

SUMMARY OF FINDINGS

2. Defining the “New Basics” in Science and Mathematics

Clearly, advanced and innovative concepts are making their way into Illinois classrooms, but overall penetration is limited. At one end of the continuum, each concept is being taught in at least a few schools somewhere in the state. At the other end, the concepts are so new or their applicability so limited that the words themselves are unknown.

At both P-12 and the higher education levels, educators tend to argue that adding more content is very difficult, because curricula are already bursting at the seams. Given general agreement on that complaint, complete redesign of science and mathematics curricula may be in order. As one teacher explained, “If the goal is truly to integrate the curriculum to include more of these topics, we need to pare down the span of topics covered and start covering topics more in-depth to allow true exploration and more student-directed learning.” Another teacher put the problem more simply. “Our curriculum is so jammed that I feel I am just brushing the surface of all topics I teach.”

These observations from the field highlight a fundamental problem: How can we keep science and mathematics curricula current at a time when new areas of knowledge are expanding rapidly? Who will decide what the “new basics” are for P-12 and higher education? Who will decide what’s appropriate at what level and will that process be timely? A highly de-centralized system exists in Illinois with individual school districts, colleges, and departments making their own curricular decisions. The piece-meal approach ensures local control and academic freedom, but does not always ensure strong connections between education and the challenges of the global marketplace. In their survey comments, many teachers seemed to be asking for guidance regarding what to include in the curriculum.

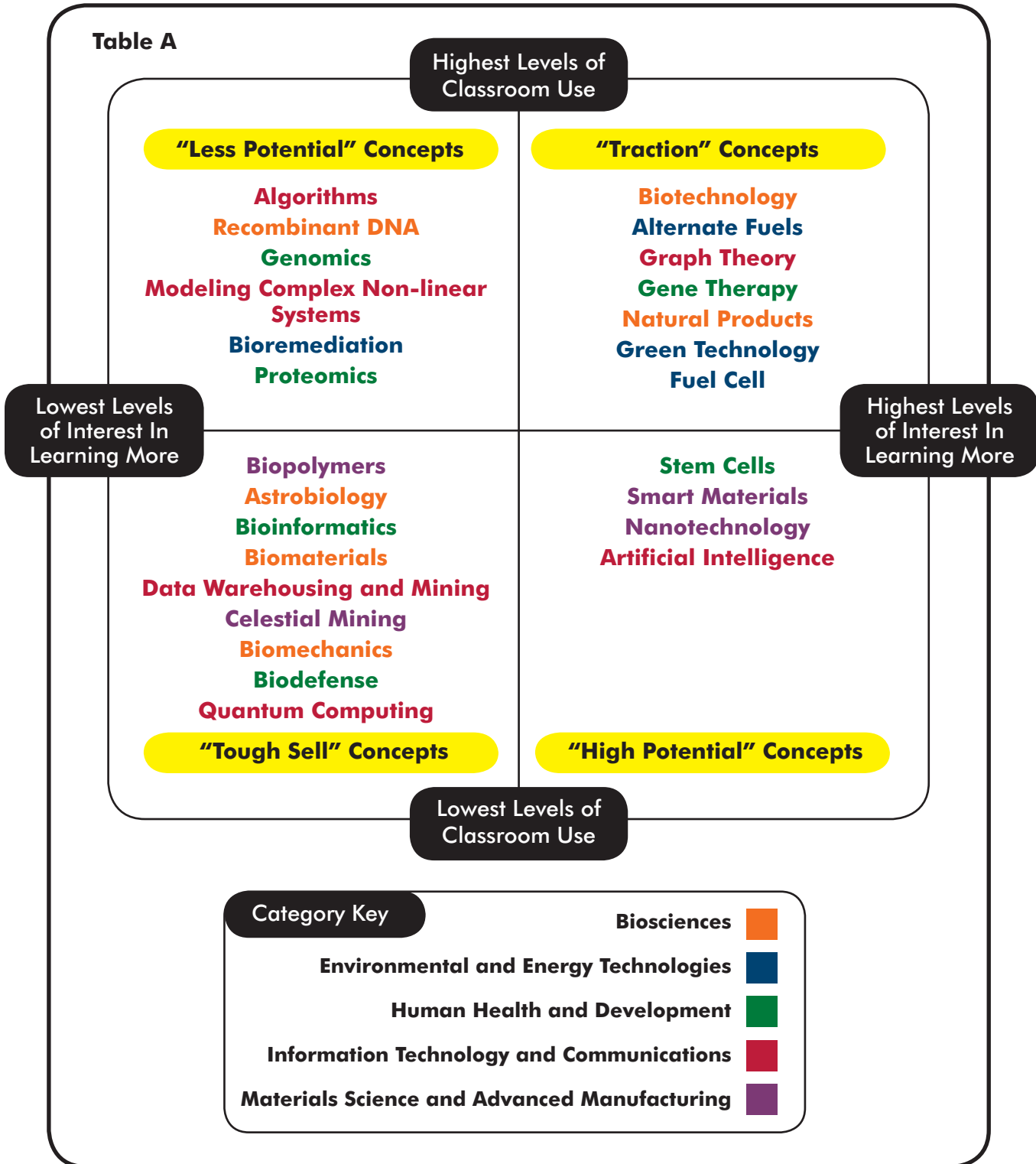
The Kentucky survey report developed a useful method called “traction analysis” for identifying which concepts teachers think are most important for their students. Since Illinois teachers are making decisions about adding content to their curricula, they are establishing new directions. After all, 38% were already teaching at least one of the concepts and 44% planned to add at least one more concept into their classes next year. Illinois teachers’ responses to two specific questions provide the best indicators of current status and a context for devising next steps in curricular development.

