Summary Brief: International Baccalaureate Standards Development and Alignment Project

International Baccalaureate

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Center for Educational Research (CEPR) and the Educational Policy Improvement Center (EPIC)

Staff at the Center for Educational Policy Research (CEPR) and the Educational Policy Improvement Center (EPIC) seek to help policy makers and policy implementers alike do a better job of using educational policy as a tool to improve schooling and student learning. Both Centers' staffs contributed to the research described in this report.

CEPR and EPIC work with federal agencies, state education departments, non-governmental organizations, private foundations, and school districts to support research on a range of issues in the areas of high school-to-college articulation, adequacy funding, large-scale assessment models, and other policy initiatives designed to improve student success.

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Although the International Baccalaureate (IB) Diploma Programme is offered by many high schools in the United States and considered to be challenging and rich in content, the curriculum has not been analyzed to determine its alignment with college readiness standards or state educational standards in the U.S. Given the importance of academic content standards in recent educational reforms and the growing emphasis on improving college readiness among high school students, such an analysis is important as a means to help the IB Diploma Programme express its aims and objectives in a format that is consistent with state-level educational policies and practices in the United States and the general trend toward increased emphasis on college readiness for all students.

Each of the 50 states has established educational standards that drive the curriculum and assessments in the state. These state-level standards are frequently compared to one another and to standards developed by national U.S. standards-setting groups, such as the American Diploma Project (ADP), Standards for Success, ACT, and the College Board. State education departments increasingly expect all educational programs offered within a state to demonstrate alignment with the state's academic content standards. Postsecondary institutions, which are offering college-level credit for courses taken in high school or are giving students preference for admission based on programs such as IB, increasingly seek confirmation that the IB Diploma Programme is in fact well aligned with college readiness standards.

Historically, the IB Diploma Programme has employed a standardized curriculum delivered to all students regardless of country of origin, but that curriculum was not specifically tied to or derived from an explicit set of educational standards. The IB relies on its course documents, with their detailed specification of course aims and goals, along with its end-of-course assessment system to create a high degree of internal consistency. For this reason, explicit standard statements have not been necessary. However, the educational landscape within the US has changed dramatically over the past 15 years, and educational standards are now the foundational element to all state and most district instructional frameworks. The IB Diploma Programme finds itself at a distinct disadvantage when it cannot compare its course content in an "apples-to-apples" fashion with state standards or to other college readiness standard systems. The creation of a unique set of IB academic content standards addresses these needs. The goal of the project was to create the standards and align them to a set of accepted college readiness standards.

Methodology

The research methodology employed by this project was a professional judgment model often referred to as convergent consensus. It requires the repeated review of documents by experts who make changes at each review stage designed to move toward consensus agreement on a final document that achieves a set of pre-established goals. In this case, the goal was to develop a set of standards that represented the knowledge and skills students learn in the curriculum of the IB Diploma Programme.

The method followed a set of predetermined steps. A core set of content experts who were also experienced IB teachers created the initial draft standards using the IB program guides, aims and objectives. This initial draft was then reviewed, edited and revised in multiple phases by additional IB teachers who had experience in standards development. The IB teachers were involved in both initial stages in order to ensure that the standards reflected the true content of the IB curriculum. As these experts edited the initial drafts, they did so with an eye toward ensuring that the standards could be both easily understood by those unfamiliar with the IB but viewed as valid by those familiar with it.

The role of CEPR/EPIC staff researchers was to develop the online tools used by reviewers, recruit and train reviewers, synthesize all recommended changes, and work with consultants to revise the standards after each review. The multiple rounds of review, feedback and revisions continued until no additional significant changes were recommended by any of the reviewers. IB academic program staff in Cardiff, Wales conducted the final review. In it they were asked to examine the standards carefully to ensure that each set reflected any curricular changes that had occurred since the beginning of the project. CEPR/EPIC staff researchers and consultants then made final revisions. IB subsequently authorized the standards.

IB Standards Development

The IB standards are organized by subject area: Language A1, Extended Essay, Theory of Knowledge, Mathematical Studies, Mathematics Standard Level/Higher Level, Biology, Chemistry, and Physics in the full version of the report. Content experts for each subject were encouraged to use a standards-writing approach that would yield the most accurate representation of their respective subject areas. Consequently, the mathematics and science standards include a larger number of standards than those of Language A1, Extended Essay and Theory of Knowledge. For the latter standards, IB teachers, content experts and standards writers serving as consultants chose to emphasize the *themes* of these portions of the IB curriculum rather than the detailed standards written by the mathematicians and scientists.

Language A1 consists of a total of 10 content standards, Extended Essay consists of a total of 12 content standards, and Theory of Knowledge consists of a total of 15 content standards. They are broad in scope to reflect the "big ideas" of these subjects and the variety of content taught within these themes. Mathematical Studies consists of a total of 73 detailed content standards in the following eight topics: 1) use of a graphing calculator, 2) numbers and algebra, 3) sets, logic and probability, 4) functions, 5) geometry and trigonometry, 6) statistics, 7) introductory differential calculus and 8) financial mathematics.

Mathematics Standard-level consists of 64 content standards across six topics and an additional 38 standards for students who take the Higher-level version of the course. The six topics of the standard-level standards describe what students learn in: 1) equations and graphs, 2) circular functions and trigonometry, 3) matrices, 4) statistics and probability, 5) calculus: derivatives and integrals, and 6) multi-variable calculus: vectors. The higher-level standards also include a section on proofs, sequences, series and complex numbers in addition to the content listed above for the standard-level standards.

