

## CO-REQUISITE COURSES FOR MAJOR SPECIFIC CLASSES

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For years, like most of the country, Bloomsburg University had developmental classes for those students who were underprepared for their college courses. In mathematics, these courses went as low as arithmetic and up to algebra. The goal was that once students completed these prerequisite courses, they would be successful in their college classes. This was the standard practice of many colleges across the country. However, as time went on and the student dynamics changed, it has been shown at Bloomsburg that there are several issues with this model. First, although, we as mathematicians would love every student to have an algebra course, for many of these students, other courses would be more appropriate. Courses such as Introduction to Statistics or Mathematical Thinking, our math for the liberal arts class, may be a better fit. Second, the fact that these courses did not count as credits towards graduation, yet impacted grade point average and cost money, caused students to resent having to take these classes. They simply did not see the value of these courses or how they would help them in their chosen field and therefore, some did not put forth the effort needed for them to succeed. Third, many of the students had to take several developmental classes and for some this became too big of a hurdle for them to pass. Finally, fourth, and probably most important, was the fact that for those students who did succeed in reaching the designated college level course, there was no guarantee they would really be prepared for it. In fact, the truth is that many were unsuccessful.

At Bloomsburg, we decided to conduct an experiment in co-requisite courses. The plan was to have a trial run in our College Algebra and Mathematical Thinking classes. The model we chose was to have a required two-credit co-requisite class. Although the instructor for both the co-requisite and traditional classes was to be the same, those students in the co-requisite course would be mixed with students who were not. Although our plan was to go slow and see how these changes impacted student performance, our administration had other ideas. It was decided that the developmental program would be eliminated and all students who needed remediation would be placed into a co-requisite course. Thus, we needed to create co-requisite courses for the appropriate first course for students' majors. In what follows, we discuss the co-requisite major specific courses, namely the courses for our elementary education and health science majors.

Last fall was the first semester we offered the co-requisite course for Mathematics for Health Sciences, our course for students majoring in health science fields. Dr. Ervin taught one section of a one-credit co-requisite with 35 students enrolled, in conjunction with three sections of the college level class consisting of the 35 students from the co-requisite class together with the 75 students who did not need the remediation. Students in the co-requisite class were evenly distributed between the sections of the regular class. Specific course

concepts that caused difficulty for lower-level students in the past were selected as the main topics for the co-requisite course. The idea was to provide ‘just-in-time’ remediation to enable struggling students to succeed in the regular Math for Health Sciences course.

Topics included in this co-requisite course were real number system and arithmetic operations, scientific notation, solving equations, basic statistics (definitions, graphical/numerical description of data, probability), measurement conversions, domain and range, evaluating and graphing functions, properties of exponential, logarithmic, and inverse functions, systems of equations, linear models and data fitting. Since the course was designed to provide background and strengthen skills before they were covered in the regular course, Dr. Ervin gave a short presentation on each topic in the co-requisite class a few days before it was presented in the regular class. The presentation was followed by practicing problems together as a whole class. As time allowed, small one or two question quizzes were given at the end of class to evaluate knowledge of previous material. This was done in an attempt to ensure that students were completing homework worksheets and keeping up with the material. Quizzes were given only after students had opportunities to ask any questions they may have had regarding the worksheets, and they were permitted to use their worksheets as a guide during quizzes. Worksheets were graded (after questions were answered in class regarding them) as homework assignments.

Results were mixed. It was stunning to see the lack of interest and apathy towards the co-requisite course. To Dr. Ervin’s knowledge, very few students took advantage of the numerous options on campus for free tutoring and did not attend her office hours. Only a few students asked questions during class, and many did not turn in any worksheets for homework grades. There were eight students who withdrew from the co-requisite and regular course, while six students failed the co-requisite cohort and failed the regular course. Of the students who stayed enrolled in both, 78% passed the regular course. This percentage may seem high before being compared to the pass rate of the regular course, which was 90%. So, although ‘most’ students were successful, the co-requisite group was not nearly as successful as their peers. It should be noted that the students enrolled in health science fields tend to be stronger mathematically than some of those enrolled in other majors at Bloomsburg. Historically, these students have high interest in science and are very goal-oriented concerning their plans for future careers and graduate school.

This spring, Dr. Ervin offered the co-requisite course for Math for Health Sciences. One section of the one-credit co-requisite ran with six students enrolled. She taught two sections of the college level class with the students from the co-requisite class equally distributed between them. There were 57 students enrolled in her regular course who did not need remediation. The format for the co-requisite course was changed a bit this spring, as Dr. Ervin used the worksheets as a combination of in-class practice as well as homework. Each page was started in class together as a group and finished as homework. This was meant to encourage completion and provide students with a sense of confidence as they worked individually outside of class.

