Participant science voice development was evaluated using:
- social network analysis of a secure online forum.
- written responses to prompts in digital and paper notebooks.
- verbal responses to prompts on Flipgrid.
- participant created astronomical images.
- research project presentations outside the classroom.
- badges earned by completing Skynet explorations.
- semistructured interviews.

### Modified Proposal: Three Dimensions and Related Manifestations

Participants demonstrated creativity and unique cultural expressiveness as they created and shared personally meaningful astronomical images.

**Interviewer:** “Tell me about your experience with our after-school astronomy program.”

**Quin:** “It was fun. When I first came and I wasn’t sure though but I stayed. We have to learn about a lot of things like Messier 1 and how the Crab Nebula looks. It’s cool and fun.”

**Aran:** “Everything. I’m learning a lot like I never knew, like it takes light years, I didn’t even know what light years were.”

**Flipgrid Prompt:** “Tell me about the first picture you took.” **Vivian:** “The first picture I took was a nebula. It kind of looked like teeth. I used the clear filter and the telescope I used Yerkes 41.”

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<table>
<thead>
<tr>
<th>Activity</th>
<th>Student</th>
</tr>
</thead>
</table>
|                       | Vivian  | X X X X X  
|                       | Jay     | X X X X  
|                       | Don     | X X X  
|                       | Quin    | X  
|                       | Aran    | X X  

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**Implications**

- Social justice implications of science voice research:
  - reduce alienation students may feel towards science.
  - increase agency in science.
  - empower students to cross science cultural borders.
  - Encourage students to become producers of knowledge instead of just consumers.

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**Badges earned by participants in our pilot study.**