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CURRICULUM ALIGNMENT BETWEEN THE IB DP AND NATIONAL SYSTEMS: GERMANY

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Executive Summary

With IB programmes available across the world in diverse educational landscapes, alignment with national educational standards is important. This project aims to provide an empirical analysis of the alignment between IB standards with the Gymnasium in two German regions. More specifically, the report examines (a) the ways in which the IB DP written curriculum align with national standards in selected regions in Germany with regard to content, cognitive demand, and philosophical underpinnings, and (b) how the intended non-scholastic attributes (if any) of international mindedness, civic-mindedness, citizenship, engagement, and motivation compare among IB DP and German curriculum documentation.

The report focuses on the Diploma Programme for students in the 16 to 19 age range in IB schools which corresponds to Years 11-13 (Oberstufe) in German Gymnasium – the main way to enter university in Germany. The study focuses on Baden-Württemberg and Berlin because these two federal states have historically either been conservative-governed (Baden-Württemberg) or in the hands of social democrats (Berlin) leaving quite distinct and different legacies on the ways in which the regional educational systems operate. The study compares and contrasts mathematics, Spanish, geography, history as well as biology. This design covers four of the six curriculum areas in the IB schools. The analysis compares content, cognitive demand and philosophical underpinnings taking into consideration also regional and national political contexts.

There are several key findings: First, unlike in the social sciences and humanities (notably history and Spanish), there is a high-level of alignment between the IB DP curriculum and the curriculum of both federal states in the natural sciences (biology and mathematics). Second, there is little variation in the natural sciences between the two German states which may have to do with the fact that social science subjects such as history are more exposed to reflecting political ideologies and identities of the state. Third, alignment between the IB DP history curriculum is therefore much greater in Berlin than it is in Baden-Württemberg, and there is very limited alignment between the IB DP geography curriculum and both German state curricula. Fourth, curricula in the German states emerge to a greater extent from local and national roots compared to the more international and global approach in the IB DP curriculum.

1. Project Goals

This project addresses the following goals: (a) identifying standards that represent the content, cognitive demand and philosophical underpinnings in the IB curricula and Gymnasium (university-preparing grammar schools, see Section 1.2) in Germany considering also regional and national political contexts; (b) analysing the alignment between those standards to validate that the IB Programme is at a level consistent with standards of the final four years in the Gymnasium in Germany.

1.1 Project Rationale

The International Baccalaureate (IB) Diploma Programme has a reputation of being challenging and rich in content allowing students to graduate in an international educational environment. With IB programmes available across the world in diverse educational landscapes, alignment with national educational standards is an important factor for both the recruitment strategies of the IB DP schools and the success of the students. This project aims to provide an empirical analysis of the alignment between IB standards with the Gymnasium in two German regions (federal states). Given the importance of academic content, cognitive demand and philosophical underpinnings in education, such an analysis is valuable as a means to help the IB Programme to compare and evaluate their curricula against the backdrop of German national educational policies and practices.

The need for alignment became fundamental in the context of education. The policy demands of accountability systems increase the need for schools to focus curriculum and instruction on what will be measured system-wide. The concept of alignment can be described as the degree to which the different elements of an education system interact functionally and effectively to facilitate successful student learning. The elements of an education system are, for instance: standards, curricula, assessments, and instructions (Ananda, 2003; Resnick, Rothman, Slattery, and Vranek, 2003; Webb, 1997). Alignment studies usually analyze the extent to which standards and assessment address the same content (Webb, 1997; Webb, 1999). By introducing his work on the enacted curriculum, Porter added the curriculum as an additional component of alignment research (Porter, 2002, 2005). Although a variation of slightly different criteria for alignment of standards and assessment is suggested by different researchers, there is general agreement on the most

fundamental requirements for alignment. These basic stipulations are content match and depth match (LaMarca, 2001, Ananda, 2003). Content match describes the extent to which test content corresponds to targeted standards. Depth match examines whether test items reflect the cognitive complexity of the knowledge and skills defined in the standards. Alignment studies are a useful source of information and can fulfill a number of different purposes: (a) identifying gaps and possible shortcomings, (b) inform whether restructuring of the existing assessment or accountability system is advisable, (c) comparing own standards to others, (d) providing information for the development of new assessment items, (e) analyzing content validity (Ananda, 2003). Accountability plays an increasingly important role in education and drew the attention of education policymakers and researchers to the relevance of alignment. Thus, concepts of alignment have become multi-dimensional and advanced to support the education systems and maintain high quality standards. Mostly applied to curricula analysis within a country, alignment research is particularly informative in international comparisons as it provides insights into the learning preferences of different educational systems. Little is known about the comparability of IB curricula to national curricula. Obtaining such insights is important as the final years of secondary schooling prepare students to enter university courses. This study therefore examines (a) the ways in which the IB DP written curriculum align with national standards in selected regions in Germany with regard to content, cognitive demand, and philosophical underpinnings, and (b) how the intended non-scholastic attributes (if any) of international mindedness, civic-mindedness, citizenship, engagement, and motivation compare among IB DP and German curriculum documentation.

Several curriculum alignment studies have been carried out to date (e.g. Byrd 2007, Conley 2009). For example, Conley (2009) compared the extent to which the IB standards align with the Knowledge and Skills for University Success (KSUS), which describe what university staff expect in entry-level students, college-ready standards in the United States. He found that the IB standards are highly aligned with the KSUS standards indicating that students who learn the IB DP curriculum in high school enter college with the type of knowledge and skills not only expected by university staff but also with skills known to promote academic success in entry-level courses. In science, biology and mathematics there was complete alignment whereas some discrepancies were observed in English and the languages. Many of the

individual IB standards are at a level more advanced than entry-level college courses. In addition, Byrd (2007) compared the Advanced Placement Programme (AP), which started in the 1950s when staff from elite US prep schools joined college professors, and the IB DP Programme. The AP was designed as a college placement incentive and is today an important factor in the college admissions process. Nearly 60% of US high schools participate in the AP programme. Byrd reviewed history, biology, English literature/language and mathematics in terms of content, clarity and rigour. She found that both the AP and IB DP curricula were much better than nearly all of the US state standards and exams. Consistency of course quality around the globe was found to be important for the IB DP programme. However, the review report found that teacher guides for courses are richly detailed, sometimes to a fault. The lengthy documents in some subject areas were found somewhat unhelpful leaving teachers little scope to decide what matters most. While quality checks were found to be much better in the IB DP programme, the AP (unlike IB DP) programme made courses available to any school with teachers willing to undertake them.

