Good Practice

for the

Implementation of Prerequisites

Academic Senate for California Community Colleges

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Curriculum Committee, 1996-97

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Introduction

Prerequisites are an essential tool in the construction of curriculum for courses in which student success is highly dependent on previously acquired knowledge or skills. However, effective use of prerequisites requires a balance of several countervailing factors. (Used in this general sense the term prerequisites applies also to corequisites and other limitations on enrollment.)

Applied overzealously, prerequisites which go beyond needed skills will unnecessarily limit students' access to courses and inhibit their ability to make normal progress toward fulfilling their educational potential and may drive qualified students away causing financial loss to the college. Used laxly or not at all, weak or non-existent prerequisites do not inform students of skills needed to succeed in their courses. Instructors will find course goals hard to achieve when precious class time is needed to teach such unprepared students. In fact, these situations often create pressures to reduce academic standards. The tendency of unprepared students to drop out will create unfilled seats for which the college will generate no income and make it seem that the instructional program is weak and ineffective.

Properly set prerequisites benefit all: students, faculty, and the college. Students know what is expected of them without being denied access, faculty teach prepared students and have a positive classroom environment, and the college has efficient educational programs.

Appropriate prerequisites also require a balance between externally imposed mandates and local control. State standards help to assure that prerequisites do not deny access but yet uphold academic standards--the balance stated above. But local control must be maintained over the mechanisms employed to institute prerequisites and to empower faculty in assessing academic standards. Striking this balance was one of the goals of the framers of the Title 5 prerequisite regulations passed in September of 1993.

As good practices for putting these regulations into place are discussed in this paper, keep in mind the balance between access and success and between state and local control.

Advisories for Recommended Preparation

An instructor may wish to give advice to students on skills which will enable them to get more out of a class. ***Advisories for recommended preparation*** are intended to identify skills which will broaden or deepen a student's learning experience but without

which the student will still succeed in the course. The college does not block student enrollment for lack of advisory skills. Students are free to ignore the advice.

As is suitable for a recommendation, not a great deal is required to establish advisories. The process is known as a ***basic content review***. Each local college is expected to develop its own content review process. Typically, the content review process is accepted by vote of the curriculum committee and the academic senate and a form and/or explanation for content review is included in the college curriculum handbook. A good model for content review is that outlined in Method #23 in *Matriculation Evaluation: Phase III Local Research Options (California Community Colleges Chancellor's Office, June 1992)*. In short, three steps are involved.

First, the discipline faculty who teach the course examine their class materials: course outline, syllabus, text, exams, and so forth. The point is to list skills that it would be a good idea for students to have but which are not necessary to pass the class. If, in the opinion of the discipline faculty, the students would be highly unlikely to succeed without one or more previously-acquired skills, then the faculty should consider proposing a prerequisite.

Next, the faculty should agree, either by consensus or vote, on the skills to recommend. Finally, the best means by which students can acquire these skills should be identified. This is usually a course--but not always. Examples of non-course advisories might include typing speed for a computer course, a high school biology class for a college biology class, or eligibility for English 1A for a history class. Note that many of these would be difficult to establish as prerequisites.

To obtain curriculum committee approval for an advisory, the originating faculty typically 1) present a rationale which summarizes the process used and 2) include the advisory skills in the course outline [Title 5 §55202(a)]. If the process is clear and the course outline coherent, committee approval is routine.

Levels of Scrutiny for Prerequisites

The method to establish a prerequisite, called the ***level of scrutiny***, varies with the type of course: 1) prerequisites for transferrable courses can be established by a basic content review plus identification of similar prerequisites used at three UC or CSU campuses; 2) courses within or across sequences, especially vocational courses which have no UC or CSU equivalents, can have prerequisites by going through a documented content review; and 3) out-of-sequence communication and computation skills (and non-course prerequisites) require data collection and analysis in addition to content review.