Although Dr. Ervin was optimistic that such a small co-requisite class size would give students the opportunity for one-on-one instruction and promote a comfort in asking questions during class, it was unsuccessful. Of the six students in the co-requisite course, two students withdrew, one student passed the regular course, and three students failed the regular course. As such, of those who stayed enrolled in both the co-requisite and regular Math for Health Science course, 25% passed the regular course, while the pass rate of the regular course was 90% (the same as the previous semester). Student attitude was even worse than in the previous fall semester; students completed even less homework worksheets and attendance was sporadic at best. One student commented that she knew she was doing herself a disservice while taking courses online during the Covid period, because she purposefully did not pay attention or participate. She admitted that it was now 'coming back to haunt her' and was 'completely her own fault.' When a student openly admits they did not attempt to put forth any effort in previous courses, it leaves one to wonder how they passed those courses and were able to advance. If exceptions were made due to the strain of Covid, perhaps those exceptions are currently hurting, not helping, students as they move beyond the pandemic. It is of great concern as to how long we will see students in this type of situation going forward.

This spring was the first semester we offered the co-requisite course for Concepts of Mathematics 1, our course for the elementary education majors. The Education Department determined that spring was the semester they wanted their students to take their first math class. Dr. Lister taught two sections of a one-credit co-requisite with 35 students enrolled, in conjunction with two sections of the college level class consisting of the 35 students from the co-requisite class together with 37 students who did not need the remediation. Those students in the co-requisite class were fairly evenly distributed between the sections of the regular class. The goal was to help the students in the co-requisite section be successful in the traditional class by reviewing material the students would need.

The co-requisite course began with a brief survey asking students in what areas they felt they were weakest. The results of this survey were consistent in that the majority of students felt they needed help with applications/word problems and fractions. These topics would be integrated into the assigned weekly homework. The structure of the co-requisite course was to have a mini-lecture, 10-15 minutes in length, followed by roughly 30 minutes of problem-solving, and finally, a 5-minute quiz on the material covered in the previous class. During the problem-solving sessions, students worked individually or in groups on the weekly assignment with Dr. Lister answering questions and discussing issues as they arose.

One major component of our Concepts of Mathematics class is what we call the Elementary Math Skills Test, which is worth 20% of their grade. This is a 20-question exam covering arithmetic involving decimals and fractions, rounding, order of operations, averaging, percents, and ordering numbers. Each problem on the exam is graded right or wrong with students needing a score of 80% to pass. Any score less than 80% is considered a zero. The students can take the exam five times with only their highest score counting. The first

six weeks of the co-requisite class focused solely on the review of the material for this exam. These topics were also included as part of the weekly assignments until the five scheduled exam dates had been completed. Other topics covered included applications involving fractions, methods of problem-solving, sequences, prime numbers and divisibility theorems, sets, and non-decimal number systems.

So, what happened in this class? Only 43% of the students from the co-requisite class completed the course. Of those, 87% were successful. As Dr. Ervin discussed, there are several possible reasons for the outcomes of the co-requisite class for the elementary education majors. The level of some students was below what Dr. Lister had expected. This made it hard to balance the needs of the weaker students with those ready for the next topic in the co-requisite class. Also, as Dr. Ervin observed, students would rarely ask for help. Throughout the semester only four of the students from the co-requisite class came to office hours and even in class they would only ask questions when errors were pointed out. Dr. Lister expected students to work in groups when given the opportunity, however, this was not the case. During the problem-solving sessions, students would quietly work alone rarely speaking. Finally, many of the students did not seem to take the class as seriously as they should. It could be that the co-requisite was only one credit or the fact they felt a disconnect between the two classes, but whatever the reason, many students did not attend the co-requisite course, even with attendance and weekly quizzes counting as part of their grade. This attitude could also be, in part, due to the pandemic as Dr. Ervin noted. The majority of these students were first year students who had spent the last two years of high school learning in a less than ideal setting, the impact of which we are only now getting to experience. This is a problem that needs to somehow be fixed. Although the numbers do not show that the course was an overwhelming success, Dr. Lister did receive one moment that all teachers hope to have, namely a thank you. One student from the co-requisite class thanked Dr. Lister, saying that they 'had struggled with math all their lives' and that she 'had helped them gain a better understanding and confidence in the subject even if it was not reflected in their grades'.

Going forward, the Department of Mathematical and Digital Sciences at Bloomsburg has implemented changes to the co-requisite program. All but one co-requisite course will become two credits in the future. The course that will remain as one credit is Mathematics for the Health Sciences, which as we have stated, has a more focused group of students. Also, the courses are now going to be combined. Instead of separate two- and three-credit classes, students will be enrolled in a single five-credit class allowing instructors the opportunity to integrate the material into the class instead of it being an add-on that the students may see as disconnected. Hopefully with these changes and as we gain more experience with co-requisite classes, we can not only improve student outcomes, but also improve student appreciation for mathematics in general.