1.2 The German Educational System

The overwhelming majority of German students attend public schools. School is compulsory for nine or ten years. From grades 1 through 4 children attend elementary school (*Grundschule*), where the subjects taught are the same for all. Then, after the fourth grade, they are separated according to their academic ability and the wishes of their families, and attend one of three different kinds of schools: *Hauptschule*, *Realschule* or *Gymnasium*. *Grundschule* teachers recommend their students to a particular school based on such things as academic achievement, self-confidence and ability to work independently. However, in most states, parents have the final say as to which school their child attends following the fourth grade (Cortina et al. 2003). The *Hauptschule* (grades 5-9) teaches the same subjects as the *Realschule* and *Gymnasium*, but at a slower pace and with some vocational-oriented courses. It leads to part-time enrollment in a vocational school combined with apprenticeship training until the age of 18. The *Realschule* (grades 5-10 in most federal states) leads to part-time vocational schools and higher vocational schools. It is now possible for students with high academic achievement at the *Realschule* to switch to a *Gymnasium* on graduation. The *Gymnasium* leads to a diploma called the *Abitur* and prepares students for university study or for a dual academic and vocational credential. The most common

education tracks offered by the standard *Gymnasium* are classical language, modern language, and mathematics and natural science. In recent years many states have changed the curriculum so students can get the *Abitur* at the end of the 12th grade. Other states are making the transition but may still require a 13th grade. The final two to three years of the *Gymnasium* correspond to the 16-19 age range in IB schools. Assessment consists of both oral and written exams and the final two to three years are added up to determine the overall grade. Universities define their own admission criteria for each subject and admit students on the basis of the overall score. The *Gesamtschule*, or comprehensive school, is only found in some of the federal states. It takes the place of both the *Hauptschule* and *Realschule*. It enrolls students of all ability levels in the 5th through the 10th grades. Students who satisfactorily complete the *Gesamtschule* through the 9th grade receive the *Hauptschule* certificate, while those who satisfactorily complete schooling through the 10th grade receive the *Realschule* certificate.

Two types of secondary schools have predominated in Berlin since 2010/2011: the new Integrated Secondary School and the *Gymnasium*. Both can lead to the highest school-leaving qualification (*Abitur*), which entitles students to enroll at a university. The integrated secondary school provides all-day schooling from 7:30 am to 4:00 pm and offers many extras, including additional classes, tutoring, sports, and cultural options. The *Gemeinschaftsschule* (comprehensive school) was launched as a pilot project in eleven schools in 2008/2009. This project keeps students together from 1st to 10th or 12th grade (instead of tracking them into academic, intermediate, or lower schools in 5th or 7th grade) and has proven to be very popular: in just two years, the number of comprehensive schools rose from eleven to twenty (www.berlin.de/berlin-im-ueberblick/kultur/schulisch.en.html). In contrast, Baden-Württemberg continues to have three types of secondary schools and is therefore more selective than Berlin: *Hauptschule*, *Realschule* and *Gymnasium* as defined above. Comprehensive schools were only launched in 2012-13 following a landmark election victory of a Red-Green coalition government in this southern federal state.

By contrast, the IB DP programme was founded in 1968 to facilitate the international mobility of students preparing for university by providing schools with a curriculum and diploma recognised by universities around the world. It is a two-year programme for high school juniors and seniors, aged 16-19, offered in 126 countries. Recently, a middle-years

and primary years programme was also introduced. IB DP students must choose one subject from each of five groups (1 to 5), ensuring breadth of knowledge and understanding in their best language, additional language(s), the social sciences, the experimental sciences and mathematics. Student may choose either an arts subject from group 6, or a second subject from groups 1 to 5. Students take written examinations at the end of the programme, which are marked by external IB examiners. Students also complete assessment tasks in the school, which are either initially marked by teachers and then moderated by external moderators or sent directly to external examiners. There are three core courses of the Diploma Programme: (1) a 4,000 word research essay (Extended Essay); (2) an interdisciplinary theory of knowledge course; and (3) creativity, action, service (CAS). The three strands of CAS enhance students' personal and interpersonal development through experiential learning and enable journeys of self-discovery (<http://www.ibo.org/diploma>).

1.3 Methodology

There are different methodologies for investigating alignment (Bloom, Madaus, Hastings 1981; Tyler 1949; Webb 1999). As this field of research is currently still emerging, alignment studies in the past were often confronted with the criticism of being too subjective and even to a certain degree arbitrary. The research field developed greatly in recent years and meanwhile applies more advanced, in-depth methods of alignment between standards, assessments, and instruction. The process became increasingly refined, asserting that assessments also include the depth and breadth of content standards for a given grade level. The current alignment process usually entails both a systematic review of the standards and a systematic review of assessment items and tasks. Hence, methodologically sound alignment studies evaluate the content match between each item and standard and additionally provide a qualitative analysis of alignment. There are several established methodologies for systematically evaluating and documenting the alignment of educational standards, the most frequently used alignment models are the Webb Model, the Surveys of Enacted Curriculum Model, and the Achieve Model (La Marca, Redfield and Winter 2000).

