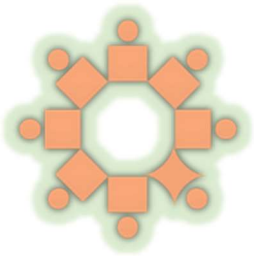

THE PEER-LED TEAM LEARNING INTERNATIONAL SOCIETY
PROCEEDINGS OF THE 2015 CONFERENCE
MAY 28-30, 2015
UNIVERSITY OF TEXAS AT DALLAS
RICHARDSON, TEXAS

PROPOSING A STUDY WORKSHOP FOR MATH AND COMPUTER SCIENCE

ISRAEL CERVANTES, HUY BUI, KEVIN CASTILLO, AMAIRANI HERNANDEZ, LUCERO PRIEGO, AND DESTINY TREVIÑO

As peer leaders at the University of Houston-Downtown, we noticed that students tend to struggle with entry-level mathematics and computer science courses. They struggle primarily because mathematics and computer science courses require different studying techniques than what they are used to. In math courses, new material is built on previously learned material. Therefore, it is important for students to retain what they have previously learned. In computer science courses, the material is very abstract, and for most entry level computer science students, they have never taken a computer science class before which makes it more difficult to understand. For both cases, students are faced with courses where learning the fundamentals of the course is vital to learning subsequent topics. To address this issue, we propose having a PLTL workshop specifically aimed at helping students learn how to study for those courses. The workshop are geared at guiding students to become independent learners.

Introduction and motivations

At the University of Houston-Downtown (UHD), peer leaders of the Collaborative Learning Community Center (CLCC), a tutoring center for math and computer science (CS) courses, have noticed that students tend to struggle with our entry level math course, College Algebra (Math 1301), and our entry level CS courses, Intro to CS with Visual Basic (CS 1408) and Introduction to CS with C++ (CS 1410). In particular, students tend to focus on one section at a time while completely forgetting about previously learned sections. However, this does not work in math and CS courses since every subsequent section is built upon what previous sections covered. This makes math and CS different from non-science courses such as history where students can solely focus on one section at a time. Another reason that students in entry level math and CS courses struggle is that they are still used to the high school way of thinking. There is a lot more hand holding in high school where students are told what to study and even how to study. However, students in college are expected to be independent learners and as such, they need to know effective studying techniques.

Our university currently offers weekly workshop sessions for the Introduction to CS with C++ (CS 1410) course and the Data Structures & Algorithms (CS 2410) course. However, these workshops focus on the content that students learn each week. They learn about abstract concepts in those workshops, but don't learn about how to study for those abstract concepts. Thus, for our proposal, we want to create a workshop that is not directly tied to the course content, but instead focuses on helping students with important studying techniques and fundamental concepts related to the course. In order to better serve students, we

propose eleven PLTL workshop sessions, where each session will cover a specific topic that will help students become independent learners.

Workshop Setup

The entire 11-week workshop will be divided into three categories: effective study techniques for math and CS, key topics on math and CS, and study groups. The effective study techniques portion will deal with similarities between math and CS, and the type of studying methods that are applicable for both courses. The key topics portion will deal with skills that are essential to building a strong foundation in each subject and are necessary for upper level courses. Two workshop sessions will be dedicated to forming study groups. In CS 2410, workshop sessions leading to midterms and finals typically have low turnout. As such, the midterm and final study group sessions are an effort to increase turnout rate. Instead of introducing new topics, the midterm and final study group workshop sessions will allow students to discuss relevant information that will help them with their exams.

Since we already have workshops for CS 1410 and CS 2410, we plan to model our workshop after those. The CS 1410 workshops are mandatory and are done online. On the other hand, the CS 2410 workshops are optional and done face-to-face. We will use elements from both workshop models for the 11-week math and CS study workshop that we propose. First of all, we plan to offer a math version of the workshop and a CS version of the workshop. Since the study techniques for math and CS are similar, the study techniques portion of both versions will cover the same topics. Even though the first five sessions will be the same for both, the peer leaders will let the students know in advance which workshop will be more math oriented and which workshop will be more CS oriented. Both versions will cover different material once we get to the key topics portion which are course specific. As for the schedule, each workshop session will be one-hour long. To allow for flexibility with the students' schedules, we will offer at least two Math workshop sessions and at least two CS workshop sessions each week. The number of times we will run each workshop session each week will depend on how many peer leaders we will have committed to running workshops for the semester. Since this upcoming fall semester will be the first time we offer this workshop, the workshop will be optional for the students. We will advertise the workshop through professors and UHD bulletin boards. We expect to have around 5-15 students per workshop session, who will mainly be incoming freshmen and nontraditional students that take Math 1301, CS 1408, or CS 1410. We will also need to have 2-4 peer leaders with knowledge in either math, CS, or both, that will alternate depending on the subject matter of the workshop. The exact schedule of the workshop sessions will be based on the available times of peer leaders. However, if the schedule does not meet the needs of students committed to the workshop, then the schedule will be modified to accommodate as many students as possible.

