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### **Promoting Proactive Behavior through Motivation: Required Math Lab Hours Case**

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## Promoting Proactive Behavior through Motivation: Required Math Lab Hours Case

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### Abstract

Requiring that students enrolled in college algebra to spend hours in a computer lab has been a practice in colleges and universities to improve success and retention. In part, because students come with different backgrounds, skills, and the computer lab environment allows for personalized supplemental instruction and tutoring. However, the way this practice may cause problems among students. Prior to this study, we realized that college algebra students are not pleased with having to wait outside the lab to get in and have to spend three hours per week to receive a small credit. The wait time is due to the limited lab capacity that cannot house a large number of students when they visit at the last minute or right after a large class meeting. Hence, we attempted to stimulate a proactive behavior of visiting the lab early in the week through offering an incentive. It entails reducing the number of lab hours for the same credit after achieving a certain mastery. The results show that the students responded well to the modification. The final exam mean test shows that the modification was an improvement.

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### Introduction

Two and four year institutions face the challenge of incoming students having weaker math skills. They implemented many initiatives and best practices to increase success and retention in those courses. One of those practices is the subject of this paper, which is the requirement of computer lab hours in addition to a lecture. In 1977, Mira Costa College in California mailed a survey to 100 community colleges and among the 40 responding, 17% had completely self-paced labs, 20% combined open labs with individualized instruction, 20% had no lab instruction, and the remainder had a variety of offerings (Kelly & Rajah, 1977). The courses connected to those labs ranged from arithmetic, element algebra, and mostly intermediate algebra. The National Center for Academic Transformation website (NCAT, 2011) shows that many universities adopted an emporium program. Some of those are University of Alabama, Virginia Tech, Alcorn State, Cleveland State Community College, University of Central Florida, etc. The reason the emporium program became a silver bullet is the students are spending the majority of their course time doing math problems instead of listening to someone talk about doing them (Twigg, 2011). In general, the emporium program depends on delivering instruction in a computer lab through technology and with the help of tutors and instructors. Students watch videos or read materials for content. The software provides them with instant feedback about their answers. The staff in the emporium lab offer tutoring and help when needed.

### Understanding Computer Lab Environment

The role of the computer lab can vary depending on its mission, which shapes its workforce and layout. General types of computer labs are drop in to help students with math questions, space used in conjunction with lecture, or as a teaching space. Their goals vary from serving all math needs to improving instruction or decreasing cost of having multiple math sections. After a number of online searches, we found that the crucial common goal among computer labs is to help students become independent learners and gain confidence in their math abilities. To achieve this vital goal typically those labs employ a team of a coordinator or a manager, tutors or undergraduate learning assistants (LAs), graduate teaching assistants (GTAs), a front desk person, and/or faculty members. In addition to managing the lab, the manager works to establish a friendly and safe environment in which students feel welcome and comfortable to ask questions. The LAs can be undergraduate students; and they go through a hiring process that may include both personality and math knowledge questions. They need to have a set of skills to be able to communicate and encourage students. Effective LAs use leading questions to engage struggling students in the lab. Yet, their roles are neither to teach nor to do homework for the students. One should not believe that even experienced LAs come

with those skills and should invest in training them. LAs may not understand that, in a given course, students come at different levels; and the goal is to help them reach certain higher levels. Therefore, the way they communicate with the students is important. Same communication principles apply to GTAs. They are usually graduate math students.

Understanding students' experience inside the lab can be complex. To think that students go to the computer lab and ask questions comfortably is a misconception. Several labs implemented ways for the students to ask questions, including raising their hands, using flags or putting red plastic cups on top of monitors. However, many students do not ask for help, or feel uncomfortable to display that flag on top of their computers. Almeda, Baker and Corbett (2017) discuss in their paper that some students do not know how to ask for help or develop strategies of avoidance of seeking help. They found that, except at very high or very low knowledge, help avoidance negatively affects learning (Almeda, Baker, & Corbett, 2017). The issue of help avoidance has been present in classrooms for some time (Butler, 1998). There is no doubt that instructors notice such behavior in their classrooms and in the computer labs. In some cases, a student would get a wrong answer multiple times and avoids asking for human aid because he or she believes that the human may judge his/her ability. Again, Almeda, Baker and Corbett (2017) summarized factors affecting help seeking:

- **Motivational Orientation:** Depending on students' motivational orientation, he or she will ask for help or avoid it. For example, students with performance-focused orientation may avoid asking for help so they are not seen as less competent.
- **Prior Knowledge:** Puustinen (2017) found that students with low prior knowledge were less effective help-seekers. In addition, sometimes they seek help only to confirm if answers are correct instead of understanding the solution to the problem (Puustinen, 2017).
- **Self-Regulation:** Newman discussed that help-seeking is deeply intertwined with self-regulated learning because recognizing the need for help requires metacognitive and self-regulating abilities (Newman, 2002). Therefore, a key is existence of both internal and external feedback as discussed by (Butler, 1998). Newman (2002) pointed out that self-regulated learners first provide themselves with internal feedback regarding the task. They feel comfortable asking for assistance when needed.
- **Cognitive Load:** Wood suggested that cognitive load can have negative effects on self-regulatory skills especially of learners with lower prior knowledge (Wood, 2001). When problems are too difficult for students, their ability to monitor their own comprehension can be compromised as a result. Puustinen (2017) has found that high achievers (based on class grade) were the best at self-regulation within help-seeking activities.

Moreover, the student may not develop a sense of belonging in the computer environment. In many institutions, the use of a computer lab leads to a big change in student to instructor ratio by allowing one instructor to teach hundreds of students. In addition, if the computer lab has few LAs and GTAs, the students to tutor ratio can become too high. Such ratios can cause students to feel alienated. This alienation within the learning space is understood as the learner separating from the process of study or what he or she should be engaged in (Andrew Barr, 2018). The general alienation is inversely related to classroom community (Rovai & Wighting, 2005). Hence, the development of learning communities increase learning and student satisfaction (Overbaugh & Lin, 2006). This kind of development is often ignored in a computer lab environment since students, mostly, work individually on computers. Dawson (2016) demonstrated the existence of a significant relationship between student frequency of communication and the sense of community as measured by Classroom Community Scale (CCS) (Dawson, 2006). Furthermore, students interacting more with peers and teaching staff indicate a higher level of satisfaction with the course of study (Dawson, 2006).

### Study Approach

Founded in 1963, the University of Central Florida (UCF) offers 215 degree programs to more than 66,000 students. As a metropolitan university, More than half the students (54%) are transfer students, More than 45% are minorities, One in four (25%) is a first-generation student, 42% are Pell-eligible, and the average age is 24 (UCF Institutional Knowledge Management, 2018). The UCF Department of Mathematics has implemented in 2008 a modified emporium (ME) model for most of its mathematics courses below Calculus. Students in the ME courses (intermediate algebra, college algebra, precalculus, and trigonometry) are required to attend one

fifty-minute lecture per week in a lecture hall and to spend at least three hours per week working in a computer lab, where tutoring is available. Students' class schedule showed the lecture time but it did not show the lab time. This allows flexibility for the students to visit the lab during different times in the week. The lecture hall capacity is up to 450 seats and the lab capacity is about 300 computers. The difference between the two capacities caused a jam when students decide to go to lab right after a class meeting.