- Which concepts are you currently teaching?
- Which concepts are you interested in learning more about?

When answers to these two questions were analyzed, the concepts fell into four groups – Traction, High Potential, Less Potential, and Tough Sell. These are arrayed in the quadrants of Table A along two axes – the horizontal one indicating teachers’ interest in learning more, and the vertical showing level of classroom use. Further explanation of each group follows Table A.

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Table A



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“Traction” Concepts

Concepts in the “Traction” group attracted above average interest from teachers and the highest level of attention in Illinois classrooms. Although the survey questions did not ask how much students learn about these concepts, the results suggest that teachers are shaping curriculum to address real-world issues. The majority of the concepts are connected to agriculture, manufacturing, and energy -- all major factors in the state’s economy.

Teachers’ enthusiasm for learning more about the “traction” concepts suggests a starting point for conversation with teacher preparation and professional development programs about increasing content knowledge and creating curricular materials. Two questions are likely to arise immediately – how do these topics align with the Illinois Learning Standards, and how will teaching them impact student performance on the state’s science and mathematics assessments? Results in both subject areas will count toward Adequate Yearly Progress in coming years.

“Traction” Concepts

Biotechnology
Alternate Fuels
Graph Theory
Gene Therapy
Natural Products
Green Technology
Fuel Cell

“High Potential” Concepts

The topics in this group are interesting to teachers who already know something about them, but are not taught to their students as often as the “traction” concepts. Teachers’ willingness to learn more about them may suggest a willingness to introduce them to students once they have mastered the content themselves. A high percentage of teachers who were familiar with or understood Artificial Intelligence (75%) and Nanotechnology (63%) planned to teach them next year. Data on how these teachers get information about new technologies imply that many are teaching themselves. Helping these teachers develop their expertise in emerging technologies would seem to be an important role for higher education, regional offices of education, and other providers of professional development.

“High Potential” Concepts

Stem Cells
Smart Materials
Nanotechnology
Artificial Intelligence

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“Less Potential” Concepts

Teachers who have some understanding of the concepts with “less potential” say that they are teaching them, but are not much interested in learning more. Further research is needed to understand the dynamics, which may be unique to each concept.

“Less Potential” Concepts

Algorithms
Recombinant DNA
Genomics
Modeling Complex
Non-linear Systems
Bioremediation
Proteomics

“Tough Sell” Concepts

The “tough sell” concepts do not generate much interest among teachers and are rarely taught in Illinois classrooms. At this time, teachers may lack familiarity and/or do not see the applicability of this group to what students should know and be able to do. Some of the “tough sell” concepts, however, have been singled out by business and industry as high priorities for the state’s future. The most influential barriers for this group of concepts are – not appropriate at these grade levels, lack of teacher preparation, and not in textbooks.

“Tough Sell” Concepts

Biopolymers
Astrobiology
Bioinformatics
Biomaterials
Data Warehousing and
Mining
Celestial Mining
Biomechanics
Biodefense
Quantum Computing