# Supplemental Material

Hood *et al.*

Supplementary Table 1. Demographic characteristics of each of the 5 classes sampled.

**Class 1 (n = 79)**

| Identified Gender | Male % (n) | 31.6% (25) |
|---|---|---|
| | Female % (n) | 68.4% (54) |
| | Prefer not to answer % (n) | 0% (0) |
| | Missing % (n) | 0% (0) |

| Ethnicity | White % (n) | 58.2% (46) |
|---|---|---|
| | Black % (n) | 2.5% (2) |
| | Native or Alaskan Native % (n) | 2.5% (2) |
| | Asian % (n) | 7.6% (6) |
| | Native Hawaiian/Pacific Islander % (n) | 2.5% (2) |
| | Other % (n) | 26.6% (21) |
| | Prefer not to answer % (n) | 0% (0) |
| | Missing % (n) | 0% (0) |

| First generation status | Yes | 41.8% (33) |
|---|---|---|
| | No | 55.7% (44) |
| | Unsure | 2.5% (2) |
| | Prefer not to answer | 0% (0) |
| | Missing % (n) | 0% (0) |

**Class 2 (n = 65)**

| | | |
|---|---|---|
| **Identified Gender** | Male % (n) | 10.8% (7) |
| | Female % (n) | 81.5% (53) |
| | Prefer not to answer % (n) | 0% (0) |
| | Missing % (n) | 7.7% (5) |
| **Ethnicity** | White % (n) | 64.4% (42) |
| | Black % (n) | 0% (0) |
| | Native or Alaskan Native % (n) | 0% (0) |
| | Asian % (n) | 15.4% (10) |
| | Native Hawaiian/Pacific Islander % (n) | 1.5% (1) |
| | Other % (n) | 10.8% (7) |
| | Prefer not to answer % (n) | 0% (0) |
| | Missing % (n) | 0% (0) |
| **First generation status** | Yes | 35.4% (23) |
| | No | 53.8% (35) |
| | Unsure | 1.5% (1) |
| | Prefer not to answer | 1.5% (1) |
| | Missing % (n) | 0% (0) |

**Class 3 (n = 29)**

| | | |
|---|---|---:|
| **Identified Gender** | Male % (n) | 6.9% (2) |
| | Female % (n) | 93.1% (27) |
| | Prefer not to answer % (n) | 0% (0) |
| | Missing % (n) | 0% (0) |
| **Ethnicity** | White % (n) | 75.9% (22) |
| | Black % (n) | 15% (2) |
| | Native or Alaskan Native % (n) | 0% (0) |
| | Asian % (n) | 13.8% (4) |
| | Native Hawaiian/Pacific Islander % (n) | 0% (0) |
| | Other % (n) | 0% (0) |
| | Prefer not to answer % (n) | 3.4% (1) |
| | Missing % (n) | 0% (0) |
| **First generation status** | Yes | 51.7% (15) |
| | No | 48.3% (14) |
| | Unsure | 0% (0) |
| | Prefer not to answer | 0% (0) |
| | Missing % (n) | 0% (0) |

**Class 4 (n = 20)**

| Identified Gender | Male % (n) | 20% (4) |
|---|---|---|
| | Female % (n) | 75% (15) |
| | Prefer not to answer % (n) | % (0) |
| | Missing % (n) | % (1) |

| Ethnicity | White % (n) | 70% (14) |
|---|---|---|
| | Black % (n) | 15% (3) |
| | Native or Alaskan Native % (n) | 5% (1) |
| | Asian % (n) | 5% (1) |
| | Native Hawaiian/Pacific Islander % (n) | 0% (0) |
| | Other % (n) | 0% (0) |
| | Prefer not to answer % (n) | 0% (0) |
| | Missing % (n) | 0% (0) |

| First generation status | Yes | 25% (5) |
|---|---|---|
| | No | 65% (13) |
| | Unsure | 5% (1) |
| | Prefer not to answer | 0% (0) |
| | Missing % (n) | 5% (1) |