Moreover, the lab is always busy because it serves more than 4000 students every semester. The lab situation made students unhappy with the hours' requirement. They frequently mentioned that they could complete the assignments on their own computers without having to visit the lab. Yet, we know that having them work completely on their own was not fruitful since college algebra success rate prior the ME implementation was 50% or below. The low passing rate could be a result of students' low motivation and interest in the course because college algebra is a general education course (Gordon, 2008). As a result, we introduced a modification that involves the students in resolving the lab problem. A modification that depends on motivating the students to be proactive in planning their lab visits. The rationale is that proactivity is often linked to a positive outcome and proactive behavior is often used to describe self-initiated behavior (Wu, Parker, WU, & LEE, 2018). The authors in (Horizons, Jun, & Issue, 1999) gave an example of a proactive person in a job as the one who tackles issues and launches new initiatives and does not sit back to wait for others to make things happen. The authors in (Crant & Bateman, 2000) stated that proactive behavior can be understood from researching proactive personality. We believe that the students enrolled in college algebra come with proactive personalities but a majority comes with low interest in the course. Hence, the catalyst we chose to activate proactivity is the extrinsic motivation. Research shows that motivation is vital but mysterious, and it can only be comprehended when it is experienced (Whiteley, 2002). The authors in (Tasgin & Coskun, 2018) discussed the positive correlation between motivation and academic achievement. The extrinsic motivator we selected (based on students' frustration and feedback) is reducing the lab requirement to keep full credit. The reduced hour can be substantial for the students because they believe that three hours are not necessary and they are too much, moreover, students live busy lives (Williams & Williams, 2012). The grading offered in this college algebra consists of class participation and lab hours. They are worth 5% each of final grade. The scoring for lab hours is "all or nothing", meaning a full credit for at least three hours per week and zero credit for less than three hours per week. No partial credit for completing less than three hours and no extra credit for completing more than three hours. Online homework and quizzes are used and are worth 15% of final grade. Homework questions' can be attempted for many times and the questions' numbers are algorithmically generated. Quizzes' questions are pooled so the single question has five instances and questions' numbers are algorithmically generated. Seven attempts were allowed on quizzes with the best score is taken. Both the homework and the quizzes can be done in the lab or at home. All tests are closed notes and textbook, they are proctored in the lab. The students are provided a scientific calculator during testing. Three grading options were offered: Option (1) in which all three tests (Tests) were given with 15% each and a comprehensive final exam that is 30% of final grade. Option (2) drops the lowest among first three tests and the final test weight increases to 45%. Option (3), the final test replaces all tests and becomes 75% of the final grade. The goal from the third option is to encourage students to remain in the course instead of withdrawing. The best of the three options was automatically used for overall grade, and students don't have to pick the best option. The final letter grades scale is A: 100-90, B: 89-80, C: 79-70, NC: 69-50, and F: 49-0. NC grade stands for no credit and it does not affect student's grade point average (GPA). It was established to encourage students to remain in the course, try their best, and if they do not pass, their GPAs are not negatively affected. A, B, and C are the passing grades. Both option C and NC grade offering helped reduce greatly withdrawal rate. The workforce of this lab consists of a lab coordinator, LAs, GTAs, and instructors. To encourage students to seek help, a software is installed in all computers for the students to send help requests. When a student needs assistance, he or she sends a request and his or her computer number appears on a television screen. The LA or TA finds the student by going to that computer. To address help seeking issue and alienation, LAs and GTAs are asked to walk around and not wait for a request to appear on the TV. They need to be aware of students' that are struggling or just not doing math. For example, if a student keeps getting a wrong answer for the same problem, the LA should approach the student, greet him or her, and start a conversation. A scenario:

*"Hello, I see that you are trying to solve a word problem. How are you approaching it if I may ask?"*

LA asks a student in the lab who had a wrong answer few times.

Afterwards, the LA would try to figure out if the mistake is (1) a reckless error (the student copied wrong values), (2) computational error (the student rounded or chopped a number in middle or not using the calculator correctly...etc.), or (3) a concept error (the student lacked the knowledge to solve).

*"I see that the setup of the problem is good but you rounded this value. My suggestion is not to round until the final step." The LA comments.*

When this interaction is genuine and done properly, students’ sense of community and learning can improve. Moreover, instructors do their best to work with all students whether they are their students or not. In this study, we compare two semesters taught by the same instructor. Some limitations are: (1) the students’ population can be somewhat different between the two semesters because often fall semesters show better performance results than those of spring semesters. We assume that they are not extensively different due to the admission and the placement criteria used by the university. (2) We did not have an instrument to measure proactivity prior to establishing the modification. The difference between the two semesters is during the second semester both the regular and the proactive paths were offered as options (Figure 1). During the first semester, the students had the regular path only (Figure 1). In the regular path, the students complete at least three lab hours for credit. In the proactive path, the student can complete two hours for the same credit if another criteria shown in Figure 2 is accomplished. We are not aware of any similar work at the Math Department prior to this attempt.

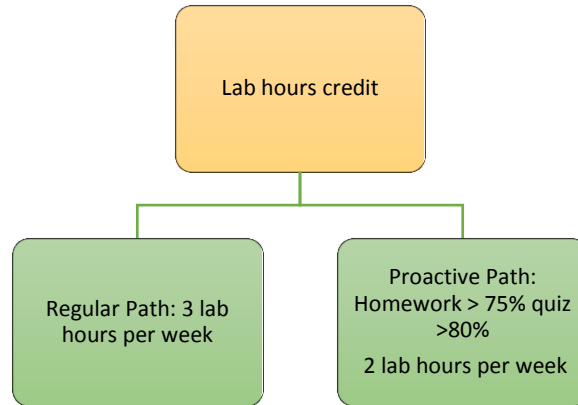


Figure 1. Two Paths in the Modification

Unlike the regular path, the proactive path required mastery on the weekly homework and quiz.