Many transferrable courses have standard prerequisites that are well recognized in the discipline. The analysis begins with ***basic content review*** as described under advisories but with a higher level of rigor: identifying skills without which the student is highly unlikely to succeed. Agreement of the discipline faculty on these skills, either by

consensus or vote, is important. In some cases it may help to have each faculty member rank the skills, for example on a scale such as 1-to-5, for the degree of impact on student success. A mean score above certain level, e.g. 4, might be recommended before advancing the skill for the prerequisite. The appropriate course which teaches these skills is then proposed. If a similar course is used as a prerequisite at ***three or more UC or CSU campuses***, the prerequisite is justified [Model District Policy II.A.1.a.].

Documentation presented to the curriculum committee might consist of 1) a summary of the process and rationale, and 2) copies of the catalog descriptions of the target and prerequisite courses at three UC or CSU campuses--perhaps with a narrative if the comparability of the courses is not obvious, and 3) a list of the prerequisite skills in the course outline. The curriculum committee approves the course and the prerequisite by separate action, applying the criteria that 1) the content review process has been followed, 2) the UC/CSU and proposed college courses are comparable, and 3) the course outline is complete, well integrated, coherent and meets Title 5 standards.

The second level of scrutiny is ***documented content review*** [Model District Policy II.A.1.b.]. This analysis is sufficient to establish prerequisites within a sequence or across a sequence, such as prerequisites for a vocational courses which have no UC/CSU equivalents. Excluded are communication or computational skills--which require data collection and analysis. The term “in a sequence” does not imply that the courses are numbered or lettered sequentially--or even that the courses are in the same discipline. If the course content of A is structured to lead into course B and students normally take B after A, clearly the courses are sequential. Examples include so-called “service courses” such as “Chemistry 70, Pharmaceutical Chemistry” (in the chemistry discipline) as a prerequisite for “Pharmacy 101: The Chemical Basis of Pharmacology” (in the pharmacy technology discipline).

The fundamental difference between a basic content review and a documented content review is the need to present evidence that the identified prerequisite skills are covered in the proposed prerequisite course.

Again, the curriculum committee approves the course outline and the prerequisite by separate action. In evaluating the proposed prerequisite, the committee is generally checking that 1) the content review process was followed, 2) the proposed prerequisite course does indeed teach the needed skills (and that both the target and prerequisite course outlines demonstrate this--perhaps using a grid analysis such as that shown below), and 3) the course outline is complete, well integrated, coherent and meets Title 5 standards.

		Target Course Prerequisite Skills		
		1	2	3
Prerequisite Course Student Outcomes	1		X	
	2	X		
	3			X

The analysis of the exit skills in the prerequisite course and the entry skills needed for the target course often leads to curriculum change.

- Courses in a sequence may not have a smooth flow of topics. Some shifting of content between courses may help.
- Discussions among instructors of the two courses may lead to the discovery of topics or teaching methods which make the prerequisite skills more effective for the target course. For example, science faculty need students to graph scattered experimental data but graphing may be taught in the prerequisite math class using points that fall neatly on a line.
- It may be that not all of the prerequisite skills are taught in the proposed prerequisite course. Options to deal with this include 1) teaching the prerequisite skill within the target course itself, 2) adding the topic to the content of the proposed prerequisite course, and 3) shifting the needed topic from another course into the proposed course. For example, 9 of the 10 skills needed for C may be taught in B but 1 may be taught in A. By moving that topic to B, the prerequisite to C could be B alone rather than both A and B.

The curriculum committee should be sure that any gaps in prerequisites are covered. If not all the needed skills are taught in the prerequisite course, how are students to learn them?