Physics consists of 31 content standards in the following six topics: 1) notation and mathematics, 2) classical motion, 3) heat and thermodynamics, 4) electricity and magnetism, 5) energy, power and climate change, and 6) waves and vibrations. Chemistry consists of 47 content standards in the following 13 topics: 1) structure of an atom, 2) electronic structure, 3) periodic properties and the periodic table, 4) the mole, 5) chemical equations, 6) bonding, intermolecular forces, and properties of substances, 7) equilibrium, 8) acids and bases, 9) kinetics, 10) enthalpy, entropy, and free energy, 11) electrochemistry, 12) organic chemistry and biochemistry, and 13) measurement and data processing. Biology consists of 19 content standards in the following seven topics: 1) the chemistry of life, 2) functions of life at the cellular level, 3) cell reproduction and heredity, 4) ecology, evolution and the diversity of life, 5) multi-cellular organisms and organ systems, 6) methodologies and tools of biological studies, and 7) science and society. Lab Process Skills consists of 30 standards in the following two broad topics: 1) be able to carry out the scientific method to investigate a scientific question and 2) work within the context of a scientific community and the standards set by the global community of scientific investigators.

In addition to the content standards in each subject developers also included standards to reflect the key cognitive strategies of the IB curriculum. Key cognitive strategies are the intellectual behaviors that lead to a disciplined approach to thinking. Developed over a long period of time they are practiced behaviors that become a habitual way of working toward a more thoughtful, intentional and intelligent approach to learning. They include intellectual openness, inquisitiveness, analysis, reasoning, argumentation, proof, interpretation, precision, accuracy and problem solving.

Alignment With College Ready Standards

After the IB standards were developed and reviewed by EPIC, then subsequently authorized by IB, a separate study was conducted to determine the degree to which they aligned with the Knowledge and Skills for University Success (KSUS) college-ready standards. Content experts who originally helped to develop the KSUS standards performed the alignment. All are university faculty members in the respective content areas.

The Knowledge and Skills for University Success (KSUS) college-ready standards are a comprehensive set of standards describing what university faculty expect in entry-level students. The KSUS standards were developed using a process in which more than 400 faculty and staff members from 20 leading research universities, all members of the Association of American Universities, participated in extensive meetings and reviews. They indicate what students must know and be able to do in order to succeed in entry-level courses at AAU institutions. The KSUS standards are divided into subject-area groups covering English, mathematics, natural sciences, social sciences, second languages and the arts. For a complete listing of the KSUS standards and the methodology used to develop them, go to: *http://www.s4s.org/cepr.uus.php.*

Table 1. International Baccalaureate standards aligned to KSUS standards by content area

IB Content Area	Aligned to KSUS Subject Area
Language A1	English
Theory of Knowledge	English
Extended Essay	English
Mathematical Studies	Mathematics
Mathematics Standard Level	Mathematics
Mathematics Higher Level	Mathematics
Biology	Natural Sciences
Physics	Natural Sciences
Chemistry	Natural Sciences

Results

The IB standards are highly aligned with the KSUS standards indicating that students who learn the IB curriculum in high school enter college with the type of knowledge and skills not only expected by college faculty but also with skills known to promote academic success in entry-level courses. Of the 73 KSUS standards in English only seven KSUS standards were not aligned with the IB standards across

Language A1, Extended Essay and Theory of Knowledge. Similarly in mathematical studies, for the 83 KSUS standards only 11 were not aligned to the IB standards. Of special note is the complete alignment found between the mathematical studies standards and the algebra, trigonometry and statistics standards of the college ready KSUS. A large section of the KSUS standards are devoted to the study and acquisition of algebra skills. This emphasis is intentional because college faculty members know that strong algebra skills are closely linked with success in college math and science courses. Students who take the IB mathematical studies course have the opportunity to learn every algebra standard expected by the college faculty who will teach them (as represented by the KSUS). In science there is complete alignment between the KSUS standards and the 47 IB chemistry standards, the 19 biology standards and the concepts of environmental science that are embedded across all three IB science courses. For IB physics (31 standards) only five KSUS standards could not be detected. In general those KSUS standards for which the faculty alignment experts could detect no alignment were simply of a grain-size more detailed than the IB standards.

Faculty members consistently report that critical thinking skills, intellectual inquisitiveness and interpretation are skills that should be mastered prior to enrolling in college freshman courses. The key cognitive strategies emphasized within the IB Diploma Programme show evidence that the content of IB is fully aligned with what is expected by university faculty.

The results of this study clearly confirm the strong relationship between the IB Diploma Programme and standards for college readiness and success. The IB standards demonstrate a very high degree of alignment with the KSUS standards in all subject areas. In addition, many of the individual IB standards are at a level more advanced than entry-level college courses. Furthermore, the IB standards address key cognitive strategies that are critical to success in entry-level college courses. These key cognitive skill areas are rarely addressed in state content standards but are identified almost universally by college instructors as being central to success in entry-level college courses. In short, students who participate successfully in IB should be well prepared to succeed in entry-level college general education courses and in some cases to have already learned material covered in such courses.

For information about additional EPIC projects contact EPIC by phone or email at 877-766-2279 or info@epiconline.org