Preface to the Instructor

According to the Community College Research Center, a student who places only one level below college mathematics (typically, Intermediate Algebra), has just a 27% chance of passing the gatekeeper college level math (such as College Algebra or Introductory Statistics). The likelihood of passing college math is even worse for students who place two or more levels below college mathematics. Further, some research suggests that up to 18% of students are under-placed in mathematics courses (*Source:* MDRC and Community College Research Center "Moving Beyond the Placement Test: Multiple Measures Assessment"). These two data points suggest that we might want to consider alternative pathways through the mathematics curriculum.

With demand for STEM (Science, Technology, Engineering, and Mathematics) students continuing to expand with employment in STEM occupations growing by 10.5% from 2009 to 2015 (*Source:* U.S. Bureau of Labor Statistics), it is very important that students succeed in courses such as College Algebra.

One pathway through the mathematics curriculum that is gaining in popularity is the "Corequisite Solution". Corequisite remediation is an approach to developmental education that places students in entry-level college courses while they simultaneously receive remedial academic support.

There are a variety of corequisite solutions that exist. It is up to the instructor to decide which model is best suited for the students at their particular institution.

The first decision an instructor must make is deciding whether they teach the corequisite course sequentially or on a just-in-time basis. With the sequential model, the developmental mathematics content is taught in its entirety prior to teaching the college level material. With the just-in-time model, the developmental mathematics material is taught on a just-in-time basis in conjunction with the college level material. For example, the developmental component might review simplifying square roots and the Pythagorean Theorem prior to covering the Distance Formula in the College Algebra course. Most experienced corequisite instructors would argue the sequential model really is not a corequisite model, and that the corequisite model was meant to be taught using the just-in-time model.

Another decision that must be made is whether to comingle college level students with corequisite students in the college level course (heterogeneous model) versus have corequisite students exclusively in the college level course (homogeneous model). There are advantages and disadvantages to both models. An advantage of the homogeneous model is that it is easier for administration to schedule classes, but heterogenous models may give students more flexibility in class scheduling for students.

The final decision is determining how to deliver the content in the corequisite section. Again, there are two prevalent schools of thought that exist. One option would be to use mastery-based learning along with personalized learning paths. With the mastery-based learning model, students may take a preliminary quiz to assess the students understanding of the corequisite material. Should the student pass the quiz at a level determined by the instructor (such as 70%), the student is considered to have satisfied the prerequisite knowledge for the corresponding college-level material. If the student does not pass the quiz, then a personalized study plan is developed that focuses only on those skills the student has not demonstrated proficiency. Upon completion of this remediation plan, the student retakes the mastery quiz/test. This process repeats itself until the student achieves the level of mastery sought by the instructor. This model works best in a self-paced learning environment such as a computer lab and is based on emporium-style education that has been touted by organizations such as the National Center for Academic Transformation (NCAT). The other option is to use a form of a lecture-based course. This means moving all students through the curriculum at the same pace, regardless of their level of understanding upon entering the course. We are not saying the course must be 100% lecture, rather, this model simply keeps all students at the same point in the corequisite course and likely has standard assessment tools for gauging understanding.

Another factor to consider is whether there should be a single instructor for both the corequisite section and college-level section. The best option is to have the same instructor for both the corequisite and college-level sections because the instructor can adapt the pacing of both courses based on the needs of the students.

The Structure of the Corequisite Material

Corequisite Support for College Algebra: Concepts through Functions provides the material necessary to have a successful corequisite College Algebra course. Each chapter in the corequisite text contains material that is needed to be successful in the corresponding chapter in *College Algebra*. Chapter R of the corequisite text (*Corequisite Support for College Algebra: Concepts through Functions 4e*) contains material that is review from College Arithmetic and Elementary Algebra. The material in this chapter forms the foundation for the rest of the corequisite course. We recommend students be given a mastery-based quiz for this content along with a personalized study plan because the students will have varied backgrounds and skill-sets upon entering the course. This will allow each student to proceed through the chapter based on their personal needs.

The material in Preparing for Chapter F of the corequisite support course is meant to be covered prior to (or while) covering the material in Chapter F of *College Algebra*. Below is a summary of the work flow.

- Complete Preparing for Chapter 1 of the corequisite support material prior to (or while) covering Chapter 1 of *College Algebra*.
- Complete Preparing for Chapter 2 of the corequisite support material prior to (or while) covering Chapter 2 of *College Algebra*.
- And so on…

There is no additional corequisite material after Chapter 4 because there are no additional developmental math skills students need to acquire after Chapter 4 to be successful in College Algebra.

