INSTITUTE for SCIENTIST & ENGINEER EDUCATORS

# Analog to Digital Vignette

Institute for Scientist and Engineer Educators (ISEE)

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This paper was written and produced by the developers of the Professional Development Program (PDP) at the Institute for Scientist & Engineer Educators (ISEE) at University of California, Santa Cruz. The PDP was a flexible, multi-year program which trained participants to teach STEM effectively and inclusively at the post-secondary level. Participants were primarily graduate students and postdocs pursuing a broad range of science and engineering careers. Participants received training through two in-person multi-day workshops, worked on a team to collaboratively design an authentic, inclusive STEM learning experience (an "inquiry" lab), and then put their new teaching skills into practice in programs or courses, mostly at the college level. Throughout their experience, PDP participants used an array of online tools and received coaching and feedback from PDP instructors. The overall PDP experience was approximately 90 hours and was framed around three major themes: inquiry, assessment, and equity & inclusion. Leadership emerged as a fourth theme to support PDP teams, which were each led by a participant returning to the PDP for a second or third time, who gained training and a practical experience in team leadership. ISEE ran the PDP from 2001-2020, and there are more than 600 alumni.

## CONTEXT FOR THIS PAPER WITHIN THE PDP

The Analog-to-Digital Vignette was used in the PDP to prepare participants for "facilitating" the inquiry activity that they designed. The term facilitation was used in the PDP for the small, in-the-moment moves an instructor makes to accomplish specific goals. This vignette was read by participants and then discussed in a workshop setting, prior to their teaching. The vignette, and the characters within it are fictional.

The PDP was a national program led by the UC Santa Cruz Institute for Scientist & Engineer Educators. The PDP was originally developed by the Center for Adaptive Optics with funding from the National Science Foundation (NSF) (PI: J. Nelson: AST#9876783), and was further developed with funding from the NSF (PI: L. Hunter: AST#0836053, DUE#0816754, DUE#1226140, AST#1347767, AST#1643390, AST#1743117) and University of California, Santa Cruz through funding to ISEE.

## Analog-to-Digital Facilitation Vignette

A group of 3 students has just started their focused investigation in the "Analog to Digital" activity. The group is being facilitated by Tyler. They are investigating a particular scene of interest, trying to determine the pixel size and number of grey scales they need to minimally resolve particular characteristics of their scene.

Tyler is simultaneously facilitating another group, so after interacting with the other team and running a simulation of pixel size and grey scales on the computer for the other team, Tyler heads over to the team consisting of Malia to the left, Carissa in the middle, and Jeremy on the right, as Tyler is facing them. They are seated at a large round table all next to each other in a row.

Tyler sits down on the opposite side of the round table that can seat up to 10 people, positioning directly across from the entire team.

Tyler: "Hey team, how is the investigation coming?"

Tyler looks at each team member while addressing them.

Malia: "Good, good, we think we have three different goals to investigate."

As Tyler looks at each team member, Tyler says, "Great, do you mind explaining them to me?"

Malia hesitates a moment, then answers, "Sure. The first goal is to…" and explains each goal in turn. Tyler is looking at Malia but also at Carissa and Jeremy as Malia explains the goals. They are nodding their heads and glancing between Tyler and Malia.

Malia then explains that they have a guess for the minimal requirements necessary to resolve their first goal. Malia tells Tyler the pixel size and number of grey scales they would like to run their image with as a first guess.

Tyler looks at Carissa and Jeremy and asks, "Can you tell me how you chose that pixel size and number of grey scales?"

After a quick glance at Malia, Carissa responds. Carissa explains why they think they have chosen the appropriate specifications. Tyler takes their specifications and goes to run the computer simulation for them.

After the simulation has run and the group has looked it over and found it has not been successful in differentiating the objects they had hoped it would, they have time as a group to decide on a new set of specifications to run.

Tyler revisits the group. Tyler sits 2 seats closer to Malia, not next to Malia, but now sitting directly across from Jeremy.

"So, now that you've seen how your solution came out, what do you think about your next iteration?" Tyler asks, looking mainly at Jeremy, but also sweeping over to Carissa and Malia.

Malia responds by telling Tyler about the group's assessment about why their initial guess at minimal specifications did not resolve the object of interest. Carissa chimes in occasionally, and finishes the conversation by stating their new specifications for the next iteration.

Tyler asks Jeremy, "Do you agree with the reasons that the first design failed and with the new specifications?"

Jeremy responds, "Yeah, I think that might be able to get what we're looking for."

Tyler leaves the table and runs the new specifications for the group. Again, the solution fails to resolve the object of interest.

After giving the group some time to think about the new iteration, Tyler returns, time sitting next to Malia. Tyler leans in to the group, slightly physically blocking Malia, and addresses Jeremy and Carissa. “What do you think about this second iteration?”

Carissa responds with a knowing smile and says, “We thought the increase in grey scales would help us see the objects, but it just got more confusing with the background colors.”

Malia pulls the computer they have all been sharing and positions it to show Tyler. Malia points to the computer screen to show areas where the background in the image has confused the foreground objects of interest. Carissa chimes in and emphasizes that they have thought about how to use pixel size more and maybe need to bring the number of grey scales down to their original guess to make things less confusing with the background. While Carissa is explaining their reasoning to Tyler, Jeremy pulls out a phone and checks it momentarily.

Tyler takes the team’s third iteration specifications back to the computer and re-runs the simulation and gives the team their results. Tyler again gives the team time to review their solution, more successful than the last, and heads back. Tyler returns to the team and sits right next to Jeremy. Jeremy puts away the phone and looks at Tyler.

Tyler asks Jeremy, “So, how do you feel about these latest results?”

Jeremy responds, “We see that we can now resolve the objects of interest with this pixel size. The grey scale is set to just black and white, which helps distinguish these particular characteristics from the messy background. I guess the last thing to do is test if this is a minimal solution by upping the pixel size and see if we can still distinguish our objects of interest.”

Tyler tells Jeremy, “That sounds reasonable.” Tyler looks at Carissa and Malia. “What do you think of that idea?” They both nod in agreement and express being on board with that. Carissa turns their screen to Jeremy, and Jeremy tells Tyler the next specifications they had come up with and written down on their computer screen.

For the final interaction with the team, Tyler comes back and sits directly across from the team, as Tyler did during the very first visit to the table. Tyler looks at all three and asks what they think of their final results.

Malia says, “I think it looks good.” Carissa nods in agreement along with Jeremy, but both Carissa and Malia look at Jeremy.

Jeremy adds to Tyler, “It shows our previous specifications were most likely minimal because now we cannot resolve every object.”