**Class 5 (n = 34)**

| Identified Gender | | |
|---|---|---|
| | Male % (n) | 20.6% (7) |
| | Female % (n) | 76.5% (26) |
| | Prefer not to answer % (n) | 2.9% (1) |
| | Missing % (n) | 0% (0) |

| Ethnicity | | |
|---|---|---|
| | White % (n) | 44.1% (15) |
| | Black % (n) | 2.9% (1) |
| | Native or Alaskan Native % (n) | 0% (0) |
| | Asian % (n) | 0% (0) |
| | Native Hawaiian/Pacific Islander % (n) | 0% (0) |
| | Other % (n) | 50% (17) |
| | Prefer not to answer % (n) | 2.9% (1) |
| | Missing % (n) | 0% (0) |

| First generation status | | |
|---|---|---|
| | Yes | 0% (0) |
| | No | 0% (0) |
| | Unsure | 0% (0) |
| | Prefer not to answer | 0% (0) |
| | Missing % (n) | 100% (34) |

Supplementary Table 2. Types and characteristics of EBIPs implemented per class.

| | EBIPs implemented | Features of implementation |
|---|---|---|
| Class 1 | Muddiest point reflection; in-class quiz group; personal response system | Students completed muddiest point reflection in four separate classes; each reflection was followed up in the next class with a timed quiz on muddiest points, which was first completed alone and then a second time in a group; no points were awarded for participation or accuracy. |
| Class 2 | Think-pair-share; personal response system | Students used personal response system to answer timed conceptual question (1 min); after short lecture, students then discussed the same conceptual question with a partner (3–5 min), and then used response system to register answer (1 min). One think-pair-share opportunity occurred per lecture across the semester for a total of 24 opportunities. Points were given for participation, not accuracy. Instructor subsequently presented correct answer and guided discussion on answer logic. |
| Class 3 | In-class quiz group; personal response system | On five separate occasions across the semester, students answered timed multiple choice questions individually (3 min), then discussed the same questions in groups and submitted the group's answers upon reaching consensus (5 min). Points were awarded according to the accuracy of individual and group answers.<br>One section of the course submitted group answers on paper and did not receive feedback on how other groups answered; a second section submitted answers using a personal response system and saw a histogram of how other groups responded. Instructor subsequently provided feedback on answers for each group. |
| Class 4 | In-class quiz group; personal response system | On five separate occasions across the semester, students answered timed multiple choice questions individually (3 min), then discussed the same questions in groups and submitted the group's answers upon reaching consensus (5 min). Points were awarded according to the accuracy of individual and group answers.<br>One section of the course submitted group answers on paper and did not receive feedback on how other groups answered; a second section submitted answers using a personal response system and received feedback on how other groups responded. Instructor subsequently provided feedback on answers for each group. |
| Class 5 | Group work | Students were assigned to work in small groups (membership was assigned, not chosen by student) throughout the semester. Groups completed assignments and case studies across time; however, groups had discretion over how frequently they would meet to complete their work. Students completed weekly reflections on their group work experiences for which they received 5% of their final course grade. |

Supplementary Table 3. Demographic characteristics of participants excluded from main sample due to incomplete questionnaires at start of term (N = 57).

| Identified Gender | Male % (n) | 1.8% (1) |
|---|---|---|
| | Female % (n) | 52.6% (30) |
| | Prefer not to answer % (n) | 3.5% (2) |
| | Missing % (n) | 42.1% (24) |
| **Ethnicity** | White % (n) | 36.8% (21) |
| | Black % (n) | 0% (0) |
| | Native or Alaskan Native % (n) | 0% (0) |
| | Asian % (n) | 0% (0) |
| | Native Hawaiian/Pacific Islander % (n) | 1.8% (1) |
| | Other % (n) | 28.1% (16) |
| | Prefer not to answer % (n) | 5.3% (3) |
| | Missing % (n) | 28.1% (16) |
| **First generation status** | Yes | 3.5% (2) |
| | No | 3.5% (2) |
| | Unsure | 0% (0) |
| | Prefer not to answer | 0% (0) |
| | Missing % (n) | 93% (50) |

Supplementary Table 4. Mean ratings of instructional practices for amount of anxiety caused at the start of term, shown by class.

