Developing Technical Vocabulary: A study in intermediate undergraduate mathematics courses

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Research indicates that math is the most difficult content area material to read, with more concepts per word, per sentence, and per paragraph than any other area. V. Schell (1982)

Why focus on vocabulary in a mathematics course?

- **Access:** Being able to participate in learning and doing mathematics requires being able to read and speak math.

- **Professional Preparation:** Learning to *talk the talk*—even appreciating its importance—is part of preparing to be a professional in any field.

I don't understand...

He can seem like he's explaining linear algebra in a foreign language because of how quickly he is to normalize math terms.

Spend more time on the vocabulary of it all and how it is all connected. The numbers part of this course is not hard, but the word games are tough.

I wish there was more numbers in the concepts. I enjoy math but this class has been so challenging with keeping up with the different concepts. The textbook also confused me how they worded the homework problems that were chosen.

Sometimes he would use very in-depth mathematical language which would confuse me sometimes. It may just be that I don't know enough of the English language however.

Glossary Journal Project

A little context:
KSU is a large, comprehensive university in suburban Atlanta. We serve roughly 43,000 (39,000 undergraduates) students in some 180+ degree programs. Enrollment is guaranteed to all students who qualify, so we serve a diverse student body, including racial, gender, age, military status, and socio-economic factors.

The courses involved in this study are

- Discrete Mathematics (MATH 2345): *(prereq = Precalculus)*
  Serves students in Computer Science, Computer Engineering, Information Technology, Computer Game Design & Development

- Linear Algebra I (MATH 3260): *(prereq = Calculus I)*
  Serves students in Computer Science, Electrical Engineering, Math, Math ED, Computer Game Design & Development, and other select Engineering (Software, Mechanical)

Glossary Journal Project

The assignment is a semester long project with various features.

- Each entry includes three parts: (1) A formal definition, (2) an informal (in the student's own words) definition, and (3) some illustrative aid.

- Students choose the terms and phrases to include in their glossary journal, and they decide on the format (Word and Power Point were most popular).

- Drafts are submitted regularly with each draft worth some portion of the overall project grade.

- The project is weigthed similarly to an exam (e.g., 15% of the total course grade).

Surveys

A quasi-experimental design was used with two sections having the project required and two sections in which it was only loosely recommended. Pre- and post-surveys were conducted to try to determine whether the project impacted

- students beliefs about technical vocabulary,

- behaviors related to learning technical vocabulary,

- and sense of mathematical self-efficacy.

Other data collected included demographic information, level of English fluency/comfort, grade predictions, and free response and Likert responses on the Glossary Journal Project experience.

Some Findings, Pit falls & Lessons Learned

We learned something about how students experience our lessons…

- Students do not necessarily distinguish between *definitions* and *statements* (e.g., theorems).

- Explicit attention to the boundaries of a definition are needed. (Students often mistake preliminary remarks and casual references as part of a definition.)

We encountered some challenges…

- The use of third party content and what constitutes plagiarism is challenging to define and convey.

- Assessment and feedback is very time consuming.

  What's the best way to provide meaningful feedback without burying the instructor?

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Some survey[1] results were surprising…

- While most students report positive mathematical self-efficacy, we saw statistically significant **negative changes** in the treatment group.

- Students in the treatment group *report* putting less focus on definitions in the post-survey.

- Student comments on the project assignment were mostly positive.

- Overall course performance (DWF, % As, etc.) were not appreciably different between the two sections.

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[1]There were 38 paired surveys, 21 treatment and 17 control.

Current Modification

This spring, I'm running a variant in two sections of Linear Algebra.

- Each submission is only three entries with one graded thoroughly.

- Students were given two rubrics, one for thorough grading and one for *mostly* completion.

- Students can specify which entry is to receive scrutiny.

- Unfortunately, the grading is still overbearing.

Thank You!