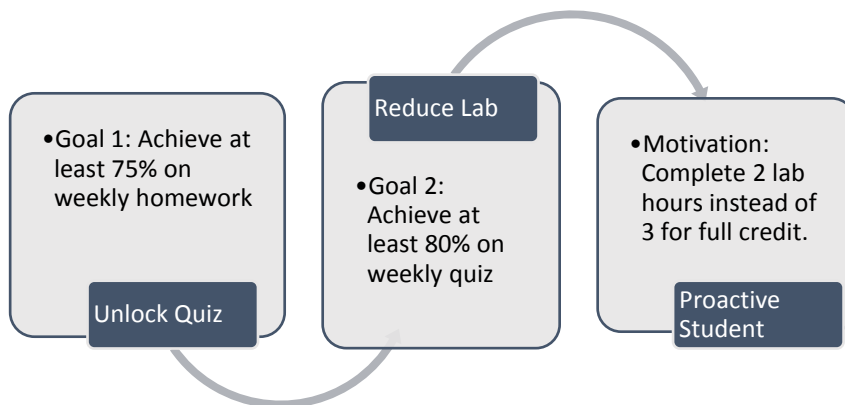


Figure 2. Proactive Path Process

There is an extensive research on mastery, and modern versions are based on John B. Carroll’s “Model for School Learning” article (1963). Carroll discussed the aptitude to be an indicator learning; all children have the potential to learn but their learning rate vary (Wright, 2015). Based on Carroll’ research, we believe that students’ with low math aptitude do not benefit from working on homework on the last day it is due. They do not allow themselves enough time to learn the subject and ask questions. Students often miscalculate the time they need to learn a subject. The degree of learning varies directly with time spent and inversely with time needed (Wright, 2015), expressed in this equation:

$$degree\ of\ learning = f\left(\frac{time\ spent}{time\ needed}\right)$$

## Results

### Before the Modification

Because students can withdraw at any week between the first week and the official day of withdrawal, and since they lose access to the computer lab after withdrawal, we find the average of their weekly hours not to be reliable compared to others. Therefore, we excluded withdrawals from the results and we are interested in investigating the behavior of those who completed the course. Figure 3 shows the grades breakdown during spring 2015. Among 324 students, 76% passed and the percentage of As is 27%, Bs is 28%, and Cs is 21%.

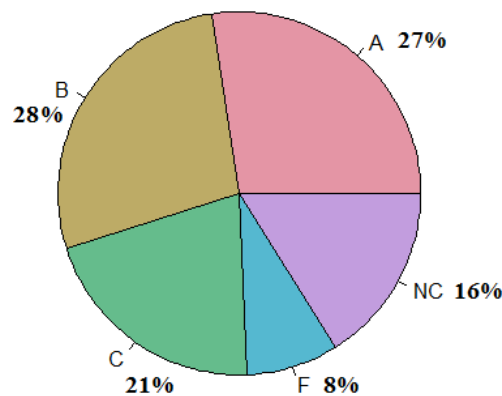


Figure 3. Final Grades Breakdown

Since students complete homework prior to attempting the weekly quiz, we checked the days in which the students worked the homework. *Worked* is defined here as the day in which the student reached the best score or completed the assignment. *Availability days* are the days in which the assignment is available and the student can improve the score, usually, it open in day 1 and closes in day 7. Figure 4 confirms the noticeable behavior that the majority of students worked the homework on the day it was due. About 11% worked the homework on day 3.

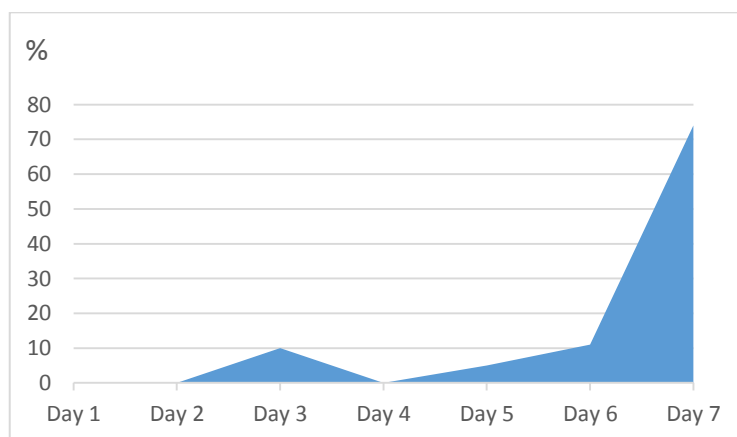


Figure 4. Percentage of Students *Worked* Homework vs. *Availability Day*

Figure 5 summarizes students' performance and its relationship to lab hours. The students are grouped based on their final grades and their lab hours are averaged. The students who earned "A" as a final grade averaged 3 weekly lab hours. Students who earned "B" as a final grade averaged 2 ½ weekly lab hours. Students who earned "C" as a final grade averaged 2.1 weekly lab hours. The students who failed the course averaged 1 ½ weekly lab hour or less. Those results match the literature finding that an increase of time on task accompanies an increase in performance. In the work (Ye1 & Herron, 2012), there is a positive correlation between the lab hours and the final exam scores; as a result, the number of hours a student spends in the computer lab is definitely a predictor of a student's achievement. Hence, the students that skip the lab are likely to fail. We also conclude that the students who passed the course averaged at least two hours per week. The latter point is the factor behind our decision to reduce lab hours to two in the stated modification.

