 2022 Learners Program, which I attended and participated in on Tuesday, December 6, 2022.

Impressions of how the Learners program went

The Learners program unfolded smoothly considering the fact that most of the Learners who participated in the program on Tuesday, December 6, 2022 were 10th Grade High School students with no or little prior knowledge of the Standard Model of particle physics. It was impressive to note the Learners' enthusiasm in Fundamental and Applied Physics at such an early stage. Activities on the day, which included Particle Cards, Cosmic Muon experiment, Particle-Collision activity and an Answer-and-Question session were beneficial to the Learners because I noted, at the end of the program, several students were of the view of taking up their career in Fundamental and Applied Physics. Overall, the program was a success even though something could still be done in introducing the Learners to Fundamental and Applied Physics as suggested here-under:

Weaknesses

- **Sorting-particle-cards activity:** I felt that we never guided the students how the particle cards were to be sorted as if students had prior knowledge of particles in the Standard Model of Physics. Hence, it was very difficult for students to exactly know what they were doing. I am, therefore, of the view that we adopt Guided Learning but still Learner-Centered approach, where Lecturers give some guidelines to students on how the particle cards should be sorted. For example, sorting cards according to particles and their corresponding anti-particles, mass, charge, force mediators, etc., Sharp as students were, they would find this activity even more satisfying with some guidelines, which may also be written on a card as a guiding-question card.
- **Question-and-answer session:** Questions from the Learners on this day seemed to be heavily biased to Cosmology. Perhaps we must find a way of also capturing interest of the Learners to ask questions about other fields such as nuclear and particle physics, energy, climate, etc. One way could be again through Guided Learning where Learners in groups are guided to prepare say a question from each branch of Fundamental Physics. What surprised me even more was the fact that Learners never asked any question from Particle-Cards, which was the first activity. The reason could be either Learners were confused, or everything was crystal clear.

Strengths

- **Sorting particle cards activity:** Particles and their properties such as mass, charge, etc., were nicely presented on cards. This was great to bring physics knowledge on play cards, which also reminded Learners that they could also learn Physics in a special way via cards enabling them to learn fast and ending a notion that Physics is a very difficult subject.
- **Particle-collision activity:** the demonstration of how particles collide was amazing and lively. Students were highly focused and eager to learn what will follow next. Such demonstration and the follow up undoubtedly remained in the Learners minds such that by the time they would take up fields such as high energy particle physics, I presume, they would still be able to remember and visualize what really happens during particle collisions and how to extract related physics observables.
- **Conclusion of the Learners' session:** The conclusion was amazing in that the Learners were given some few minutes to ask questions to Lecturers after the session had ended. This I feel gave a chance even to shy Learners to make a follow up with their Lecturers. I saw after the session had ended, many Learners quickly sat with some Lecturers and asked several questions of their interest, which they were unable to ask during the normal session.

Anecdotes or observed outcomes

- Learners were highly motivated, and I heard some say, they would take up a physics career.
- Doubts Learners had about our Universe were cleared through the question-and-answer session, I presume.
- Learners came to understand that an atom is not the smallest particle or fundamental particle through the introduction of the Standard model of elementary particles that they learnt during the sorting-particle-card activity.

Suggestions for the future of the ASP Learner Programs

- Introduce the program in many schools and undergraduate universities globally. This could be achieved through sensitization during international conferences and workshops as was done during the ASP 2022.
- If resources allow, such particle cards could be given as gifts to schools and university libraries where Learners could access them to enhance their knowledge of Fundamental and Applied Physics.