Since our first semester for our workshop will be a trial run, we need to be able to determine the effectiveness of our workshop. Thus, each workshop session will be evaluated through surveys. At the beginning of each workshop session, students will be handed out an entry survey where they will rate their confidence with the workshop material for that workshop session. They will then be given a short entry task, for about 3 minutes, to test their prior knowledge of the workshop material. For example, in the Building Algorithms workshop session, students will be asked to list the necessary steps to create code for a mathematical equation. After the entry task, the students will run through the workshop material. They will then take an exit level task that is similar to the entry level task. We will compare their exit task with

their entry task to see how much they learn from the workshop session. After the exit task, students will be given an exit survey for them to reevaluate their confidence with the workshop material. We will use these surveys and tasks to analyze the effectiveness of our workshop sessions, and to determine how we should modify it for the following semesters.

Workshop summaries

1. What's the difference?

This workshop session will cover how studying for math and CS courses is different from studying other courses. While most courses only cover what is taught in its own particular section, math and CS are based on everything covered in that section plus previous math and CS courses. Both subjects tend to build on preceding knowledge and therefore make studying for them different from other classes. Furthermore, since we expect that most of the entry level students will be freshmen, we will also cover how studying for college courses is different compared to studying for high school classes. In high school, the students' notes are constantly checked for progress and sometimes, they are even checked to make sure that the students have the exact same notes as their teacher. This is starkly different in college where students are expected to take their own notes as they see fit. Students in college need to be much more independent and know how to study effectively.

2. Taking notes

Note-taking in math and CS courses is vital. Numbers, formulas, and code must also be jotted down along with words for future application. For both courses, it is vital for students to realize that they need to follow along with their professor as they take notes. Solving problems for both courses require many steps and more often than not, simply copying down the worked-out solution is not enough for students to fully understand what happened at each step. Furthermore, professors do not typically write down everything that they say. Therefore, students need to have good note taking skills to help them study independently.

3. Solving a problem

We observed that for most students who struggle with word problems, they first read the entire problem and then just shut down. They get overwhelmed by the seemingly daunting task and get lost on what to do next. This workshop session focuses on how to break down a problem into simpler steps. They will be shown how to analyze a problem by looking for keywords and focusing on only the pertinent information. Next, students will be shown how to solve a problem step-by-step by going over the information that they currently have and where they can proceed from there. By breaking down a problem into steps, students will feel less overwhelmed with solving them.

4. Practice, practice, practice

Practicing helps students retain the techniques that they learn. This allows them to quickly recognize a problem, and to know which methods they can use to solve a problem. While students will be given some practice problems to work on, having them practice on problems for an hour is not the intent of this workshop session. Rather, students will be shown how to quickly recognize new problems based on problems that they have worked on.

5. Study groups

One workshop session will be dedicated to forming and using study groups. An important idea of the PLTL model is that students learn better by collaborating with each other. Thus, this workshop session is intended to encourage students to form study groups. To do so, students will be asked to solve several short but challenging problems as a group. However, the role of the workshop leader here is unlike that of a traditional PLTL workshop where the workshop leader guides the group by giving them hints and questions to consider. Instead, the workshop leader will just supervise the group and motivate them to rely on each other to solve the problem. The workshop leader will only intervene as an absolute last resort. This workshop session also helps students become independent learners since forming study groups is something that they will be able to do on their own, outside the workshop sessions.

6a. Why CS?

This workshop session will explain the significance of CS and the importance of understanding how to program. Also, this workshop session will aim to make students more comfortable with their CS course. Furthermore, this will help even non-CS majors appreciate having some knowledge of CS. Seeing as technology pervades our lives, having some basic knowledge of computer science will allow students to be better equipped in dealing with technology.

6b. Why math?

Mathematics sharpens students' analytical skills, helps them become better problem-solving, and gives them the tools needed in many different disciplines that rely in quantitative and reasoning skills. Even non-Math majors will learn about how the analytical skills that they develop in their Math courses can help them succeed elsewhere.

7a. Pseudocode

The focus of this workshop session is to help students write pseudocode. Often times, while tutoring Introduction to C++ and Introduction to Visual Basic students, we notice that they dive straight into typing code without having a general idea of how to approach a given problem. They then resort to trial and error to see what works and what doesn't work. This leads to unorganized code with numerous errors. Writing pseudocode helps students organize their thoughts before typing on the computer. This can also reduce the number of errors that appear in their code. Furthermore, it helps with their critical thinking skills by having them think of a solution that works instead of just relying on trial and error to solve a problem. The topics that will be covered in this workshop session include flowcharts, writing pseudocode, and then transitioning from pseudocode to code with proper syntax.

7b. Arithmetic techniques

One glaring problem that we notice among math students is their struggle with basic arithmetic. We peer leaders notice that even with upper level math courses, it's not the content that students make errors on, but their arithmetic calculations. As the result, we will dedicate a workshop session to arithmetic with the purpose of introducing students to several tips on how to calculate faster and efficient methods to minimize commonly algebraic mistakes.