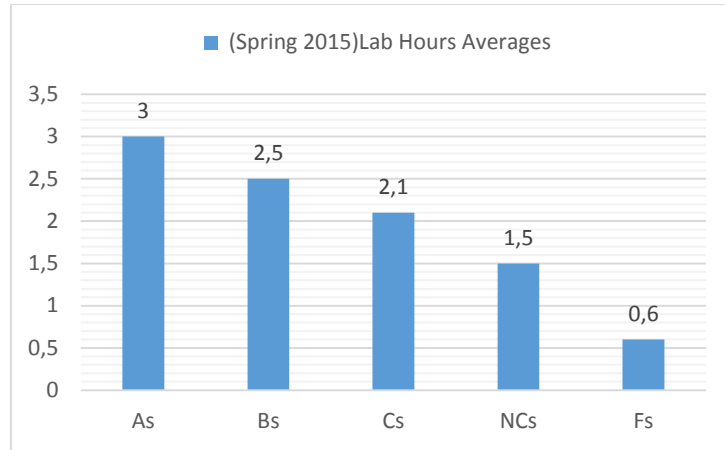


Figure 5. Lab Hours Averages vs. Grouped Letter Grades (Spring 2015)

**The Modification: Offer a Proactive Path**

In fall 2015, same grading was kept and same tests were given. Proactive path (Figure 2) was offered to two sections with 695 students as an option with the regular path (Figure 1). Figure 6 shows lab hours averages for the grouped students based on their final letter grades. Unlike Figure 5, the lab hours averages for As, Bs and Cs are very close to each other, about 2 hours per week.

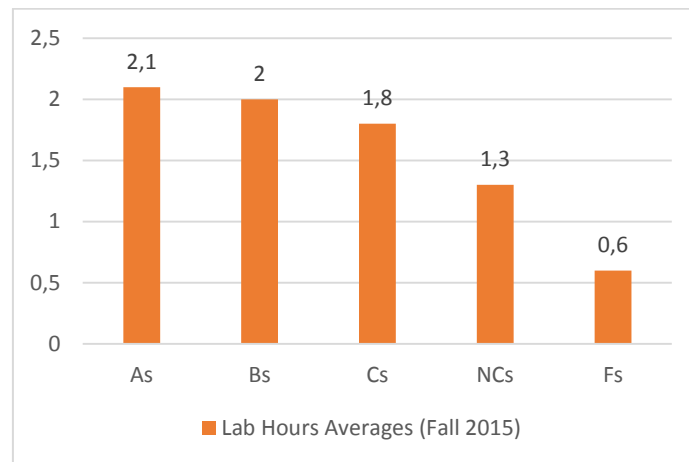


Figure 6. Lab Hours Averages vs. Grouped Letter Grades (Fall 2015)

The lab time is reduced and can cause panic that performance is affected. However, Figure 7 shows a new behavior. The majority of students *worked* the assignments early.

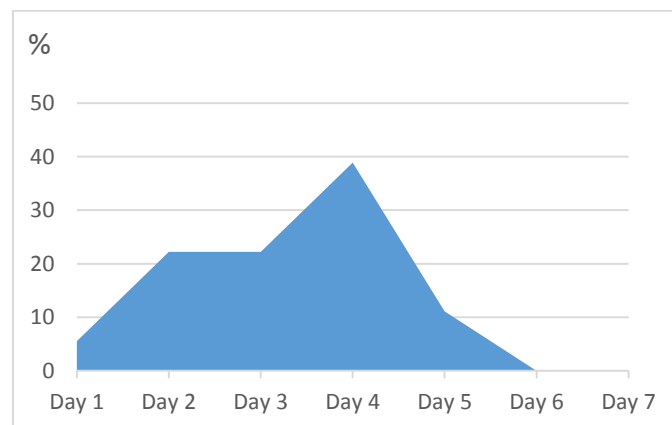


Figure 7. Percentage of Students Worked Homework vs. Availability Day (Fall 2015)

Shifting the area in Figure 4 to left as in Figure 7 was the intent of the modification. The students should complete homework and quiz to a certain level (spend time at home) prior to going to the lab (spend 2 hours), which increases their time on task. We often saw students in the lab working on practice tests or view other resources because they already completed weekly assignments. In the regular path, students associated homework with the lab hours so they do homework in the lab. Figure 8 displays the final grades distribution. The success rate increased from 76% in spring 2015 to 84% in fall 2015 (+8%). The grade distribution changed, especially for As percentage, it increased from 27% to 43% (+16%).

