Appendix 3: Development and Implementation of Aspects of the Engage PD program

Discussions during the PD meetings revolved around the philosophy and implementation of the Engage PD aspects in the classroom. The discussion around “how people learn,” involved encouraging GTAs to consider students’ prior knowledge and experiences as important ingredients for reconstruction of knowledge, and help students draw relationships between what they are learning and what they already know (e.g., students write down what they know about a new concept at the beginning of the class). Emphasis was also placed on the need to engage students in learning in ways that will make their thinking processes visible for constructing new knowledge (e.g., designing a procedure for experiment and engaging in critical thinking questions) (Bransford et al., 2000).

For “subject-matter knowledge and lesson goals”, discussions for each PD meeting were tailored on big questions for each laboratory investigation and important knowledge and skills students should demonstrate by the end of each interdisciplinary experiment. The interdisciplinary learning community also served as a platform for the TAs to share ideas and learn from each other, instead of merely absorbing the information from the facilitators. This was, particularly important as TAs explained principles in their disciplines and examples of how they can address anticipated challenges in teaching the intervention experiments. For example, the chemistry TAs learned the biology principles from the biology TAs and vice versa. The learning community was also important in discussing the interdependence of the two disciplines and the relevance of the content to students’ daily lives and/or real-world.

In addition to reviewing materials and discussing levels of inquiry approaches to instruction (Lederman, 1999; Buck et al., 2008), TAs were encouraged to provide students with opportunities to: 1) design procedures for the experiments as needed; 2) probe students to make sense of their observations and data; and 3) draw conclusions based on their observations, with minimal assistance. Discussions on “questioning techniques” focused on the importance of formulating guiding prompts prior to the lesson, and examples of general questions that promote critical thinking. TAs were encouraged to move beyond the “what” questions soliciting recall and comprehension to the “how”, “why”, or “what” questions that solicit critical thinking. Central to this discussion was brainstorming ideas on the amount of time adequate for students to think through the questions before answering them or interrupting their thinking (i.e., wait time 1) (Rowe, 1986; Atwood & Wilen, 1991; Stahl, 1994; Brooks & Brooks, 1999). Although Rowe recommended at least 3 s for questions that are less demanding and at least 7 s for cognitively demanding questions or tasks, the TAs were encouraged to allow at least 10 s for wait time 1. This was to give students adequate enough time to process the information as they also adjusted their role from passive listeners to active participants.

For “lesson closure,” PD facilitators engaged TAs in a discussion about the benefits of wrapping the lesson to both the students and the instructors. Discussed benefits included identifying and addressing lingering student misconceptions; tying together the key concepts of the lesson to help students organize meaningful information; helping students reflect on, and compare and contrast their ideas against those of their peers from other groups; and assessing if the lesson objectives have been achieved (Webster et al., 2009; Nilson, 2010). TAs were encouraged to implement whole-class lesson closures by bringing the groups together and facilitating the discussion around the intended lesson goals.

TAs were also exposed to various types of formative Classroom Assessment Techniques (CATs) to actively engage students and monitor their progress in the learning. Additionally, the facilitators focused the discussion on when and how to implement them. Examples of CATs
discussed included 1) focused listing: assesses prior knowledge and identifying misconceptions; 2) punctuated pre-lab lectures: promotes self-reflection by identifying boosters for, and hindrances in learning; 3) muddiest point: identifying confusing concepts 4) one-minute paper: summarizing the most useful points and unanswered questions; and 4) application cards: drawing connections between the learned material and real-world applications (Angelo & Cross, 1988; Nilson, 2010).

References


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