This project uses a mixed method approach drawing mainly on documentary analysis, content analysis (Faas 2011) and the Surveys of Enacted Curriculum Model which was developed by Andrew Porter and John Smithson (Porter 2002; Porter 2005; Porter,

Smithson, Blank and Zeidner 2007). As the focus of this project lies in the international comparison of curricula, this methodological framework provides the most instructive approach for our purposes. We use documentary analysis, in which content and structure is analyzed by using a system for encoding. The data is categorized according to content topics and cognitive demand (CCSSO 2002). Cognitive demand is described using categories that are characteristic of each subject area. The cognitive demand in mathematics, for instance, may contain the following categories: memorize facts/definitions/formula, perform procedure, communicate understanding of concept, and solve problem/make connections. This categorization produces a matrix that enables a comparison of the mainstream of content and cognitive demand in the curricula of both countries and the IB curriculum (Porter et al. 2007). The encoded data can be quantified and systematically compared to the alignment of the documents. Content analysis is applied to the underlying principles of educational belief which are described in each of the curricula. The ideas go back to the American philosopher and educator John Dewey, who believed that the learning process of a growing mind is shaped by real-life experiences. Dewey argued that 'the real process of education should be the process of learning to think through the application of real problems' (Dworkin 1959: 20). Qualitative content analysis will primarily be used to address the philosophical underpinnings of the curricula, with quantification of the findings when feasible. Curriculum documents will be read and objectively and systematically reviewed. This process is described as 'data reduction and sense-making (...) to identify core consistencies and meanings' (Patton 2002: 453).

We focus on the Diploma Programme for students in the 16 to 19 age range in IB schools which corresponds to Years 11-13 (Oberstufe) in German Gymnasium. The study focuses on Baden-Württemberg and Berlin because these two federal states have historically either been conservative-governed (Baden-Württemberg) or in the hands of social democrats (Berlin) leaving quite distinct and different legacies on the ways in which the regional educational systems operate. In both states, despite different structures, the Gymnasium is the only pathway to enter university and the study therefore focuses on this school type.

The study compares and contrasts the following subject curricula: mathematics (mathematics higher level in the IB schools), a modern foreign language (Spanish),

geography, history as well as biology. This design covers four of the six curriculum areas in the IB schools. Mainstream Gymnasium do not have a separate literature and language subject/curriculum and several of the arts subjects in IB such as theatre, film, dance are also not taught which makes a comparison not feasible in these areas. An overview of the documents analysed for this project is included in Appendix 1.

The analysis compares content, cognitive demand and philosophical underpinnings taking into consideration also regional and national political contexts. The content analysis compares and contrasts learning units and topics between IB and mainstream curricula. With regard to cognitive demands, the study looks at expectations of student thinking including categories such as problem-solving and memorizing formula in mathematics or synthesising and understanding topics in social science subjects. With regard to philosophical underpinnings cultural, linguistic and religious heritage, interaction and student involvement, the impact on student and learner identities (such as active citizen, integration in local communities, social justice and tolerance) is examined.

Following the notion of Grounded Theory (Glaser and Strauss 1999), our approach started with the collection of curriculum data aiming to develop categories from this data which capture the underlying educational objectives of each of the subjects in the different school types. This approach allows for structured comparison between the different dimensions of analysis. In a first step, the central aspects of the curriculum data were marked with codes. In order to organise the data, related codes were then grouped into umbrella concepts describing the main aspects of each group of codes. From these concepts, categories were formed which are presented in the tables of the report.

The quantitative content analysis of geography, history, biology, mathematics and Spanish curricula refers to the presence of a set of optional or pre-assigned topics in the curriculum. To this end, we will count which units and sub-units across the identified age groups in the five subject areas refer to specific topics such as identity, interculturalism, and Europe with a view of uncovering the level of alignment between IB subject curricula and curricula in two selected regions in Germany: Baden-Württemberg and Berlin. The qualitative content analysis focuses on the discourses employed in the curriculum. For example, attention will

be given as to the extent to which 'Europe' was constructed in political, economic, geographical, historical, or socio-cultural terms, and the ways in which these discourses combine European and multicultural issues (see Faas 2011). As can be seen in Appendix 1, the IB DP curricula are far more comprehensive and complex than any of the subject standards issued in the two German states.

A methodical caveat is in order here as this study focuses only on the comparative analysis of IB and mainstream curricula rather than looking at the interpretation of curricula in the classroom or the assessment techniques linked with the delivery of these curricula.

2. Content Analysis of Curricula in Germany and IB DP Schools

2.1 Biology

The IB DP curriculum for biology presents three options including several sub-topics for students (see Table 1) whereas all topics in the German state schools are pre-assigned (four in Baden-Württemberg and Berlin respectively). The core topics in the IB DP curriculum correspond to what we call pre-assigned topics or areas in the German state curriculum.

Table 1: Comparison between IB DP, Baden-Württemberg and Berlin Biology curricula

Content	IB DP	Baden-Württemberg (Ba-Wü)	Berlin
Focus	Human biology General biology Plant biology	Human biology Plant biology Applied biology	Human biology Plant biology Applied biology
Options (available areas of concentration)	3 options: Options SL, Options SL and HL, Options HL	None	None
Topics	Core: 1. Cells 2. Genetics 3. Ecology and evolution 4. Plant science 5. Statistical analysis 6. The chemistry of life 7. Human health and physiology 8. Nucleic acids and proteins 9. Cell respiration and photosynthesis	Preassigned: 1. Cells 2. Genetics 3. Evolution and ecology 4. Plant science	Preassigned: 1. Cells 2. Genetics 3. Evolution 4. Plant science

Like with the other subjects, there is a great deal of options and choice in the IB DP curriculum whereas the German state curricula are more prescriptive leaving less room for teachers to adapt the curriculum. Both German state curricula cover aspects of human biology, plant biology and applied biological topics, emphasising that the human being is part of the biosphere and cannot be studied in isolation. Unlike in the social sciences and humanities, the majority of topics align between the IB DP curriculum and the curriculum of both Baden-Württemberg and Berlin. All four major pre-assigned topic areas are also part of the topics covered in the IB DP schools. The only substantial difference is that the IB DP curriculum covers an even broader range of topics and subtopics including aspects of human

biology such as nutrition and health, neurobiology and human physiology. Students can define their area of concentration according to their interests and preferences choosing between one these topics and sub-topics. Statistical analysis is also missing from the two German state curricula in biology. Unlike with the social science subjects, there is also very little if any variation between the two German states which may have to do with the fact that social science subjects such as history are more exposed to reflecting political ideologies and identities of the state.