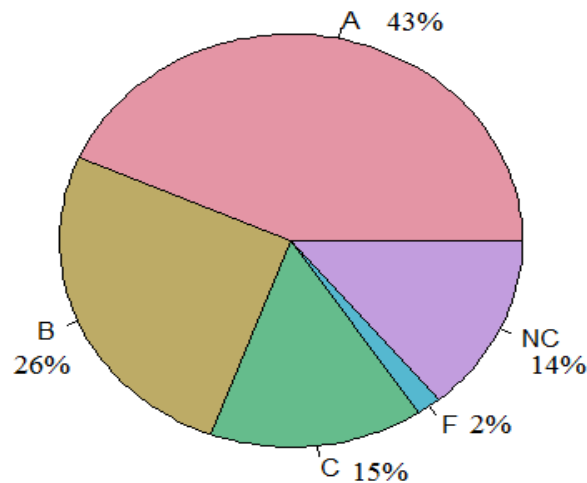


Figure 8. Final Grades Breakdown

We can suggest that the increase of success is due to students being proactive and developing better studying habits. The increase of As is due to the mastery requirement that improved their homework and quiz scores (Table 2). Class activities scores improved as well. We examine first week assignments during both terms as posted in Table 1. It looks that the students' buy-in of the proactive path was quick. The lab hours scores average was 97.55% for 2.52 hours per week in fall 2015 while it was 69.98% score for 2.47 hours per week in spring 2015.

Table 1. First Assignments Comparison

|                    | Lab time in hours<br>(average) /week |              | Lab hours 1 -<br>Scores average |              | Homework 1 -<br>scores average |              | Quiz 1 - scores<br>average |              |
|--------------------|--------------------------------------|--------------|---------------------------------|--------------|--------------------------------|--------------|----------------------------|--------------|
|                    | Spring<br>2015                       | Fall<br>2015 | Spring<br>2015                  | Fall<br>2015 | Spring<br>2015                 | Fall<br>2015 | Spring<br>2015             | Fall<br>2015 |
| Mean               | 2.47                                 | 2.52         | 69.98                           | 97.55        | 94.81                          | 90.31        | 87.26                      | 85.07        |
| Standard Error     | 0.07                                 | 0.05         | 1.81                            | 0.59         | 0.81                           | 0.72         | 1.04                       | 0.89         |
| Median             | 3.06                                 | 2            | 84.21                           | 100          | 100                            | 97.5         | 90                         | 90           |
| Mode               | 0                                    | 2            | 89.47                           | 100          | 100                            | 100          | 100                        | 100          |
| Standard Deviation | 1.26                                 | 1.42         | 32.60                           | 15.46        | 14.60                          | 18.85        | 18.74                      | 23.42        |
| Range              | 5.09                                 | 10           | 100                             | 100          | 100                            | 100          | 100                        | 100          |
| Minimum            | 0                                    | 0            | 0                               | 0            | 0                              | 0            | 0                          | 0            |
| Maximum            | 5.09                                 | 10           | 100                             | 100          | 100                            | 100          | 100                        | 100          |

The homework and quiz scores averages are comparable because the students did not figure out the ideal way of following the proactive path. Yet, students figure it out the overall results in Table 2 summarizes them. The final exam is standardized, proctored and it is comprehensive. Many schools use it as a measure to learn about an improvement or students' mastery leaving the course. We use it to check whether the modification produced a reliable improvement in performance or this is just a luck. The two cases are set up as hypotheses:

$$\begin{aligned} \text{The null hypothesis } H_0: \mu &\leq 68.87 \\ \text{The alternative hypothesis } H_1: \mu &> 68.87 \end{aligned}$$



Let  $\mu$  symbolize the average of the population of college algebra students that were offered the proactive path option. For the traditional alpha value  $\alpha = 0.05$  or  $F(z) = 0.95$ , we use Excel z-test to find the critical value one-tail to be 1.645, and the value of z equals 2.191. Because 2.191 is greater than the criterion 1.645, we reject the null hypothesis and accept the alternative hypothesis. Consequently, offering the proactive path was an improvement. The two assumptions of this test are the population of scores is normally distributed and the scores are independently distributed.

