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Legislature

#### Abstract

Many students believe they are equipped for college only to discover that they need additional preparation in understanding how to apply content and/or improvement of study skills. How can public schools work together with colleges to better prepare students? Great scrutiny of the curriculum in conjunction with determination of college-entrance readiness can determine needs. This paper describes an examination of 7-12 science curriculum in an Eastern Kentucky public school system and entry-level readiness in sections of a biology class at a regional Kentucky university. Results indicated that students at greatest readiness tended to score a B in entry-level courses. In response to the readiness and performance findings, teachers in grades 7-12 called for more vertical alignment of curriculum, traditional classes instead of block scheduling, a change in diploma options, and more science unit requirements for a high school diploma.

## College-entry level biology aligned to high school and middle school curriculum

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Readiness to attend college can be misleading. At least one-third of all freshmen require remedial courses (*Presidency*, 2007). The introduction in the 2004 American Diploma Project (ADP) Ready or Not Report noted a troubling result in [http://www.achieve.org/files/ADPreport\\_7.pdf](http://www.achieve.org/files/ADPreport_7.pdf) regard to the high school diploma. “Far too many students are graduating from high school without the skills and knowledge they need to succeed”. This partnership of Achieve, Inc.; The Education Trust; the Thomas B. Fordham Foundation; and the National Alliance of Business worked closely with K-12, postsecondary and business leaders in five states (Kentucky was included) to identify knowledge and skills needed for success in both college and work. A set of benchmarks in English and mathematics to serve as an anchor for high school standards-based assessments and graduation requirements resulted. While the effort was supported, it was not mandated (Cohen, Lingenfelter, Meredith, & Ward, 2006; Vaishali, 2004). The ADP also indicated that high school graduates need remedial help in college and too many college students never complete the program requirements for a degree. Mr. Jim Applegate, then vice president of academic affairs for the Kentucky Council on Postsecondary Education in 2004, stated that “50% of students entering community colleges in the state need remedial courses in math” (Vaishali, 2004).

The National Science Foundation (2006) reported that transcript data from the National Education Longitudinal Study of 1988, which tracked student progress from middle school through postsecondary education, among 12th graders in the high school class of 1992 who had earned bachelor's degrees by 2000 and who entered K–12 teaching trailed graduates in non-teaching occupations on a number of academic measures in high school and college. They took fewer rigorous academic courses in high school, had lower achievement test scores at the 12th grade, and scored lower on college entrance examinations (<http://www.nsf.gov/statistics/seind06/c1/c1s3.htm>). Knowledge and skills retained from high school science courses may be important indicators of success in college courses (Odom, 1995). Identification of the knowledge and skills students have received and retained from middle school and high school that are integral to success in entry-level college biology courses can be a significant indicator of readiness. As part of the Teacher Education Model Program (TEMP) grant, the science curriculum in grades 7-12 in one Eastern Kentucky County was examined. Two secondary teachers of biology and one middle school science teacher were asked to evaluate curricular content and alignment of middle school and secondary school courses to improve readiness for and success in an entry-level college biology course. Students in

the college entry-level course at the regional university serving this county were assessed for readiness and final grade in the course. The study sought to provide recommendations for curricular change at the middle and high school level that would better enable freshmen for success in the entry-level course.

### **Method**

To help determine readiness of students in the entry-level college biology course, a readiness pre-test was planned. This entry-level college biology course has learner outcomes and assessments which require an understanding of content to interpret and evaluation information, and solve problems relevant to the world of biology. This includes utilization of mathematical skills and some basic understanding of chemistry. With these properties in focus the readiness pre-test was developed using selected questions from the Kentucky Core Content Tests (KCCT and KIRIS) released 1997-2004 test items for grade 11 science and math testing (Kentucky Department of Education, 2006). The Commonwealth Accountability Testing System (CATS) is the current name for this P-12 test from which the questions were developed.

Students' scores on the readiness test were then compared to their final grades in two sections of the entry-level biology course. Student information regarding grade in high school when general biology was taken, whether or not the student had taken an additional biology course in high school, grade in high school in which the student had taken their last math course, whether or not the student had taken a biology course in college, and what math course(s) the student had taken in college was collected to determine if these variables could be predictive of readiness.

Participating middle and high school teachers were asked to evaluate their curriculum to provide recommendations commensurate with success in the entry-level college course.