| Practice | Class 1 mean ± std (n) | Class 2 mean ± std (n) | Class 3 mean ± std (n) | Class 4 mean ± std (n) | Class 5 mean ± std (n) |
|---|---|---|---|---|---|
| Lecturing | 1.77 ± 1.03 (79) | 1.44 ± 0.83[a] (64) | 1.48 ± 0.79 (29) | 1.40 ± 0.60 (20) | 2.32 ± 1.32[a] (34) |
| PRS alone | 1.86 ± 1.11 (79) | 2.25 ± 1.12 (65) | 1.86 ± 1.13 (29) | 1.80 ± 1.06 (20) | 2.38 ± 1.30 (34) |
| PRS pair | 2.22 ± 1.13 (79) | 2.35 ± 1.10 (65) | 1.93 ± 0.92 (29) | 1.70 ± 0.73 (20) | 2.44 ± 1.16 (34) |
| volunteer | 2.89 ± 1.19 (79) | 3.30 ± 1.15 (64) | 3.17 ± 1.28 (29) | 3.00 ± 1.26 (20) | 3.47 ± 1.19 (34) |
| cold call | 3.70 ± 1.32 (77) | 4.05 ± 1.13 (61) | 4.52 ± 0.80 (27) | 3.85 ±1.31 (20) | 4.09 ± 1.15 (32) |
| muddiest point | 2.10 ± 1.22 (78) | - | - | - | 2.75 ± 1.19 (32) |
| in-class quiz alone | 2.26 ± 1.10 (78) | 2.32 ± 1.03 (65) | 2.48 ± 1.12 (29) | 2.10 ± 1.07 (20) | 2.47 ± 1.48 (34) |
| in-class quiz group | 2.43 ± 1.23 (77) | 2.20 ± 1.19 (65) | 2.24 ± 0.99 (29) | 1.85 ± 0.99 (20) | 2.45 ± 1.42 (33) |
| quiz out of class | 1.74 ± 0.97 (76) | - | - | - | - |
| Non-graded group activity | 2.03 ± 1.22 (78) | - | - | - | - |
| Non-graded alone activity | 1.56 ± 0.86 (78) | - | - | - | - |
| think-pair-share | - | 2.03 ± 1.03 (65) | - | - | - |

Superscripted letter indicates significantly different pairwise comparison, p < 0.0001

Supplementary Table 5. Mean ratings of how much each instructional practice contributes to learning at the start of term, shown by class.

| Practice | Class 1 mean ± std (n) | Class 2 mean ± std (n) | Class 3 mean ± std (n) | Class 4 mean ± std (n) | Class 5 mean ± std (n) |
|---|---|---|---|---|---|
| Lecturing | 4.00 ± 0.97 (78) | 3.98 ± 1.26 (65) | 4.07 ± 1.07 (29) | 3.80 ± 1.11 (20) | 3.85 ± 1.26 (34) |
| PRS alone | 3.01 ± 1.16 (78) | 3.18 ± 1.10 (65) | 2.59 ± 1.09 (29) | 3.10 ± 0.85 (20) | 3.53 ± 1.24 (34) |
| PRS pair | 3.01 ± 1.23 (78) | 3.65 ± 1.18 (65) | 3.21 ± 1.01 (29) | 3.00 ± 1.08 (20) | 3.62 ± 1.37 (34) |
| volunteer | 2.88 ± 1.25 (78) | 3.03 ± 1.17 (65) | 2.76 ± 1.24 (29) | 3.05 ± 1.28 (20) | 3.00 ± 1.30 (34) |
| cold call | 2.33 ± 1.33 (78) | 2.48 ± 1.16 (64) | 2.03 ± 1.30 (29) | 2.70 ± 1.49 (20) | 2.88 ± 1.37 (34) |
| muddiest point | 3.34 ± 1.05 (77) | - | - | - | 2.81 ± 1.12 (32) |
| in-class quiz alone | 3.49 ± 0.99 (78) | 3.41 ± 1.22 (64) | 2.93 ± 1.00 (29) | 3.05 ± 1.10 (20) | 3.56 ± 1.21 (34) |
| in-class quiz group | 3.34 ± 1.14 (77) | 3.64 ± 1.19 (64) | 3.28 ± 1.03 (29) | 3.05 ± 1.10 (20) | 3.62 ± 1.33 (34) |
| quiz out of class | 3.73 ± 1.14 (78) | - | - | - | - |
| nongraded group activity | 3.05 ± 1.23 (77) | - | - | - | - |
| nongraded alone activity | 3.38 ± 1.35 (78) | - | - | - | - |
| think-pair-share | - | 3.97 ± 1.15 (65) | - | - | - |

