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Using Bloom's Taxonomy in a Peer-Led Workshop in Probability and Statistics

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Abstract

Bloom's Taxonomy goes hand in hand with the peer-led workshop's methods by providing us as peer leaders with a structured order of the learning levels taken to extend our learning capabilities. We, the Peer Leaders, assist students into progressing to the next level in mathematics by going beyond recalling, understanding and applying (Levels 1-3 of Bloom's Taxonomy). In our Probability and Statistics I and II workshop, we apply Bloom's Taxonomy to help the students, especially with the application of comprehension, application, and analysis (Levels 2-4). By proposing questions to the students, we initiate the recollection of the subject at hand. As a result, these questions help the establishment and encouragement of critical thinking for the students, especially in the higher levels. The Analytical level (Level 4) specifically shows that an individual can know whether what he or she is doing allows them to perform well in the subject.

Literature Review

The Cognitive Taxonomy (Forehand, 2005) has six levels:

Knowledge: Recognize data, or recall data.

Comprehension: Understand the material; being able to interpret the material.

Application: Able to apply a theory learned into practice under real-life circumstances.

Analysis: Able to determine the internal relationships of individual components, as well as structure and construction of the material, Material learned is split into parts so that its structure may be better understood (Mohtashami, Scher, 2000).

- Analysis, the fourth stage. The Analytical is known as the development of the critical analysis advantage to progress to the next level of knowledge (Benson, Sporakowski & Stremmel, 1992).
- An individual may critique their previous studies that contradict the ideas based on the validity or reliability of the new problem being introduced (Benson, Sporakowski & Stremmel, 1992).

Synthesis: One develops creative thinking, operations skills; approaches and ideas in respect the material.

Evaluation: The use and review of strategic options to solve the material.

The use of the Revised Bloom's Taxonomy facilitates authentic earning which occurs when the students reach beyond imitation or reproduction of information and are able to analyze and interpret information to solve a problem that can't be solved by information retrieval alone (Pickard, 2007).

Observations

Case 1 (Probability and Statistics I): The instructor assigned students to use Moment-Generating Functions to find Mean and Variance for Binomial distribution and Poisson distribution. Since some students had problems, they went to workshop to get help.

First, the peer leader suggested students go through their classnotes together. Then students asked questions and other students tried to answer them. Students then started to solve the Mean and Variance of Binomial distribution together with the peer leader.

Students were then separated into two groups to attempt to solve the Poisson distribution individually. After they got the answer, one group went to the board to show us the Mean, and the other group showed us the Variance. Everyone checked whether the solutions were right or wrong together.

Case 2 (Probability and Statistics II): The students tried to solve a problem as follows: Given x/y, where x and y are independent random variables of uniform (0, 1) distribution. They had the formula: $f(u,v) = f(u(x,y),v(x,y)) \ |J(u,v)|$, but did not know what to do.

Since they were working in a group, the peer leader asked what the formula was. One student said it was the two-variable transformation formula. Then the peer leader asked what was the difference between f(x,y) and f(u(x,y),v(x,y)), and why f(u(x,y),v(x,y)) needed to multiply by $|J(u,v)|$. Throughout the discussion, students were able to understand and managed to find $f(u,v)= f(u(x,y),v(x,y)) \ |J(u,v)|$.

After students solved the problem, the peer leader asked whether the result would be different if we let u = x/y or v = x/y. Some students said it did not matter. In order to confirm their expectations, students worked together to solve this problem.

Case 3 (Probability and Statistics II): With respect to the Analytical level (Level 4), a couple of students were asked to deduce the final product of a transformation logically. They were given the initial question as well as the answer, where the answer was derived by a fellow student. Then students were asked to determine why or why not their logic was a fallacy, and if so, what other fallacies could arise from this scenario.

Discussion

Case 1: By going through their notes and having discussion together, students were able to clear their questions so that they could go to the next steps. Solving the Mean and Variance of Binomial distribution as a whole group gave students an opportunity to apply their knowledge. After that, they did the problem by themselves, which would let students know how to manage the material.

Case 2: At the beginning, the students didn't know how to apply the formula. However, they knew parts of the formula. By asking them leading questions and comparing f(x,y) and f(u(x,y),v(x,y)), they knew the difference. As a result, they were able to solve the problem with the formula. By asking further questions regarding the setup of the problem, the students realized that they could have different approaches to solve the same problem.

Case 3: When both students came up with different solutions, they were able to explain their thoughts in front of the other students and brought a discussion about in the group. During their discussion, students were asked to determine the correct logical solution. This inspired students to determine a correct answer logically and be able to find out their error instead of asking for answers.

However, some comments were required to express that neither of students' original solutions were right, in order to prevent some misleading judgments. Students were able to analyze their logical

fallacies because they experienced making a similar error in solving a problem. They would have the capability to prevent and discover their mistake in their future studies.

Conclusion

Our Probability and Statistics I and II peer-led workshop study followed Bloom's Cognitive Taxonomy, because students must go through each level before proceeding to the next level. In other words, the knowledge and comprehension skills must be attained before proceeding to the next level.

Bloom's Cognitive Taxonomy provides peer leaders different strategies to approach students who are at different levels, which is more effective for students. Students go to a "free-standing" workshop to study with other students and the Peer Leader, which gives them a chance to handle their class material better to be able to persevere and go on to a higher-level course.

These workshops not only build up students' knowledge and solid foundation to study well, but also give them opportunities to evaluate their studies with peer leaders to make a suitable plan to study. This helps them discover their potential and reinforces their critical thinking in logic in studying mathematics. Refining students' critical thinking and succeeding in their undergraduate programs will make students more interested in applying to graduate school.

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