2.2 Mathematics

The mathematics curricula in the federal states of Baden-Württemberg and Berlin show strong similarities to the IB DP curriculum (see Table 2).

Table 2: Comparison between IB DP, Baden-Württemberg-Berlin Mathematics curricula

Content	IB DP	Baden-Württemberg (Ba-Wü)	Berlin
Focus	<ul style="list-style-type: none"> - Algebra - Functions and equations - Circular functions and trigonometry - Vectors - Statistics and probability - Calculus 	<ul style="list-style-type: none"> - Algebra - Geometry - Functions and equations - links between analysis, geometry and stochastic - Differential and integral calculus 	<ul style="list-style-type: none"> - Algebra, - Geometry - Functions and equations - Statistics and probability - Calculus
Options (available areas of concentration)	4 options: 1. Statistics and probability 2. Sets, relations and groups 3. Calculus 4. Discrete mathematics	None	None
Topics	Core: 1. Functions and Equations 2. Calculus 3. Algebra 4. Statistics and probability 5. Circular functions and trigonometry 6. Vectors	Preassigned: 1. Functions and equations 2. Calculus 3. Statistics and probability 4. Geometry	Preassigned: 1. Functions and equations 2. Calculus 3. Algebra 4. Stochastic

One major difference is that, like with other subject curricula, there are no elements of choice in the German state curricula and all topics and units are pre-assigned. However, like

in Biology, the majority of topics align between the German mathematics curriculum and the IB mathematics curriculum. This seems to be a pattern that is particularly marked across the STEM subjects (science, technology, engineering and mathematics) whereas there was far greater variation and limited alignment between the social science subjects. All curricula cover algebra, geometry and to a somewhat lesser extent stochastic. Geometry is not one of the topics covered in the Mathematics HL option in the IB DP because it is a prerequisite which students should have studied prior to this course. There is also very little if any difference between the Baden-Württemberg and Berlin mathematics curriculum. Overall, the IB DP schools again provide the most flexibility allowing students to focus on an area of interest and specialising in one of the optional topics.

2.3 History

The history curricula of the federal states of Baden-Württemberg and Berlin both focus mainly on the 19th and 20th century with a set number of pre-assigned topics (4 in Baden-Württemberg and 4 in Berlin, see Table 3 below).

The Baden-Württemberg guidelines leave the option for teachers to go back and integrate topics from antiquity to modern times while one of the four topic areas in Berlin is explicitly on how the modern world evolved out of antiquity and medieval age. The focus in the 19th century topics in both federal states is on modernization, particularly economic and social developments. In Baden-Württemberg, the focus then shifts to Germany's role in Europe during the 20th century including the changes from dictatorship to democracy and its new role post-1945 in a European context. With the focus mainly on Germany's role in Europe, there is only limited scope to address wider world issues, notably the bipolar world and confrontation between the USA and the Soviet Union during the Cold War.

By contrast, in Berlin, there is a wider range of topics including aspects of the histories of the Americas and Asia as well as the Ottoman Empire and links between Christianity and Muslims. The alignment between the IB DP history curriculum is therefore much greater in Berlin than it is in Baden-Württemberg. This may have to do with the far more cosmopolitan, multicultural character of this city state and the fact that, unlike Baden-Württemberg, it has been governed by a tolerant, liberal Social Democratic Party for over a decade now. This is

quite different from the legacy and history of conservative governments in Baden-Württemberg which appeared to have left a different imprint on the curriculum (Faas 2011).

Table 3: Comparison between IB DP, Baden-Württemberg and Berlin History curricula

Content	IB DP	Baden-Württemberg (Ba-Wü)	Berlin
Epochs covered	2	1	1
Options (available areas of concentration)	<p>Route 1 HL Option: Aspects of the history of medieval Europe and the Islamic world</p> <p>Route 2 HL Options: Aspects of the history of Africa, the Americas, Asia and Oceania, Europe and the Middle East</p>	None	None
Topics	<p>Route 1:</p> <ol style="list-style-type: none"> 1. Modernisation (society and economy) 2. The origins and rise of Islam c500–661 3. The kingdom of Sicily 1130–1302 4. Dynasties and rulers 5. Wars and warfare 6. Intellectual, cultural and artistic developments 7. Religion and the state <p>Route 2:</p> <ol style="list-style-type: none"> 1. International relations 1918–36 2. The Arab–Israeli conflict 1945–79 3. Communism in crisis 1976–89 4. Causes, practices and effects of wars 5. Democratic states—challenges and responses 6. Origins and development of authoritarian and single-party states 7. Nationalist and independence movements in Africa and Asia and post 1945 Central and Eastern European states 8. The Cold War 	<p>Preassigned:</p> <ol style="list-style-type: none"> 1. Modernisation (society and economy) 2. Democracy and dictatorship in Germany 3. The Cold War 4. Germany after 1945 in Europe 	<p>Preassigned:</p> <ol style="list-style-type: none"> 1. Modernisation (society and economy) 2. Democracy and dictatorship in Germany 3. The Cold War 4. The Ottoman Empire 5. Aspects of the history of the Americas and Asia

2.4 Geography

In Baden-Württemberg, the geography curriculum discusses topics from physical and human geography alike and uses different sub-disciplines of geography as the main topic unit such as pedology, hydrology or economic geography. By contrast, in Berlin, the curriculum uses Europe or the Third World as a region to then illustrate aspects of both physical and human geography within that region, as illustrated in Table 4 below.

