MONTANA STATE UNIVERSITY MSSE

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The Effects of Explicitly Teaching Bloom's Taxonomy and Providing Direct Student Practice in the High School Science Classroom to Increase Student Success and Higher-Order Thinking

PROJECT OVERVIEW

PURPOSE: Critical thinking is a skill that many high school students are falling short in. I have noticed my students struggle when answering challenging questions. I have observed students assume a poor attitude and easily give up when asked a higher-level question. I began to wonder, what can I do to help them be more equip to engage in answering these tough questions instead of turn away?

WHAT DOES THE LITERATURE SAY?
In a peer-reviewed article, over 600 questions were analyzed that appeared in life science courses exams in college and found that lower-order cognitive skills including memorization and recall facts are being tested leaving students lacking in higher-order cognitive skills and a deeper understanding of the information. *Biology in Bloom: Implementing Bloom's Taxonomy to Enhance Student Learning in Biology*, Crowe, A., Dirks, C., & Wenderoth, M. (2008). CBE-Life Sciences Education (7), 368-381.

MAIN RESEARCH QUESTION: Does explicitly teaching Bloom's Taxonomy and providing direct student practice increase student success on higher-order questions?

THERE ARE MANY SUB-QUESTIONS TO FOLLOW:

- What foundational skills do students feel they need to complete higher order thinking questions successfully?
- What activities can be used to teach higher-order thinking questions effectively?
- Do student test scores increase with exposure to teaching question decoding and Bloom's Taxonomy?
- Do student confidence levels increase with question exposure?

BACKGROUND

WHAT IS A HIGHER-ORDER THINKING QUESTION? A higher-order thinking question requires students to utilize more cognitive processing skills such as analyzing and evaluation or connecting various pieces of information together. This engagement builds a deeper understanding of the material, not just recall facts.

WHAT IS BLOOM'S TAXONOMY? The graphic below helps to summarize Bloom's Taxonomy, a hierarchical model to help guide educators in organizing their student learning objectives by skills and complexity.

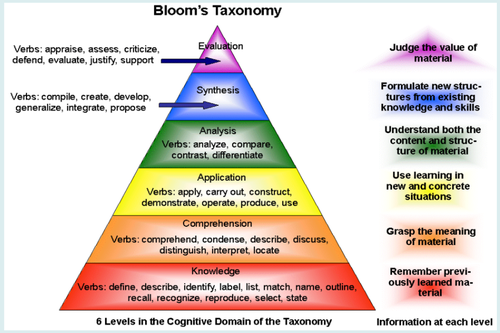


Image from http://ar.cetl.hku.hk/images/blooms.gif

METHODS

RESEARCH DESIGN: I focused on a descriptive study where students are followed throughout a six-week treatment period. The units taught during this time were DNA, Transcription and Translation, Genetics, and Classification and Taxonomy. Using a "within" design, all freshman biology classes were taught about Bloom's Taxonomy.

TREATMENT: During the treatment timeframe students received direct instruction on Bloom's Taxonomy levels and worked to identify the level of Bloom's within lessons, integrating Bloom's into what they were doing. They utilized Bloom's in various contexts applying it to their notes, investigating topics using research forms, and employing it in media engagements. They were asked to share-out their questions and findings following each activity and engage in discussions to breakdown questions for understanding.

Figure 1 (below): Image of a student investigation on a topic utilizing Bloom's levels. Each level scaffolded to the next, building knowledge on one topic.

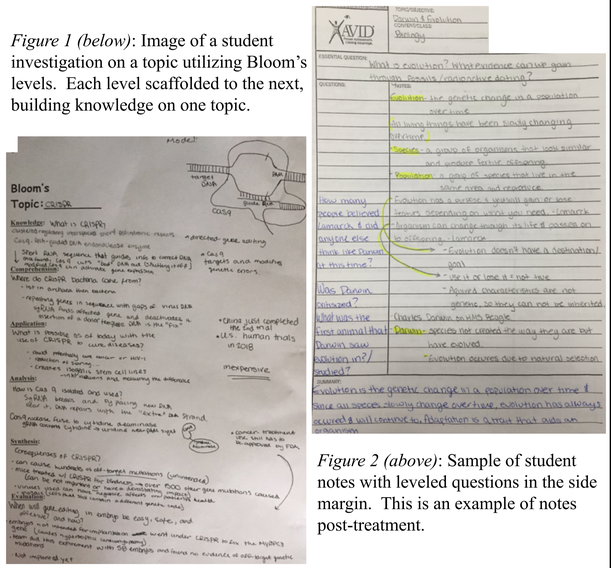


Figure 2 (above): Sample of student notes with leveled questions in the side margin. This is an example of notes post-treatment.

