Preparing for Academic Exams:
Deep Better than Shallow Processing

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Background and Predictions:

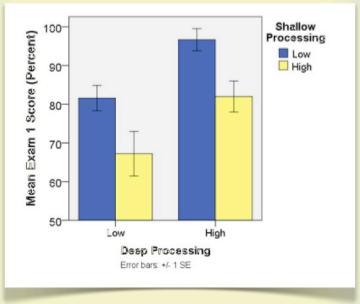
Is the study approach that students tend to use associated with exam performance in the course in which they are currently enrolled?

Students' use of certain types of study approaches have been demonstrated to promote learning, retention, and transfer of learning in academic settings. Many students, however, are unaware that some study approaches produce better learning outcomes than others. We identified a number of study behaviors that should be associated with positive learning outcomes.

We predicted that one study approach (*shallow processing*: e.g. , rereading, highlighting, massed practice) should be associated with poorer learning and, hence, with poorer exam performance. We also predicted that another study approach (*deep processing*: e.g. , self-testing, generation, distributed practice) should be associated with better learning and, hence, with better exam performance.

Method:

Fifty-four students enrolled in an introductory statistics course completed their first in-class exam. After receiving exam feedback, students completed an inventory that tapped the deep and shallow approaches to study.



Results:

Exam scores were positively (r = .21, p = .07) and negatively (r = -.16, p = .12) correlated with deep and shallow processing, respectively. Because deep and shallow processing ratings were positively and moderately correlated (r = .60, p = .001), we also calculated two partial correlation coefficients. Controlling for shallow processing, the correlation between exam scores and deep processing was .38 (p = .002); controlling for deep processing, the correlation between exam scores and shallow processing was -.36 (p = .004).

We created high and low groups for each measure by selecting students who scored in the upper and bottom third of the distributions on the deep and shallow measures. As predicted, the mean exam scores for the high deep/low shallow and high shallow/low deep were the highest (M = 96.67) and lowest (M = 67.20) of the four groups, respectively.

Conclusions:

Results in this study were in full agreement with the predictions.

- Students who reported higher use of deep processing while preparing for the exam performed better than students who reported lower use of deep processing.

- Most important, students who reported high use of deep processing and low use of shallow processing during preparation for the exam performed especially well. In contrast, students who reported low use of deep processing and high use of shallow processing during preparation for the exam performed especially poorly.

- We found the same pattern of results in a replication study in an introductory psychology course as well as replication studies in molecular and cellular biology, evolutionary biology and ecology, and chemistry for engineers courses.

Let's discuss the implications of this study for educational practice.

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Study Behaviors: Deep Versus Shallow

Spacing of study

Students are likely to report a preference for *massed* practice, for example cramming, over spaced practice involving spreading studying episodes over time. An illusion of effective learning can occur through massed exposure to study materials, especially just prior to an examination, when memory of the studied material is fresh and when performance is likely to be high. Massed study involves shallow processing, as measured by the inferior benefit of long-term retention of material. In contrast, spacing study events over time improves learning and long-term retention of meaningful material. Spaced practice involves deep processing.

Testing

Testing can be instrumental in the learning process itself. The "testing effect" refers to teacher administered or student self-testing throughout learning, resulting in improved performance on final tests, compared to study alone or rereading the material. Testing during learning promotes deep processing.

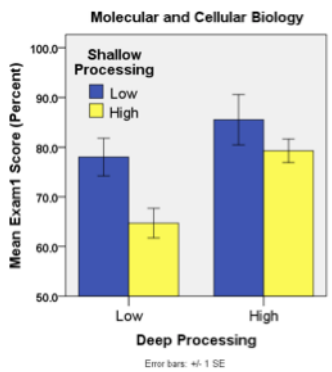
Generation (Self Explanation / Elaboration / Explain Concepts to Others)

Learning is enhanced when people generate answers to questions rather than reading or being told the answers. Generative study promotes deep processing. In contrast, asking a classmate or teacher to help understanding promotes shallow processing.

Prior Knowledge

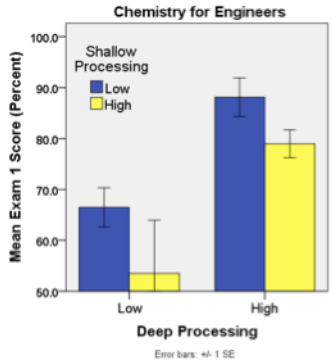
Prior knowledge in a domain has been associated with better learning, including learning of complex scientific material and material in an introductory psychology course. Relating prior knowledge to course material promotes deep processing.

Additional Study Results



The figures to the left and the right represent mean exam performance in molecular and cellular biology and chemistry for engineers courses respectively.

Note that the pattern of results was the same as for the introductory statistics courses. Refer to poster on



Suggested Readings

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