Supplementary Table 6. Anticipated final grade (reported at the beginning of term) and received final grades (%) by class.

| Performance measure | Class 1 (n = 73) | Class 2 (n = 55) | Class 3 (n = 28) | Class 4 | Class 5 |
|---|---|---|---|---|---|
| Mean anticipated grade ± std* | 2.73 ± 1.47 | 2.20 ± 1.24 | 1.54 ± 0.58 | - | - |
| Mean final grade (%) ± std | 75.28 ± 18.80 | 83.51 ± 13.97 | 78.46 ± 12.58 | | |

*Anticipated grade was assessed through the selection of a letter grade; for the purposes of analysis, each letter grade corresponded to a whole number (A+ = 1; A− = 2; …; E = 12)

Supplementary Table 7. Pairwise comparisons of anxiety ratings of instructional practices at the start and end of term.

| Practice | Start of term<br>Mean anxiety rating<br>mean ± std (n) | End of term<br>Mean anxiety rating<br>mean ± std (n) | t (df) | 95% CI difference in means | Effect size (Cohen's d) |
|---|---|---|---|---|---|
| Lecturing | 1.57 ± 0.92 (134) | 1.47 ± 0.87 (134) | 1.32 (133) | -0.05, 0.26 | 0.11 |
| PRS alone | 1.96 ± 1.09 (135) | 1.79 ± 0.95 (135) | 1.72 (134) | -0.02, 0.35 | 0.15 |
| PRS pair | 2.22 ± 1.08 (134) | 1.95 ± 0.97 (134) | 2.89 (133)* | 0.09, 0.45 | 0.25 |
| volunteer | 3.16 ± 1.20 (131) | 2.89 ± 1.34 (131) | 2.51 (130) | 0.05, 0.48 | 0.22 |
| cold call | 3.99 ± 1.18 (121) | 3.79 ± 1.36 (121) | 1.77 (120) | -0.02, 0.42 | 0.16 |
| muddiest point | 2.13 ± 1.29 (55) | 1.42 ± 0.88 (55) | 4.04 (54)* | 0.36, 1.06 | 0.55 |
| in-class quiz alone | 2.32 ± 1.01 (133) | 1.90 ± 1.04 (133) | 4.49 (132)* | 0.24, 0.61 | 0.39 |
| in-class quiz group | 2.28 ± 1.17 (134) | 1.95 ± 1.08 (134) | 3.04 (133)* | 0.12, 0.54 | 0.26 |
| quiz out of class | 1.64 ± 0.96 (53) | 1.55 ± 0.85 (53) | 0.84 (52) | -0.13, 0.32 | 0.11 |
| nongraded group activity | 2.07 ± 1.27 (54) | 2.07 ± 1.30 (54) | 0.00 (53) | -0.37, 0.37 | 0.00 |
| nongraded alone activity | 1.49 ± 0.79 (55) | 1.31 ± 0.72 (55) | 1.70 (54) | -0.03, 0.40 | 0.23 |
| think-pair-share | 1.98 ± 0.98 (48) | 1.67 ± 1.00 (48) | 1.94 (47) | -0.01, 0.64 | 0.28 |

*indicates significance at p < 0.004 (Bonferroni-corrected alpha for 12 comparisons)

Supplementary Table 8. Pairwise comparisons of learning contribution ratings of instructional practices at the start and end of term.