Table 4: Comparison between IB DP, Baden-Württemberg and Berlin Geography curricula

Content	IB DP	Baden-Württemberg (Ba-Wü)	Berlin
Focus	<ul style="list-style-type: none"> - Methods: statistics, geographic data production and interpretation - Population - Disparities in wealth 	<ul style="list-style-type: none"> - Physical geography (hydrology, climatology, pedology) - Human geography (economic geography, sustainability, structural analysis) 	<ul style="list-style-type: none"> - Europe - Developing countries - World economic regions (USA, Asia Pacific)
Options (available areas of concentration)	<p>SL/HL Option: Freshwater, Oceans and their coastal margins, Extreme environments, Hazards and disasters, Leisure, sport and tourism, The geography of food and health, Urban environments</p> <p>HL Option: Measuring global interactions, Changing space, Economic interactions and flows, Environmental change, Socio-cultural exchanges, Political outcomes, Global interactions at the local level</p>	None	None
Topics	<p>Core:</p> <ol style="list-style-type: none"> 1. Populations in transition 2. Disparities in wealth and development 3. Patterns in environmental quality and sustainability 4. Patterns in resource consumption 	<p>Preassigned:</p> <ol style="list-style-type: none"> 1. Relief sphere 2. Hydrosphere 3. Atmosphere 4. Pedosphere 5. Economic structures and processes 6. Global problems and sustainability 7. Problem-oriented structural analysis 8. Economic actions 	<p>Preassigned:</p> <ol style="list-style-type: none"> 1. Population development 2. Europe: structural changes 3. Living in One World – developing countries 4. World economic zones in transformation

Overall, like in History, there is a much wider prescribed range of geographical areas to cover in Berlin, most notably the USA and Asia Pacific as well as countries in the tropics and subtropics. In the IB DP schools, there is a very strong focus on methodology and approach to the discipline, notably from a global perspective, although in geography there are fewer options than in the other subject curricula (7 core units). Little detail is given about the actual regions or countries to be studied in the IB DP schools, which results in limited alignment between the IB DP geography curriculum and both German state curricula from a content point of view. Arguably, a less prescriptive curriculum leaves room for more alignment with the national curricula. Alignment is greater between the Baden-Württemberg and Berlin curriculum especially around economic geography although the scope in Berlin is more global in nature based on pre-assigned topics.

2.5 Spanish

The analysis of the content of the Spanish curriculum suggests that the core topics of the IB DP curriculum are communication and media, social relationships and global issues. The IB DP curriculum for Spanish offers flexibility and choice to students whereas the curricula in both German schools are fixed (see Table 5). There are five additional options, one of which is cultural diversity. The IB DP curriculum in Spanish is organized alongside topics just like the Berlin curriculum whereas the curriculum in Baden-Württemberg is centered on language skills including phonetics, syntax, morphology rather than a thematic outline (Berlin) as to which topics should be covered.

In the IB DP programme, language learning is integrated in its social and cultural context and structured around topics, similar to Berlin, whereas in Baden-Württemberg it is more of a technical learning approach that is centered on phonetics, morphology, syntax and listening skills. Global and social issues as well as questions of identity which are explicitly embedded in the Berlin curriculum are absent from the Baden-Württemberg curriculum for Spanish. The Baden-Württemberg curriculum focuses mainly on written comprehension, listening comprehension, written and oral expression whereas the Berlin curriculum is structured around topics: The individual and society, national and cultural identity, One world – global questions and Contemporary challenges. These topics overlap to quite an extent with those in the IB DP programme, notably the core units on global issues and social relationships. The

cultural and social aspects of the Spanish language area are fully integrated in the learning content in both the IB DP schools and Berlin, but only very loosely in Baden-Württemberg.

Table 5: Comparison between IB DP, Baden-Württemberg and Berlin Spanish curricula

Content	IB DP	Baden-Württemberg (Ba-Wü)	Berlin
Focus	- Literature - Social, cultural and political issues of the Spanish language area	- Literature - Phonetics, morphology and syntax of Spanish	- Social, cultural and political issues (including identity) of the Spanish language area
Options (available areas of concentration)	Options: 1. Cultural diversity 2. Customs and traditions 3. Health 4. Leisure 5. Science and technology	None	None
Topics	Core: 1. Communication and media 2. Global issues 3. Social relationships	Preassigned: 1. General communication 2. Phonetics 3. Reading comprehension 4. Listening comprehension 5. Syntax	Preassigned: 1. Individuals and society 2. One world – global issues 3. National and cultural identity 4. Contemporary challenges

In sum, there is this considerable divergence between the Spanish curriculum in Berlin and Baden-Württemberg and, like with History, the IB DP programme has more aligned topics with the Berlin Spanish curriculum.

3. Analysis of the Cognitive Demand and Philosophical Underpinnings

3.1 Biology

In the IB DP schools, biology promotes a diversity of approaches and explanations and addresses several ways of knowing in science, but also the limitations of data and knowledge, as summarized in Table 6:

Table 6: Cognitive demand in Biology curricula in Baden-Württemberg and Berlin

Cognitive Demand	IB DP	Baden-Württemberg (Ba-Wü)	Berlin
Methods	<ul style="list-style-type: none"> - embrace the diversity of approaches and methods in the natural sciences - learn that knowledge is produced in observations and experiments - use models if elements are not observable - learn to produce theories - identify correlations between a factor and an outcome 	<ul style="list-style-type: none"> - use instruments of observation and measurement - plan, conduct, demonstrate and assess experiments - develop and evaluate hypotheses - use models - understand easy scientific texts - foster individual experiments and development of social competence through teamwork 	<ul style="list-style-type: none"> - use instruments of observation and measurement - plan, conduct, demonstrate and assess experiments - develop and evaluate hypotheses - use models - understand easy scientific texts - foster cumulative learning and problem-based learning in a continuously changing world
Making connections	<ul style="list-style-type: none"> - understand that data is limited - understand that knowledge is limited 	<ul style="list-style-type: none"> - students are encouraged to be curious, to enjoy discovery and be responsible towards nature 	<ul style="list-style-type: none"> - students are encouraged to be curious, to enjoy discovery and be responsible towards nature
Biology and its systemic context		<ul style="list-style-type: none"> - students are encouraged to understand systemic contexts and symbiotic communities and their interactions 	<ul style="list-style-type: none"> - students are encouraged to understand systemic contexts and symbiotic communities and their interactions
Knowledge production	<ul style="list-style-type: none"> - learn that science requires freedom of thought and open-mindedness 	<ul style="list-style-type: none"> - understand the world from a natural scientific perspective 	<ul style="list-style-type: none"> - understand the world from a natural scientific perspective

In the IB DP biology curriculum the methodological diversity in biology is a central part of the curriculum. Students are introduced to the instruments of science and learn to conduct experiments and observations. They learn that research involves rigour and scrutiny but also open-mindedness. Knowledge production in the sciences differs from other subject areas and is an important cognitive learning objective in the IB DP schools.