MY STUDENT SAMPLE AT A GLANCE: My research took place within my three sections of freshman biology (N=61). Freshman biology is a graduation requirement for our school.

- 16% Latino/a
- 15% are students with IEPs or 504 accommodations
- 27% of the freshman class is new to our school and district (this is fairly typical to see in our school as many families move to Telluride (a resort town) for their children to finish their high school career)
- 6% are sophomores that are re-taking the course
- School-wide, about 25% are eligible for free or reduced lunch and this is represented in the sample
- Approximately 50% male and female enrollment

DATA COLLECTION AND RESULTS

DATA COLLECTION: I administered the pre/post critical thinking test (CTSR-Classroom Test of Scientific Reasoning), and a pre/middle/post confidence survey and a skills inventory. Additionally, I engaged in group small group interviews surrounding problem solving. I also recorded my observations of student comments and attitudes daily in a notebook.

RESULTS: The data suggests that utilizing Bloom's Taxonomy in my classroom during the three units it was referenced and directly taught helped improve student critical thinking scores as measured by the Classroom Test of Scientific Reasoning (CTSR).



Figure 3. Score distributions of pre- and post- CTSR test scores, *(N=61)*.

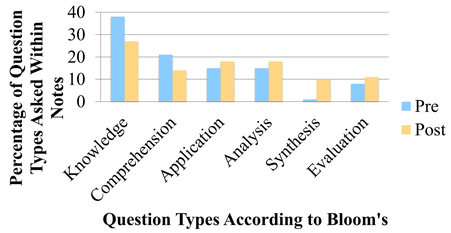


Figure 4. Question types asked according to Bloom's pre- and post-treatment within student notes, *(N=61)*.

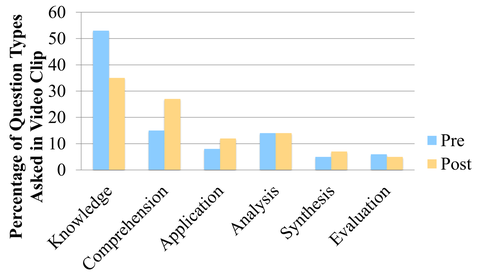


Figure 5. Question types asked according to Bloom's pre- and post-treatment from a video clip, *(N=61)*.

RESULTS CONTINUED: The data also suggests that the types of questions students posed shifted over the treatment period. Students still asked knowledge and comprehension questions following the treatment, but the number of upper level questions increased, such as application, analysis, synthesis, and evaluation type questions. This trend was observed in both the student notes and when asked to watch and reflect on a video clip.

CONCLUSIONS

IMPLICATIONS IN THE CLASSROOM: Students in their freshman year of high school have not been introduced to Bloom's Taxonomy. By introducing them to this hierarchical model, students are given more questioning and problem solving tools. Some will choose to utilize these skills to help them in their future. Implementing Bloom's Taxonomy into my classroom helped students improve with their critical thinking scores and gave them another tool to help access class material.

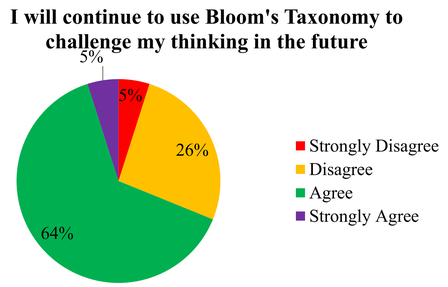


Figure 6. Student reported data from the post-treatment Likert survey question, *I will continue to use Bloom's Taxonomy to challenge my thinking in the future, (N=61).*

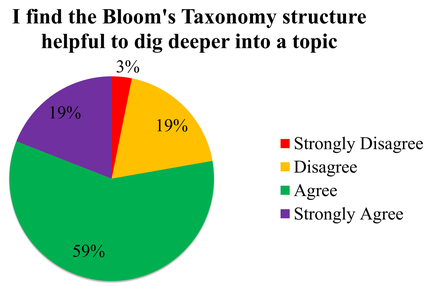


Figure 7. Student reported data from the post-treatment Likert survey question, *I find the Bloom's Taxonomy structure helpful to dig deeper into a topic, (N=61).*

VALUE:

- I have begun to discover ways in which I can develop and encourage higher-order thinking skills in my classroom. This begins with gaining ideas from literature and other researchers, then careful planning and executing the implementation.
- My research has helped to begin many conversations within my school with my colleagues (a math teacher and ELL teacher specifically) on the topic of questioning, critical thinking, and its importance in the classroom. It pleasantly reminded me that as teachers we are all working toward the same goal.
- Students were excited to participate and enthusiastic to receive results. They truly want to improve and participate in their learning.
- I can and will continue to ask students for qualitative feedback and surveys to improve my practice as it was very informative.
- It is fun to grow as an educator through the AR process.