Table 2. Assignments Scores Comparison

|                   | Spring 2015 (N=324) |        |       |                    | Fall 2015 (N=695) |        |      |                    |
|-------------------|---------------------|--------|-------|--------------------|-------------------|--------|------|--------------------|
|                   | Mean                | Median | Mode  | Standard Deviation | Mean              | Median | Mode | Standard Deviation |
| Homework          | 79.02               | 86.98  | 100   | 22.334             | 90.38             | 94.81  | 100  | 14.636             |
| Quizzes           | 74.47               | 82.27  | 95.55 | 22.62              | 85.09             | 90.79  | 100  | 17.824             |
| Lab Scores        | 67.36               | 75     | 100   | 31.311             | 86.60             | 100    | 100  | 24.437             |
| Class             | 77.75               | 90.83  | 100   | 27.689             | 85.76             | 98.08  | 100  | 22.344             |
| Three Tests       | 77.86               | 83.455 | 100   | 20.551             | 74.61             | 80.54  | 100  | 21.196             |
| <b>Final Exam</b> | <b>68.87</b>        | 74.97  | 0     | <b>24.91</b>       | <b>72.35</b>      | 76.25  | 95   | <b>20.69</b>       |
| Overall           | 74.28               | 79.645 | 91.8  | 20.489             | 82.70             | 87.16  | 100  | 16.834             |

### Conclusion

This study reaffirms that requiring weekly lab hours in a college algebra course is fruitful. It should also lead the way to consider researching the integration of motivation in other low math courses. College algebra is known to be one of the worst courses for students. Either they did not retain the knowledge after taking it or they did not learn it well. College algebra is also a general education course and it is mandated for several majors in many school (Gordon, 2008). Consequently, a good number of students see it as an item to check off a mandated courses list. The situation lowers the intrinsic motivation.

As previously discussed, research has shown that intrinsic motivation correlates positively with the academic achievement (Corpus, McClintic-gilbert, & Hayenga, 2009). Therefore, one should find a motivator to incorporate. We suggest to request students’ feedback about the course design and environment to draw some conclusions about a possible motivator. Furthermore, in addition to motivation, Figure 10 summarizes the factors we tried to bring as strategic to make a computer lab successful in supporting students to be independent learners.

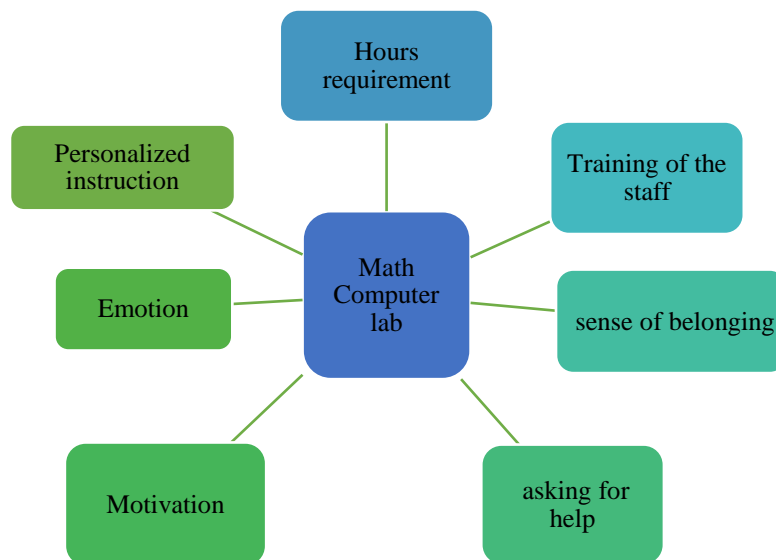


Figure 10. Key factors for Success

Requiring lab hours can be implemented in different ways depending on the lab role discussed in the introduction. Training of the staff on effective tutoring strategies and on giving good feedback is crucial. Both emotion and sense of belonging are significant to learning, hence, the lab environment should be positive and welcoming. Asking for help should be facilitated through different methods. Finally, the lab cannot accomplish the desire mission without a personalized instruction since students are going to be working on different content and come with different skills.