In Baden-Württemberg, the focus is very much on independent experiments as well as developing social competence as part of group work (see Table 6). The human being is to be recognised in his/her double role as part of nature and creator of nature. Biology is conceptualised as being connected to the other natural sciences and not simply knowledge acquisition. In Berlin, the curriculum emphasises cumulative learning and sustainability. Mankind interacts with nature and students are taught to be responsible in their dealings with the environment. Key cognitive demands revolve around communication skills, as well as obtaining new insights and knowledge. Another overarching goal in the German state curricula of biology is to inspire the joy of discovery but also a sense of responsibility towards nature. Methodological pluralism is also important in both federal states when researching biological phenomena.

Sustainability is a key guiding principle in both the Berlin and Baden Württemberg biology curricula along with the key principle that biology investigates life and interconnections between living organisms. An additional aim is to encourage students to be curious, to enjoy discovery and be responsible towards nature. In IB DP biology curricula open-mindedness and freedom of thought play an important role. Students are encouraged to embrace diversity and address problems in biology from different perspectives and in an unbiased way. Students will acquire a limited body of facts and, at the same time, develop a broad, general understanding of the principles of the subject.

3.2 Mathematics

Similarities can be found with regard to the cognitive demand in the curricula in both German state schools and the IB DP schools (see Table 7).

Table 7: Cognitive demand in Mathematics curricula in Baden-Württemberg and Berlin

Cognitive Demand	IB DP	Baden-Württemberg	Berlin
Critical Thinking	- develop logical, critical and creative thinking, and patience in problem-solving	- develop logical, critical and creative thinking, and patience and persistence in problem-solving	- develop logical, critical and creative thinking, and patience and persistence in problem-solving
Methods	- develop an understanding of the principles and nature of mathematics	- Learning: structure the learning process - Arguing: learn and apply mathematical reasoning - Problem-solving: Use aides like calculators to solve problems - Communication	- learn to solve problems with simulations and models - apply statistical knowledge - communicate - Arguing: learn and apply mathematical reasoning
Making connections	- enjoy mathematics, and develop an appreciation of the elegance and power of mathematics - employ and refine their powers of abstraction and generalization	- understand mathematical problems and interrelations - employ and refine their powers of abstraction and generalization	- understand mathematical problems and interrelations - employ and refine their powers of abstraction and generalization
Communication	- communicate clearly and confidently in a variety of contexts	- learn precise communication and reasoning - describe problems in a suitable, mathematical format	- learn precise communication and reasoning - describe problems in a suitable, mathematical format
Transferability of universality of mathematics	- apply and transfer skills to alternative situations, to other areas of knowledge and to future developments - appreciate the moral, social and ethical implications arising from the work of mathematicians and the applications of mathematics - appreciate the international dimension in mathematics through an awareness of the universality of mathematics and its multi-cultural and historical perspectives - appreciate the contribution of mathematics to other disciplines, and as a particular “area of knowledge” in the TOK course.	- apply mathematical knowledge to new problems	- apply mathematical knowledge to new problems

In all curricula the joy and appreciation of mathematics is encouraged, but also problem-solving and the transferability of skills, as well as the precision and universality in which mathematics is communicated. The IB DP schools emphasize the transferability of mathematics to other knowledge areas and the universality adding to the advancement of other areas and disciplines and being applicable in an international multicultural context. The German curricula both focus more on communication and methods. In Baden-Württemberg, the guidelines emphasise individual and group learning, reasoning, problem solving and communication as key cognitive goals, and in Berlin, the guidelines stress problem-solving, modelling, reasoning, cooperation and illustration of mathematical matters. There is thus a different focus between the IB schools on the one hand and the German state schools on the other in terms of cognitive demands in mathematics.

The nature of mathematics is seen as an abstract system of ideas and a useful tool in IB DP schools and in German schools. Students' attention is drawn to questions relating theory of knowledge and mathematics in IB DP schools, and they are encouraged to raise such questions themselves. The philosophical underpinnings in Germany prioritize the creativity, elegance and subtleness of mathematical thoughts, and students encouraged to be curious, imaginative and critical with regard to mathematical methods. In IB DP schools the universality of mathematical thoughts is an important aspect introducing students to a creative and transferrable way of thinking and problem solving.

3.3 History

The cognitive demands of all history curricula are focused on causality, multiple perspectives and students' sense of narratives and historical reconstruction as well as understanding and evaluation of major events (see Table 8).

A key emphasis in Baden-Württemberg, apart from critical thinking, is links with other social science subjects that should be explicitly fostered. In Berlin, there was a more explicit reference to Europeanisation and globalization as well as the importance of forming one's own identity in such historical contexts. While the German federal state curricula explicitly refer to the importance of knowledge about European history (in addition to regional and national history), the IB DP curriculum promotes an 'understanding of the impact of

historical developments at national, regional and international levels’ without explicitly promoting European history and identity. This may have to do with educational policy developments in Germany. Building on various earlier initiatives to implement a European dimension (e.g. the 1978 and 1990 ‘Europe in the Classroom’ documents), in 2008, the Standing Conference of the Ministers of Education published the revised document ‘Europe at School’ (*Europabildung in der Schule*). It reaffirmed that the goal of education must be ‘to awaken in young people the consciousness of a European identity; to prepare them to be aware of their responsibilities as citizens of the European Community’ (Kultusministerkonferenz 2008: 6f.). Social science subjects including history and geography are ideal for promoting this sense of collectivity which is incorporated far stronger in Baden-Württemberg than Berlin. The reflection on the past and the students’ historical identity is encouraged in both school types.