| Practice | Start of term Mean learning contribution ratings mean ± std (n) | End of term Mean learning contribution ratings mean ± std (n) | t (df) | 95% CI difference in means |
|---|---|---|---|---|
| Lecturing | 4.07 ± 1.07 (135) | 4.11 ± 1.18 (135) | −0.43 (134) | −0.25, 0.16 |
| PRS alone | 3.07 ± 1.14 (135) | 3.13 ± 1.34 (135) | −0.48 (134) | −0.31, 0.19 |
| PRS pair | 3.26 ± 1.20 (134) | 3.60 ± 1.19 (134) | −3.12 (133)* | −0.56, −0.13 |
| volunteer | 2.95 ± 1.19 (133) | 2.89 ± 1.33 (133) | 0.53 (132) | −0.16, 0.28 |
| cold call | 2.41 ± 1.28 (132) | 2.36 ± 1.33 (132) | 0.44 (131) | −0.19, 0.29 |
| muddiest point | 3.37 ± 1.02 (54) | 2.96 ± 1.44 (54) | 1.93 (53) | −0.02, 0.83 |
| in-class quiz alone | 3.50 ± 1.06 (133) | 3.46 ± 1.18 (133) | 0.43 (132) | −0.16, 0.25 |
| in-class quiz group | 3.50 ± 1.17 (133) | 3.59 ± 1.15 (133) | −0.10 (132) | −0.30, 0.11 |
| quiz out of class | | | | |
| nongraded group activity | 3.15 ± 1.30 (54) | 3.02 ± 1.34 (54) | 0.61 (53) | −0.30, 0.56 |
| nongraded alone activity | 3.40 ± 1.42 (55) | 2.98 ± 1.46 (55) | 1.84 (54) | −0.04, 0.87 |
| think-pair-share | 4.15 ± 0.99 (48) | 4.42 ± 1.18 (48) | −1.57 (47) | −0.62, 0.08 |

*indicates significance at $p < 0.004$ (Bonferroni-corrected alpha for 12 comparisons)

**Student questionnaire**
1. With which gender(s) do you identify?
   - Answer options: male; female; transgendered man; transgendered woman; queer; nonbinary; other; prefer not to say
2. Please indicate your ethnicity (i.e. peoples' ethnicity describes their feeling of belonging and attachment to a distinct group of a larger population that shares their ancestry, colour, language or religion)
   - Answer options: White; Black or African American; American Indian or Alaska Native; Asian; Native Hawaiian or Pacific Islander; other; prefer not to say
3. What grade do you expect to get in this class?
4. What is your estimated overall academic average?
5. Are you a first generation college student?
6. Evaluate the following classroom activities based on how much anxiety they cause you to feel.   (authors' note: questions with an asterisk were included only if an instructor had made use of this practice)

| Question | 1 No anxiety | 2 | 3 | 4 | 5 Extreme anxiety | Prefer not to answer |
|---|---|---|---|---|---|---|
| Listening/watching the instructor deliver a powerpoint lecture | | | | | | |
| Working alone to answer an anonymous student response system (clicker) question | | | | | | |
| Working with another student to answer an anonymous student response system (clicker) question | | | | | | |
| Volunteering to answer a question posed by the instructor | | | | | | |
| Being asked a question by the instructor without volunteering (cold calling) | | | | | | |
| Completing a quiz alone that counts for less than 5% of the class mark | | | | | | |
| Completing a group quiz that counts for less than 5% of the class mark | | | | | | |
| *Think-pair-share | | | | | | |
| *Muddiest point assignments | | | | | | |
| *Working in a small group to complete an assignment that is not submitted for marks | | | | | | |
| *Working alone to complete an assignment | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| that is not submitted for marks | | | | | | |
| *Quiz out of class | | | | | | |

7. Evaluate the following classroom activities in terms of how much they contribute to your learning.
   (note: questions with an asterisk were included only if an instructor had made use of this practice)

| Question | 1 Very little | 2 | 3 | 4 | 5 Signifi-cantly | Prefer not to answer |
|---|---|---|---|---|---|---|
| Listening/watching the instructor deliver a powerpoint lecture | | | | | | |
| Working alone to answer an anonymous student response system (clicker) question | | | | | | |
| Working with another student to answer an anonymous student response system (clicker) question | | | | | | |
| Volunteering to answer a question posed by the instructor | | | | | | |
| Being asked a question by the instructor without volunteering (cold calling) | | | | | | |
| Completing a quiz alone that counts for less than 5% of the class mark | | | | | | |
| Completing a group quiz that counts for less than 5% of the class mark | | | | | | |
| *Think-pair-share | | | | | | |
| *Muddiest point assignments | | | | | | |
| *Working in a small group to complete an assignment that is not submitted for marks | | | | | | |
| *Working alone to complete an assignment that is not submitted for marks | | | | | | |
| *Quiz out of class | | | | | | |