8a. Building algorithms

It cannot be stressed enough that in CS, there are always multiple ways to solve a problem. Furthermore, students also need to consider how to write code which efficient and easy to understand as this is important in industry. This workshop session will help students identify what code they would need when solving a problem or when given a specific task.

8b. Functions

In this workshop session, students will learn about functions. Students will be able to define the range and domain of a given function or graph. They will also learn how to combine functions and find the inverse of a function. By understanding more about functions, students will better be able to interpret real-world scenarios as they relate to Math.

9a. Reading code

This workshop session will be dedicated to reading code. Being able to read and analyze code is important in computer science for two reasons. First, it enables students to read from examples and other pre-existing code and understand what that code does. Second, it also helps them better troubleshoot their own code since they will be able to trace out their code and figure out from where the errors are occurring. Being able to read code also helps them collaborate with other students since this will make it easier for them to understand the work of their peers.

9b. Graphing

Students in upper level Math courses have trouble graphing one variable equations. In this workshop session, we will start with parent functions and lead on to more complicated functions. We will discuss the effects of transformations and translations on given functions. The students will be given a problem in which they need to write the proper form of function after that function undergoes several transformations, reflections and translations.

10. Midterms study group

Both the math and the CS workshops will hold study group sessions around midterms. While the workshop participants will be given a study guide to review for their tests, it will be up to them, as a group, on what they will study. The role of the workshop leader is just to give them hints or otherwise steer the discussion whenever they are stuck. The workshop leader will also ensure that the students stay on task and that they reach whatever objectives they set from the study guide. Other than that, the workshop leader is just there to supervise the session. This is to help us see if the students utilize the studying techniques that they have learned from the workshop.

11. Finals study group

Since finals are comprehensive, the workshop leaders will help the workshop students go over key points that the courses covered over the semester. This will be carried out in the form of a study group, similar to the Midterms workshop.

<u>Challenges</u>

Since we are creating a brand-new workshop for the upcoming fall semester, there are several potential challenges that we need to consider. Our first challenge is the availability of peer leaders. At UHD, peer

leaders are invited on a semester by semester basis. This means that the peer leaders that we have running workshops one semester may not necessarily come back the following semester. Furthermore, we may not have enough peer leaders for certain subjects such as CS. Also, the schedule of each workshop session need to revolve around the schedules of the peer leaders. Thus, how often we run workshop sessions each week depends entirely on the availability of our peer leaders.

Aside from the availability of peer leaders, there is also the issue of workshop attendance. Since this Fall 2015 semester will be our trial run, we decided to make our workshop optional. Thus, we cannot guarantee that we will have enough students attend our workshop, nor can we guarantee that the same students will consistently attend our workshop. This will make it harder for us to track the effectiveness of our workshop.

The next challenge is the appropriateness of what the workshop covers in relation to the entry level math and CS courses. Normally, workshops simply follow along with what the corresponding courses cover each week. However, since ours do not, we need to figure out how to make our workshop relatable to what the students learn in class. Additionally, our workshop is designed from a peer leader's perspective of what we observe students struggle with. Since not all students struggle with the same concepts, there may be workshop sessions that some students will find irrelevant to them.

Our last foreseeable challenge is faculty cooperation. This would not be a problem if the faculty are the ones who decide that they need this kind of PLTL workshop. However, we peer leaders are the ones who took the initiative to create this particular workshop and that what our workshops will cover are based entirely on our observations. As such, it is up to us to convince the faculty to support our workshop, or at the very least let their students know of our workshop.

Conclusion

As peer leaders, we draw from both our personal experiences as students, workshop leaders, and tutors in determining where students struggle with their courses. Based on our experiences and observations, we decided to create a workshop that is geared at helping students learn how to study. We want the students to become independent learners, capable of studying on their own outside of the workshop setting. By helping them become independent learners, we are also preparing them for when they reach upper level math and CS courses.

Future Work

Over the summer of 2015, the 11 workshop sessions will be further refined and transformed to better fit the PLTL workshop model. In addition, surveys along with corresponding tasks will be created for each workshop session. We will use the trial run of the workshop in the fall semester to make necessary adjustments based on the feedback from the students and the workshop leaders. Once we have a more solid workshop, starting in the Spring 2016 semester, we will restrict workshop attendance from entry level math and CS students in general to students taking specific Math 1301, CS 1408, and CS 1410 sections. The reason for doing this is so that we can begin to track student performance and determine whether there is a correlation between the workshop and student success. We want to see if students who regularly attend the workshop improve over the semester, and compare them to students from the course. Lastly, we plan to extend the workshops to other STEM fields such Chemistry and Biology.

Acknowledgments

We gratefully acknowledge the support of Ms. Mitsue Nakamura, Department of Mathematics and Statistics, UHD; and Scholars Academy, UHD.

Cite this paper as: Cervantes, I., Bui, H., Castillo, K. Hernandez, A. Priego, L. Treviño, D. (2016). Proposing a study workshop for math and computer science. *2015 Conference Proceedings of the Peer-Led Team Learning International Society*, May 28-30, 2015, University of Texas at Dallas, Richardson, Texas. www.pltlis.org; ISSN 2329-2113.