The highest level of scrutiny is ***data collection and analysis***. This analysis is applied to out-of-sequence communication and computation skills and non-course prerequisites. Examples are “English 1A: Freshman Composition” as a prerequisite to “History 17A: Early United States History,” “Math 1A: Calculus” as a prerequisite to “Physics 4A: General Physics” and “Computer Science 20: Basic Programming within the last three years” as a prerequisite to “Computer Science 25: Intermediate Programming.” (The latter is called a *recency* prerequisite, establishing how recently the prerequisite course has been taken.)

The basic premise is that the college must demonstrate, using sound research practices, that students are highly unlikely to succeed without these skills. The Model District Policy, II.A.1.g.(3), states, “The research design, operational definition, and numerical standards, if appropriate, shall be developed by research personnel, discipline faculty, and representatives of the Academic Senate.” The college should establish a procedure for developing such research designs. This procedure should be

approved by the curriculum committee and the academic senate and should appear in the college's curriculum handbook.

The Model District Policy II.A.1.g. lists three options for student success: 1) grades, either mid-term or final; 2) the instructor's evaluation of the student's readiness for the course, and 3) the student's own self-evaluation of his or her readiness. (A fourth option, assessment, can be used as a measure and will be covered in the next section.)

When using grades, success is a "satisfactory grade" of A, B, C, or CR [Title 5 §55200(d)]. Final grades are certainly a well-recognized measure of student success, but mid-term grades may be a better yardstick for readiness--given that students who drop a course late in the term rarely do so because of a lack of prerequisite skills. When doing a grade analysis, classifying 'W' withdrawals (drops after the add/drop date) and 'NG' no grades (drops before the add/drop date) is quite advantageous. Some W's and NG's result from lack of student readiness, but others are attributable to job changes, family responsibilities, and so on. Should a W or NG be counted as non-success or left out of the study entirely? One approach is to ask instructors to make the determination. Did the drop occur for non-academic reasons, job changes, family situations and so on? If so, leave the W or NG out of the sample. If not, include the student in the sample. As you will see, sample size, particularly that of the "non-success" population, is critical in producing a meaningful statistical result.

Besides grades, success may be ascertained by an evaluation of readiness by the instructor or student. Typically, instructors and/or students are surveyed for this information. A good practice is to use a scale such as 1-to-5 or 1-to-10 from "very prepared" to "not prepared at all." The five or ten point spread produces a more meaningful correlation with whether or not the student had the prerequisite. The survey may be more effective when administered about one-third of the way into the course. This gives enough time for students to attempt course material but is not so late in the term that the survey just duplicates the final grade results.

Standard research methods to evaluate the relationship between having the prerequisite and success in the course include:

1) a ***correlation coefficient*** such as the Pearson r (useful for continuous data such as grade-to-grade correlations, often corrected for factors such as restriction of range),
2) a matrix or four-cell table and accompanying ***chi-square*** (for discrete categories of data such as the "yes/no" answer to "does the student meet the prerequisite?," and
3) a matrix or four-cell analysis showing ***net increase in accuracy***, a comparison of the percentage of the students who succeed in the course before and after imposing the prerequisite. (Applying the prerequisite should show a significant gain in the percentage of students succeeding.)

The details of these methods can be gleaned from standard statistics texts, and, in particular, Method #23 in *Matriculation Evaluation: Phase III Local Research Options (CCCCCO, June 1992)* and Appendix A in *Assessment Validation Project Local Research Options (CCCCCO, February 1991)*. The diagram below may be useful in

visualizing these methods.

success? \ prerequisite?	YES	NO
YES	66 right	1 wrong
NO	9 wrong	24 right

The Four Cell Process

Goals: 1) minimize students who pass without the prerequisite and thus would be denied access (here only 1), 2) significant chi-square, typically > 3.84 (here $\chi^2 = 60$, significant at the 0.05 level, 3) maximize right/wrong ratio, typically ≥ 2:1 (here 90:10 = 9:1), 4) maximize incremental gain in success, typically by ≥ 10% (here before applying the prerequisite 67/100 = 67%, after applying the prerequisite 66/75 = 88%; 21% gain).