Table 8: Cognitive demand in history curricula in Baden-Württemberg and Berlin

Cognitive Demand	IB DP	Baden-Württemberg	Berlin
Critical Thinking	<ul style="list-style-type: none"> - human experience and behaviour - physical, economic and social environments; - history and development of social and cultural institutions 	<ul style="list-style-type: none"> - ability to critically engage with the topic 	<ul style="list-style-type: none"> - encourage students to ask open, critical and independent questions
Methods	<ul style="list-style-type: none"> - analyse and evaluate theories, concepts and arguments - collect, describe and analyse data - test hypotheses - interpret complex data and source material 	<ul style="list-style-type: none"> - analyse and evaluate concepts and key arguments - emphasis on causality, problem-oriented, multiple perspectives - co-operation with other subjects 	<ul style="list-style-type: none"> - analyse and evaluate concepts, key arguments (reflections on historical events) and images
Making connections	<ul style="list-style-type: none"> - understanding of history as a discipline - toleration of uncertainty in content and methods 	<ul style="list-style-type: none"> - understanding of historical events in their context - knowledge of events, people and epochs 	<ul style="list-style-type: none"> - reconstruct the past and understand important events - understand other people’s interpretations of the past
History of culture and identity	<ul style="list-style-type: none"> - historical identity through the study of the historical experiences of different cultures. 	<ul style="list-style-type: none"> - develop an understanding for regional, national, European and partly also global history 	<ul style="list-style-type: none"> - develop an understanding for Europe and globalisation and own identity

The philosophical underpinnings of the history curriculum in IB DP schools explore the interactions between humans and their environment in time, space and place. History is not only seen as the study of the past, but primarily as the process of recording, reconstructing and interpreting the past through the investigation of a variety of sources. It is a discipline that gives people an understanding of themselves and others in relation to the world, both past and present. In order to understand the past, students are encouraged to engage with it both through exposure to primary historical sources and through the work of historians. The German curricula focus more strongly on tolerance and pluralism (Berlin) and the formation of a European identity (Baden-Württemberg) which should be fostered and looked at throughout the teaching. This is a notable difference from the IB DP history programme.

3.4 Geography

In line with the focus in the content of the geography curriculum, the cognitive demand in the IB DP curriculum prioritizes the development and application of methodological skills and critical thinking about geographical concepts and the impact of human actions. Global responsibility is also a central aspect of the IB DP curriculum, teaching students to realize the interdependence between environmental issues and the maintenance of human welfare (see Table 9). The curricula in Baden-Württemberg and Berlin are broadly similar in their methodological focus and promotion of critical awareness of other countries, cultures and peoples. In Berlin, the notion of developing one's own identity through geography is specifically mentioned which is not the case in the other curricula. In contrast, there is more explicit emphasis given to intercultural learning and tolerance in the Baden-Württemberg curriculum. From a philosophical point of view it is interesting to see this emphasis on intercultural learning and tolerance. In 1996, the German Kultusministerkonferenz issued a guideline 'Intercultural Education at School' (*Interkulturelle Bildung und Erziehung in der Schule*) stating that federal states should 'overhaul and further develop their curricula and guidelines of all subjects with regard to an intercultural dimension [and] develop teaching materials which address intercultural aspects as an integral part of school and education' (Kultusministerkonferenz 1996). The results of this are clearly visible in social science subjects such as geography. The concept of interculturalism is not explicitly mentioned in the curriculum guidelines of the IB DP geography curriculum although the subtext is similar in that geography promotes respect and tolerance and mutual understanding.

Table 9: Cognitive demand in Geography curricula in Baden-Württemberg and Berlin

Cognitive Demand	IB DP	Baden-Württemberg (Ba-Wü)	Berlin
Critical Thinking	- develop in the student the capacity to identify, to analyse critically and to evaluate theories, concepts and arguments about the nature and activities of the individual and society	- develop ability to solve problems, apply knowledge in different contexts	- develop the capacity to understand and evaluate contemporary realities and interactions with the ecosystem - develop critical awareness
Methods	- enable the student to collect, describe and analyse data used in studies of society, to test hypotheses, and to interpret complex data and source material	- develop methodological and media expertise and reflect on knowledge	- develop methodological and media expertise and reflect on knowledge with a view of moving on to university
Making connections	- develop an understanding of the inter-relationships between people, places, spaces and the environment	- use geographical knowledge - understand the inter-dependence between humans and nature	- develop an understanding of the inter-relationships between people, places, spaces and the environment
Global responsibility	- develop a concern for human welfare and the quality of the environment, and an understanding of the need for planning and sustainable management - promote the appreciation of the way in which learning is relevant both to the culture in which the student lives, and the culture of other societies	- develop responsibility towards the living environment - fostering intercultural competence through knowledge of different peoples and countries, and thereby promoting tolerance	- develop responsibility towards the living environment - students are encouraged to be open-minded towards the world and other cultures - develop respect, tolerance, solidarity and global consciousness
Interdisciplinarity	- appreciate the relevance of geography in analyzing contemporary issues and challenges, and develop a global perspective of diversity and change.	- students are encouraged to recognize the larger context of topics - students are encouraged to discuss topics across disciplines	- students are encouraged to recognize the larger context of topics - students are encouraged to discuss topics interdisciplinary

The philosophical aspects of geography in IB schools highlight the dynamic of the subject that is grounded in the real world and focuses on the interactions between individuals,

societies and the physical environment in both time and space. The identification of trends and patterns in these interactions is a key competence of the geography curriculum, but also the human response to change and the associated management strategies. This approach is somewhat different from that in Baden-Württemberg where the focus is on fostering intercultural competence, physical and cultural characteristic of particular areas, and topographical understanding more generally. In Berlin, the interconnection between natural and social scientific approaches which characterizes geography is emphasized. Another underlying philosophy is the formation of one's identity and critical reflection, and to get an insight into other cultures with a view of increasing tolerance and world peace.

3.5 Spanish

In line with the focus in the content of the curriculum, the cognitive demand in IB DP schools prioritizes cultural understanding and the role of language for the personal and intellectual development of the students.

