

Supplemental Material

CBE—Life Sciences Education

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Supplementary Material

This supplemental section provides information about the performances of the participants who did not meet the learning criterion for the concept-building task (criterion was final training block MAE < 10): their final training block mean absolute error (MAE) was greater than or equal to 10. Accordingly, these 88 participants were not included in the key data analyses of the paper. For brevity of exposition we term these participants *nonlearners*.

Figure S1 displays the mean predictions of the nonlearners and the learners on the final training block of the concept-building task. Inspection of this figure shows that the nonlearners' final training block predictions varied little across the input values, resulting in a flat prediction curve that deviated substantially from the inverted-V target function. This pattern verifies their incomplete (or poor) learning on the concept-building task. By contrast, it can be seen that the learners' predictions generally followed the output values generated from that target function. Performance markers presented in the main paper suggest that the nonlearners generally displayed low effort on the concept-building task, likely contributing to their failure to reach the learning criterion.

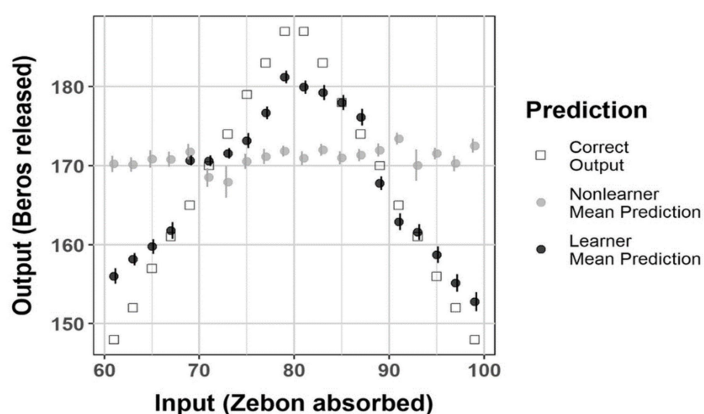


Figure S1. Mean learner predictions and nonlearner predictions for the final training block. Error bars represent the standard error of the means.

Figure S2 shows the nonlearners' exam performances, as well as exam performances for students classified as exemplar and abstraction learners (based on their transfer performances on the concept-building task). As is apparent from the figure, the nonlearners' performances were comparable to those of the exemplar and abstraction learners on retention items (except for exam 1, where nonlearners performed less well) and to the exemplar learners on transfer items.

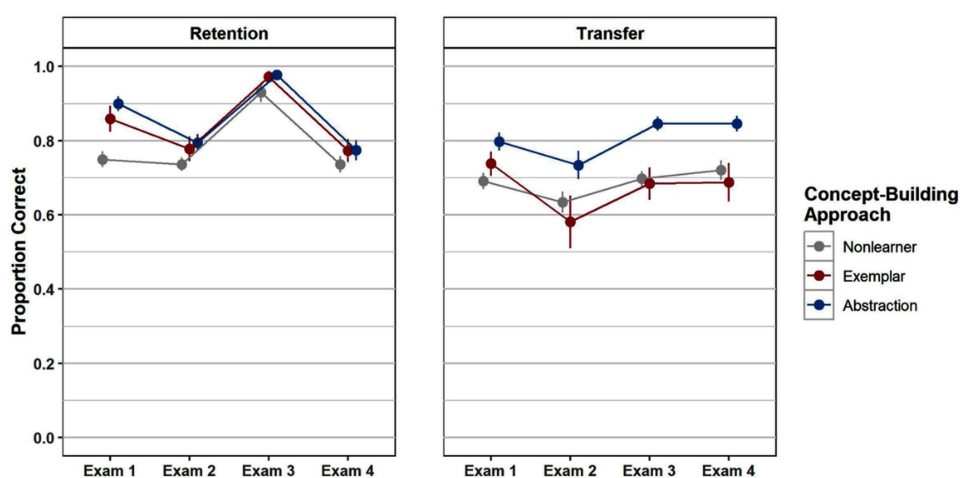


Figure S2. Transfer and retention performance as a function of exam and concept-building approach. Points represent the descriptive mean of proportion correct for the given level concept-building approach, exam, and question type. Plotted are the 83 nonlearners, 21 exemplar learners, and 44 abstraction learners with complete exam and ACT data. Points are offset horizontally to avoid overlapping between nonlearner, exemplar, and abstraction points for a given exam. Error bars represent standard error of the means.