Effectiveness of Heutagogical Learning Methods in PAL Courses

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Abstract

In this study, we addressed a prevalent issue among college students: grappling with intricate concepts in STEM subjects. Our approach involved leveraging heutagogical learning methods and engaging Peer-Assisted Learning (PAL) students across multiple disciplines to teach complex ideas to one another. Our methodology began with the random allocation of questions related to core topics learned in class to each PAL student. Each student not only answered their assigned question but also elucidated and instructed their peers on the concept. We also administered pre and post surveys to assess students' comprehension of the assigned topic both before and after their teaching sessions. Our experiment found that students' demonstration of concept, precision, and overall comprehension increased by a statistically significant amount.

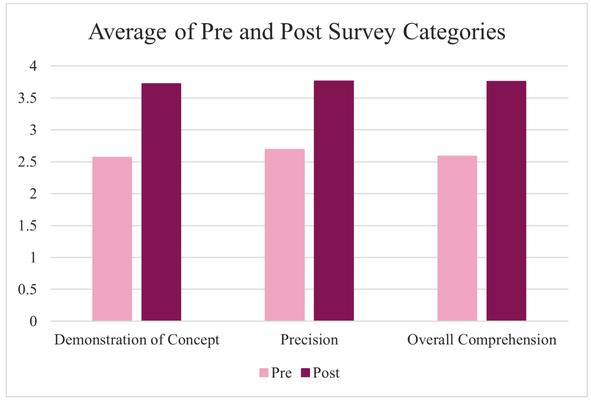
Background

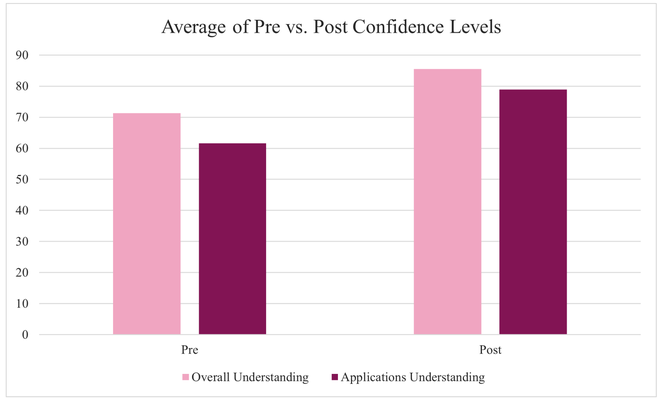
This study aimed to measure the effectiveness of interactive learning on student's ability to understand concepts through the use of a heutagogical learning approach. This learning technique involveed condensing and simplifying complex topics and teaching it to peers. This technique has been thought to improve the teacher's comprehension of a topic instead of encouraging automated recall. Research projects such as "Feynman Technique as a Heutagogical Learning Strategy for Independent and Remote Learning" inspired this project to emphasize the concept of heutagogy which centers around learners exhibiting high autonomy and self-determination so that they become "well-prepared for the complexities of today's workplace" (Reyes, 2021). There have also been studied benefits of a "flipped classroom model," which this study utilizes and heutalogical learning's lifelong impact as a whole (Green, 2017), (Blaschke, 2012). We used elements of the Feynman technique by having students clarify their knowledge and present it interactively to their peers. Our approach differs through its use of pre and post surveys that allows students to self-evaluate and helps us quantify their understanding.

Methods

- To test the validity of heutagogical learning, PAL facilitators of Pre-Calculus, Calculus II, Calculus III, Molecular Cell Biology, and Anatomy and Physiology had students present a specific topic pertaining to their discipline to the rest of the PAL section.
- Students were given a topic by their facilitator through randomization and then had time to research said topic before presenting to the class. Presentations were no longer than five minutes with emphasis on explaining the techniques for solving problems related to their topic.
- Before starting a presentation on their specific subject, students took a pre-survey on what they understand about the topic, applications of the topic, and a scale 1-100 on their confidence level and understanding of the matter they're presenting. After presenting to their peers, the presenter took a post-survey with similar questions provided in the pre-survey.
- Data collected through the research was given a score from 1-4 with respect to demonstration of concept, precision, and overall comprehension of their topic. Figure 2 references the rubric created for this data collection

Data & Results





	1	2	3	4
Demonstration of Concept	Students provided no demonstration of the concept or utterly did not participate.	Students provide some demonstration that somewhat relates to their topic but overall misses the mark.	Students provide sufficient demonstration in relation to their topic, although some errors or inaccuracies are made.	Students demonstrate complete understanding of the concept.
Precision	Students are unable to provide any accurate information pertaining to their topic.	Students are able to provide minimal, accurate information pertaining to their topic.	Students are able to provide sufficient and accurate information pertaining to their topic.	Students' display plentiful and accurate information pertaining to their topic.
Overall Comprehension	The student completely misunderstands their topic or did not know.	It is uncertain as to whether the student comprehends their topic.	The student exhibits partial comprehension of the topic.	The student exhibits complete comprehension of the topic.

Results

The mean values for the students' demonstration of concept, precision, and overall comprehension before presenting was 2.57, 2.69, and 2.58, respectively, while the mean values after presenting were 3.72, 3.76, and 3.76. For our paired t-test of student's understanding before and after, assuming a hypothesized difference of 0, we acquired p-values of 2.9349e-05, 1.2596e-07, and 1.98309e-09. This implies that there was a statistically significant difference in the mean scores of students' demonstration of concept, precision, and comprehension before and after their presentations.

Our students' qualitative responses varied from helpful, to potentially detrimental. Many students included key words associated with a positive experience, such as "good", "confident", "great", and "relaxed". The responses that indicated a potentially negative experience included keywords such as "stressful", "counterproductive", and "awkward". One of the common situations that was found in all types of responses was the issue of time: many students struggled condensing their presentations to be less than 5 minutes long. Many facilitators used this as an opportunity to encourage class participation when the presenter was working through a problem.

Discussion

The hypothesis that implementing heutagogical learning methods will improve a students' ability to demonstrate a concept, as well as increase comprehension of the concept was supported. The students' mean comprehension level increased 45.73%, precision increased 39.25%, and demonstration of concept increased 35.42%. The differences in means, in each category, shows that there is an increase in overall comprehension, precision, and demonstration of concept after applying heutagogical learning methods. Our p-values suggest that our results are statistically significant, and there is a significant difference between overall understanding of the topic after implementing heutagogical learning methods. We reason that reinforcement of knowledge via the heautagogical learning methods will increase overall comprehension and ability to demonstrate knowledge of the material. Possible lurking variables could be differences in grading preferences from the various facilitators, or students stating textbook answers for topic knowledge. Future studies could examine how other forms of heutagogical learning could be implemented, and how those different methods of reinforcement may aid in reinforcement of material knowledge.

References

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Quotes

"Through the research project from my facilitator Elijah, it has become easier to 'complete the square' for equations that needed it." - Gilliean Gameng, Math 29 Student

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