### **Results**

Table 1: Readiness Test Scores

Entry-Level Biology Class	Mean Readiness Test Score	Total Number of Students
Section-1	66.00% +/- 13.60	43
Section -2	65.52% +/- 11.75	54

The results in Table 1 indicate that the overall performance on the readiness test by the students entering these sections of the college biology course is not high. Mean readiness test scores of section-1 compared to section-2 are not significantly different (t-test  $\alpha$  .05).

The readiness test scores of the students were compared to their final grades in each of the college course sections. Data analysis included grouping of readiness score (e.g. 80-100%, 60-79%, 40-59%, and less than 40%) and then comparing what percentage of students from each group received a final grade of A, A + B, and A + B + C. The total number of students considered included those with grades of A, B, C, D, E, U (students who stopped attending class), and W (those students withdrawing from class).

Table 2: Comparison of Readiness Test Scores and College Course Performance

Readiness Test Score	% of Students Receiving Course Grade A	% of Students Receiving Course Grade A + B	% of Students Receiving Course Grade A + B + C	Total Number of Students
Between 80% and 100%	8	42	50	12
Between 60% and 79%	5	23	49	57
Between 40% and 59%	0	4	26	23
Less than 40%	0	0	20	5

Consideration of the data in Table 2, which indicates a level of effectiveness of the readiness test (a higher readiness test score indicates a higher performance in the course), and the recommendations from the members of the TEMP project lead to conclusions similar to those noted in the Mathematics Post-Secondary Placement Policy Groups Study (<http://209.85.165.104/search?q=cache:-Zlc55RLudgJ:cpe.ky.gov/NR/ronlyres/419CEE1F-1744-4BAF-AF60-D3B73F53278E/0/08KYCollegeReadinessStandards.pdf+Mathematics+Post-Secondary+Placement+Policy+Groups+Study&hl=en&ct=clnk&cd=1&gl=us>).

- Students need a pre-college curriculum that provides the components necessary to learn the essential concepts which are required for successful performance at the college level in biology.
- Students need a pre-college curriculum that promotes retention of essential concepts which are required for successful performance at the college level in biology.

Use of regression analysis to investigate and model the relationship between the readiness score and possible predictor variables [data regarding grade in high school when general biology was taken, whether or not the student had taken an additional biology course in high school, grade in high school in which the student had taken their last math course, whether or not the student had taken a biology course in college, and what math course(s) the student had taken in college] did not reveal a statistical forecasting model.

### **Recommendations**

The readiness test, developed as an instrument to measure college entrance skills readiness was examined by the 7-12 science teachers with regard to the expected curriculum for concepts and skills for high school graduates. The middle-school science teacher and the secondary biology teachers conducted several meetings to assess the curriculum and make recommendations for change. The following were recommended changes to better meet high school graduates' expectations of the college entry-level biology course:

- Recommend to the Site-Based Decision-Making Council (SBDM) that the school return to a six period day rather than remain on block scheduling. While block scheduling provides the time for laboratory purposes, this type of scheduling poses a problem for immature minds with the amount of materials that must be covered in a single day.
- Recommend to the SBDM that biology, including Advanced Placement (AP) biology, and other math and science classes be year-long classes even if school remains on block scheduling. This could be accomplished by sharing a block (90 minutes) with another class (e.g. math) so each class would have 45 minutes and extend the two classes for the entire year.
- Use fewer worksheets in class and include more hands-on activities, with data collection, charting, graphing, and analysis in daily assignments and laboratory activities.
- Yearly professional development where all middle school and high school science teachers come together to evaluate curriculum and ensure that alignment is followed. This professional development should also include the evaluation of CATS testing results with regard to areas of strengths and weaknesses.

- Suggest to counselors that students be assigned to advisor groups based on the main area of interest to the student. In other words, allow the science department to be advisors to students in science-related fields.
- Give special weight to physics and AP biology classes so more students will be willing to take the classes without worrying about a drop in their GPA.
- Recommend to the Curriculum Committee and SBDM that this high school resumes the availability of a general track diploma and a college prep diploma, rather than the one academic diploma now offered.
- Require four credits of science rather than the three credits presently required.
- Give the students a readiness test developed by 7-12 teachers, based on released CATS test items, upon entry to middle school and high school. The present time frame does not allow the teachers to review CATS results until perhaps six weeks of school has passed. The results of the readiness test would be immediate and developmental or remedial help could begin at the start of the semester.
- While an aligned curriculum of core content for assessment was addressed in this county in the previous spring, it may not be readily followed. The aligned curriculum should be referenced by both the middle and high school in planning a scaffolded curriculum.

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