## References

- Almed, V., Baker, R., & Corbett, A. (2017). Help avoidance: When students should seek help, and the consequences of failing to do so. *Teachers College Record*, 119(3), 1–24. <https://doi.org/10.1080/10601325.2017.1387481>
- Andrew Barr, W. (2018). Ecomorphology. *Vertebrate Paleobiology and Paleoanthropology*, 26(1), 339–349. [https://doi.org/10.1007/978-3-319-94265-0\\_15](https://doi.org/10.1007/978-3-319-94265-0_15)
- Butler, R. (1998). Determinants of Help Seeking: Relations between Perceived Reasons for Classroom Help-Avoidance and Help-Seeking Behaviors in an Experimental Context. *Journal of Educational Psychology*, 90(4), 630–643. <https://doi.org/10.1037/0022-0663.90.4.630>
- Corpus, J. H., McClintic-gilbert, M. S., & Hayenga, A. O. (2009). Within-year changes in children ' s intrinsic and extrinsic motivational orientations : Contextual predictors and academic outcomes. *Contemporary Educational Psychology*, 34(2), 154–166. <https://doi.org/10.1016/j.cedpsych.2009.01.001>
- Crant, J. M., & Bateman, T. S. (2000). Charismatic leadership viewed from above : The impact of proactive personality Charismatic leadership viewed from above : The impact of proactive personality J Michael Crant ; Thomas S Bateman, 1379(November 2017). [https://doi.org/10.1002/\(SICI\)1099-1379\(200002\)21](https://doi.org/10.1002/(SICI)1099-1379(200002)21)
- Dawson, S. (2006). A study of the relationship between student communication interaction and sense of community. *Internet and Higher Education*, 9(3), 153–162. <https://doi.org/10.1016/j.iheduc.2006.06.007>
- Floyd Kelly, M. R. (1977). *A Math Lab Study*. Eric. Oceanside, CA.
- Gordon, S. P. (2008). What ' s Wrong with College Algebra? What ' s Wrong with College Algebra ?, 1970. <https://doi.org/10.1080/10511970701598752>
- Horizons, S. B., Jun, M., & Issue, V. (1999). Proactive Behavior : Meaning , Impact ., *Business Horizons*, 42(3), 63–70.
- NCAT. (2011). NCAT. <https://doi.org/10.1360/zd-2013-43-6-1064>
- Newman, R. S. (2002). How Self-Regulated Learners Cope with Academic Difficulty: The Role of Adaptive Help Seeking. *Theory Into Practice*, 41(2), 132–138. [https://doi.org/10.1207/s15430421tip4102\\_10](https://doi.org/10.1207/s15430421tip4102_10)
- Overbaugh, R. C., & Lin, S. (2006). Student characteristics, sense of community, and cognitive achievement in web-based and lab-based learning environments. *Journal of Research on Technology in Education*, 39(2), 205–223. <https://doi.org/10.1080/15391523.2006.10782480>
- Puustinen, M. (2017). Help-seeking behavior in a problem-solving situation : Development of self-regulation Author ( s ): Minna Puustinen Stable URL : <http://www.jstor.org/stable/23420179> Linked references are available on JSTOR for this article : Help-seeking behavior in a pr, 13(2), 271–282.
- Rovai, A. P., & Wighting, M. J. (2005). Feelings of alienation and community among higher education students in a virtual classroom. *Internet and Higher Education*, 8(2), 97–110. <https://doi.org/10.1016/j.iheduc.2005.03.001>
- Tasgin, A., & Coskun, G. (2018). The Relationship between Academic Motivations and University Students' Attitudes towards Learning. *International Journal of Instruction*, 11(4), 935–950. <https://doi.org/10.12973/iji.2018.11459a>
- Twigg, C. A. (2011). The math emporium: A silver bullet for higher education. *Change: The Magazine of Higher Learning*, 43(4), 25–34. <https://doi.org/10.1080/00091383.2011.569241>
- Whiteley, P. (2002). *Motivation*. Oxford, United Kingdom: John Wiley and Sons, Inc.
- Williams, K. C., & Williams, C. C. (2012). Five key ingredients for improving student motivation. *Research in Higher Education Journal*, 1–23. <https://doi.org/10.5430/ijhe.v4n1p22>
- Wood, D. (2001). Scaffolding, contingent tutoring and computer-supported learning. *International Journal of Artificial Intelligence in Education*, 12, 280–292. <https://doi.org/10.1177/1362168813482935>
- Wright, J. D. (2015). Mastery Learning. *International Encyclopedia of the Social & Behavioral Sciences - Elsevier*, 14(2), 752–759. <https://doi.org/10.1016/j.radphyschem.2014.05.010>
- Wu, C., Parker, S. K., Wu, L.-Z., & Lee, C. (2018). When And Why People Engage In Different Forms Of Proactive Behavior : Interactive Effects Of Self-Construals And Work Characteristics, 61(1), 293–323.
- Ye1, N., & Herron, S. S. . (2012). a Correlation Between Hours Spent in the Math Computer Lab and Final Exam Scores Among Computer-Based College Algebra Students. *Review of Higher Education & Self-*

*Learning*, 5(16), 26–30. Retrieved from  
<http://ezproxy.lib.utexas.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eue&AN=94256096&site=ehost-live>

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