The presentation of the material in *Corequisite Support for College Algebra: Concepts through Functions 4e* is innovative. For example, the annotations are provided to the **left** of the arithmetic/algebra rather than the right, which is the practice in most texts. Because we read from **left to right**, placing the annotation on the left will make more sense to the student. It becomes clear that the annotation describes what we are about to do

EXAMPLE 3 Solving a Linear Equation by Combining Like Terms

Solve the linear equation: $3y - 2 + 5y = 2y + 5 + 4y + 3$

Solution

$$3y - 2 + 5y = 2y + 5 + 4y + 3$$

Combine like terms: $8y - 2 = 6y + 8$

Subtract $6y$ from both sides: $8y - 2 - 6y = 6y + 8 - 6y$

$$2y - 2 = 8$$

Add 2 to both sides: $2y - 2 + 2 = 8 + 2$

$$2y = 10$$

Divide both sides by 2: $\dfrac{2y}{2} = \dfrac{10}{2}$

$$y = 5$$

Check $3y - 2 + 5y = 2y + 5 + 4y + 3$

Let $y = 5$ in the original equation: $3(5) - 2 + 5(5) \stackrel{?}{=} 2(5) + 5 + 4(5) + 3$

$$15 - 2 + 25 \stackrel{?}{=} 10 + 5 + 20 + 3$$

$$38 = 38 \quad \text{True}$$

Because $y = 5$ satisfies the equation, the solution of the equation is 5, and the solution set is $\{5\}$.

instead of what was just done. The annotations may be thought of as the teacher's voice offering clarification immediately before writing the next step in the solution on the board.

There are also "How to" examples that provide a guided, step-by-step approach to solving a problem. Students can then immediately see how each of the steps is employed. "How to" examples have a three-column format in which the left column describes a step, the middle column provides a brief annotation, as needed, to explain the step, and the right column presents the arithmetic/algebra. With this format, students can see each step in the problem-solving process in context so that the steps make more sense.

EXAMPLE 2 How to Factor Out the Greatest Common Factor in a Polynomial

Factor out the greatest common factor: $4a^2b^2 - 10ab^3 + 18a^3b^4$

Step-by-Step Solution

Step 1: Find the GCF.	$\text{GCF} = 2ab^2$
Step 2: Rewrite each term as the product of the GCF and the remaining factor.	$4a^2b^2 - 10ab^3 + 18a^3b^4 = 2ab^2 \cdot 2a - 2ab^2 \cdot 5b + 2ab^2 \cdot 9a^2b^2$
Step 3: Factor out the GCF.	$= 2ab^2(2a - 5b + 9a^2b^2)$
Step 4: Check	$2ab^2(2a - 5b + 9a^2b^2) = 2ab^2 \cdot 2a - 2ab^2 \cdot 5b + 2ab^2 \cdot 9a^2b^2$ $= 4a^2b^2 - 10ab^3 + 18a^3b^4$

So $4a^2b^2 - 10ab^3 + 18a^3b^4 = 2ab^2(2a - 5b + 9a^2b^2)$.

Placed at the conclusion of most examples, the Quick Check exercises provide students with an opportunity for immediate reinforcement. By working the problems that mirror the example just presented, students get instant feedback and gain confidence in their understanding of the concept. All Quick Check exercise answers are provided in the answer section.

Quick ✓

1. When factoring a polynomial of the form $x^2 + bx + c$, find pairs of integers m and n such that $\underline{m \cdot n} = c$ and $\underline{m + n} = b$.
2. *True or False* $x^2 + 12x + 11 = (x + 11)(x + 1)$ True
3. $x^2 + 19x + 84 = (x + 12)(x + \underline{7})$

In Problems 4 and 5, factor each polynomial.

4. $y^2 + 9y + 18$ $(y + 6)(y + 3)$
5. $p^2 + 14p + 24$ $(p + 2)(p + 12)$

Every objective has at least one video that has been created by Michael Sullivan, III. The videos are often from his actual classroom lectures. This makes the videos authentic and gives the viewer the sense of participating in the lecture. The videos are under 12 minutes in length. For those objectives that require more than 12 minutes, we have multiple videos. Students are alerted to the availability of a video with the ▶ icon. The videos are available in MyLabMath or through a Quick Response (QR) code at the beginning of each section. There are also QR codes at the end of section exercises where underlined problems have complete video solutions. All videos are captioned in English and Spanish.

QR Code

Problem Icons In addition to the carefully structured categories of exercises selected problems are flagged with icons.

- Problems whose number is underlined have completed worked-out solutions found in MyMathLab.

- △ These problems focus on geometry concepts.
- A calculator will be useful in working the problem.

The Learning Path

As mentioned earlier, the learning path for students in a corequisite course is something that each individual instructor must decide upon. However, the course downloaded from Pearson has been developed by the authors and comes with the following learning path:

1. For Chapter R, Elementary Algebra Review.
   a. Student takes a diagnostic quiz on Sections R.1 through R.4. The material in these sections qualifies as an arithmetic quiz. If the student passes, the student then moves to taking a diagnostic quiz on Sections R.5 through R.10, which represents an Elementary Algebra quiz.
   b. If the student does not pass the R.1-R.4 diagnostic quiz, then the student must complete a personalized homework for each section in which the student does not demonstrate mastery. For example, if the student demonstrates mastery on the Section R.1 material, then the student will not need to complete personalized homework for that section. However, if the student does not demonstrate mastery on Sections R.2, R.3, and R.4, then the student must complete the personalized homework for those sections before retaking the R.1-R.4 diagnostic quiz.
   c. Once the student completes the arithmetic sections (R.1 to R.4), the student takes a diagnostic quiz on Sections R.5 to R.10 (Elementary Algebra). If the student passes the quiz, the student may move to Preparing for Chapter F. If the student does not pass the R.5-R.10 diagnostic quiz, then the student must complete a personalized homework for each section in which the student does not demonstrate mastery. For example, if the student demonstrates mastery on Sections R.5 and R.7, but not R.6, and R.8-R.10, then the student must complete personalized homework for Sections R.6 and R.8-R.10. Upon completion of the personalized homework, the student retakes the diagnostic quiz until mastery is achieved.
2. Student works through an assignment for each section of Preparing for Chapter F.
3. Student works through an assignment for each section of Preparing for Chapter 1.
4. And so on.

Each assignment in the Preparing for chapters has two MyLabMath assignments.

- The first assignment is a multimedia assignment that incorporates the Author in Action lecture videos, the new applet discovery exercises, “How To” guided exercises, and the Quick Check exercises from the text. Recall, the Quick Check exercises follow many of the examples in the text. To assist students in utilizing the text, the Textbook learning aid for each Quick Check exercise will link directly to the corresponding example in the text. All learning aids, with the exception of “View an Example”, will be available for this portion of the homework. Our experience as instructors has been that too many students rely on this learning aid while doing homework, thereby reducing the effect of homework as students simply mimic the View an Example content.
- The second assignment is based on the Skill Building and Mixed Practice exercises from the text. Skill building exercises are tied to objectives within the text, so the Textbook learning aid will link directly to the objective within the section. The idea is to reduce the amount of guidance provided to the student (compared with Quick Check exercises) so they are more responsible for identifying the problem type. The Mixed Practice exercises are based on multiple concepts learned within the section or text, so the Textbook learning aid is linked to the

section. The student must determine the problem type based on Quick Check and Skill Building exercise experience. The "View an Example" learning aid is disabled for this exercise set as well. Because this text has Skill Builder available in MyLabMath, you may consider reducing the number of exercises in the second assignment. By checking the Skill Builder box, the assignments will adapt to provide support exercises personalized to each student's needs.

Note: If you are using a mastery-based learning model, you will need to build quizzes (at either the chapter or section level to assess mastery of skills for each Preparing for chapter).

Study Skills

In our experience as corequisite instructors, one of the main impediments to success for our students has been their lack of study skills. In fact, data based on Tennessee corequisite students compiled by the Tennessee Board of Regents showed that students who failed both their corequisite course and college-level course also only earned roughly 20% of all attempted college credits for all their courses, while students who passed both courses also earned roughly 85% of all attempted credits for all their courses. What does this suggest? It suggests that students who are not successful in corequisite courses tend not to be successful in any of their courses. These students can be described as not being college-ready (as opposed to academically ready). Therefore, corequisite courses must develop quality study skills in students. To address this, Jessica Bernards and Wendy Fresh developed innovative study skills videos. The following skills are addressed in the videos and are assignable within MyLabMath.

1. How Learning Math Is Different
2. Grit and Growth Mindset in Math
3. Resources Available for Help
4. Time Management
5. How to be an Effective Listener and How to Take Notes
6. How to Do Math Homework the Right Way
7. How to Study for a Math Exam
8. Overcoming Math and Test Anxiety

Classroom Activities

For students to fully grasp mathematical concepts, they need to be active learners. With this in mind, we developed a variety of classroom activities for every section of the corequisite material. Activities such as station mazes, math scavenger hunts, matching activities, and math puzzles that engage the student and allow them to work together in a meaningful way to flush out misconceptions and gain a deeper understanding of the mathematical concepts. Additionally, each activity has instructor suggestions for implementing the activity such as group size, focus, and time. Theses are available in the Instructor Resource Tab of the MyLabMath course.

Course Dependencies

Teaching a corequisite course is a delicate balancing act. The instructor must be sure the students have mastery of the corequisite content while also making sure the integrity of the corresponding college algebra course is maintained (and the course content is completed). Therefore, it is likely necessary for an instructor to begin some college algebra material even though the corresponding corequisite content is not complete. The table below lists sections in the corequisite course that should be mastered prior to introducing the corresponding college algebra material. A detailed table of contents for both the college algebra text and corequisite support text follows on the next page.

Co-Requisite Section Completed before…	…College Algebra Section
Chapter P Elementary Algebra Review	Any College Algebra material
Section PF.1	Section F.1
Sections PF.2 through PF.4	Section F.2
Section PF.5	Section F.4
Section P1.1	Section 1.1
Section P1.2	Section 1.3
Section P1.3	Section 1.7
Sections P2.1 through P2.3	Section 2.3
Section P2.4	Section 2.7
Section P2.5	Section 2.8
Sections P3.1 and P3.2	Section 3.2
Section P3.3	Section 3.4
Sections P3.4 through P3.6	Section 3.5
Sections P4.1 and P4.2	Section 4.3
Section P4.3	Section 4.6
Sections P4.4 and P4.5 are optional and included for completeness of the discussion of radicals	