The development of linguistic and intellectual competences is the key point in the Baden-Württemberg curriculum alongside intercultural learning and sensitization for other cultures and value traditions. In Berlin, intercultural competence is placed on a par with methodological competence and linguistic competences. Given the many Spanish-speaking areas, Spanish is seen as a key subject for fostering intercultural competence in Berlin schools which in turn could impact on identity formation. This is not to say that intercultural competence is not important in Baden-Württemberg, rather that it is given more curriculum space and mentioned more explicitly in the Spanish curriculum in Berlin. There are other signs that point towards a more inclusive, equal and intercultural emphasis in Berlin. For example, in recent years, most German states have introduced legislation banning headscarves including a similar provision to make clear that Christian (and Jewish) symbols are *not* affected (Faas 2010).

The philosophical underpinning in all types of curricula promotes awareness and a greater respect for other cultures and the reflection on cultural behaviour and values.

Table 10: Cognitive demand in Spanish curricula in Baden-Württemberg and Berlin

Cognitive Demand	IB DP	Baden-Württemberg	Berlin
Language acquisition	<ul style="list-style-type: none"> - enable students to understand and use the language they have studied in a range of contexts and for a variety of purposes 	<ul style="list-style-type: none"> - development of linguistic and intellectual competences - development of useful and situational vocabulary - competences in grammar, written and oral communication - text writing competences 	<ul style="list-style-type: none"> - development of linguistic and intellectual competences - development of useful and situational vocabulary - competences in grammar, written and oral communication - text writing competences
Cultural understanding	<ul style="list-style-type: none"> - encourage, through the study of texts and through social interaction, an awareness and appreciation of the different perspectives of people from other cultures - develop students' awareness of the relationship between the languages and cultures with which they are familiar 	<ul style="list-style-type: none"> - fostering intercultural learning and understanding 	<ul style="list-style-type: none"> - students know cultural and linguistic characteristics of Spanish speaking countries and reflect on these
Role of language	<ul style="list-style-type: none"> - develop students' awareness of the role of language in relation to other areas of knowledge - provide students with a basis for further study, work and leisure through the use of an additional language - provide the opportunity for enjoyment, creativity and intellectual stimulation through knowledge of an additional language 	<ul style="list-style-type: none"> - enable students to communicate verbally and in writing - develop tolerance and a better insight into the socio-cultural reality of countries of the Spanish speaking world 	<ul style="list-style-type: none"> - enable students to express their ideas, arguments and thoughts - developing an intercultural dimension is the key goal of the Spanish curriculum which promotes mutual understanding and tolerance

4. Discussion and Conclusion

In natural scientific disciplines such as mathematics and biology the content of IB curricula and the curricula in the selected two federal states in Germany demonstrate a high level of alignment in terms of topic overlap. In contrast, in the humanities and social sciences (particularly History and Spanish), there is a lower level of alignment in terms of content. In general the availability of options that allow students to specialize in their area of choice is a benefit of the IB DP curricula and cannot be found in Germany. However, it bears the risk that some of the options are less demanding and comprehensive than others. These findings resemble Conley (2009) who found that, in biology and mathematics there was complete alignment whereas some discrepancies were observed in English and the languages when comparing IB DP programmes and US mainstream schools.

Key differences can be found in the cognitive demand of the curricula in IB DP and German school, particularly in the social sciences and humanities subjects. The local and national roots from which curricula in Germany emerged and the more international approach in IB DP schools could be the reason for this diversity. The cultural and political history of a federal state clearly has an impact on curriculum design and development, hence the more liberal multicultural and cosmopolitan design in Berlin compared to Baden-Württemberg which has been more conservative (Faas 2011). The notion of a European identity and history seems to be stronger in the two German state curricula, especially Baden-Württemberg than in the IB DP curricula. Therefore, languages, the promotion of a national and European identity are a central aspect of education in the social science subjects in Germany whereas the IB DP curricula have a more global approach including cultural studies of different world regions and the discussion of social issues from a global perspective.

It should be noted that there were far more elective options available in the IB DP schools, compared to German mainstream curricula. However, that does not mean that all is prescribed in the German federal state curricula. Instead, the educational standards that were introduced some ten years ago define topic areas and competences that should be achieved by a particular grade but they leave sufficient scope for teachers to specify the topic area. The curriculum does however not list specific options or choices and it is then up to the teacher to think about suitable units and topics, often based on what was previously

taught prior to the introduction of educational standards (see Faas 2011, 2013). In general the availability of options that allow students to specialize in their area of choice is a benefit of the IB DP curricula and cannot be found to that extent in German state schools. The IB DP curricula offer flexibility to pursue academic interests and require a larger amount of thought and reflection in the selection process. However, it might bear the risk that some of the options are less demanding and comprehensive than others.

5. Recommendations

1. We recommend that IB content is updated and reviewed in a regular revision cycle considering alignment with national and regional topics and updates relevant to the subject.
2. We recommend that the content be regularly scrutinized to guarantee comparability in time and effort required for each of the options offered in IB DP curricula.
3. We recommend IB curriculum experts to consider the different cognitive approaches to determine whether the IB curriculum should be revised adding additional aspects or if the cognitive objectives should deliberately not be altered or expanded.
4. In some cases the IB curricula show strong preferences towards specific aspects of the discipline's cognitive demand compared with the curricula in Germany - for example, the focus on the cultural understanding of the Spanish-speaking world, the knowledge production in biology and the transferability and universality of mathematics. We recommend evaluating if an emphasis on specific aspects may introduce a bias into the cognitive approach to certain disciplines.
5. The IB DP curriculum, especially in the social science subjects, could be reviewed to strengthen the European dimension and therefore ensure students knowledge (and identity) is in line with mainstream schools. Arguably, the IB DP curriculum can accommodate various local needs and the European dimension could be viewed to be one of these.

6. The social dimensions of geography and its role in citizenship education and identity formation could be strengthened in the IB DP schools. Despite the inclusion of a topic on population and disparities of wealth, there is an overemphasis on methods in the IB geography curriculum compared with the German state curricula.

6. Appendix

Table of Syllabi documents analysed – IB DP and Germany

Age/Cycle	Document Title	Pages	Author/Date
16-19/Diploma programme	Mathematics HL guide: First examinations 2014	85	IB, 2012
16-19/Diploma programme	History guide: First examinations 2010	98	IB, 2008
16-19/Diploma programme	Geography guide: First examinations 2011	82	IB, 2009
16-19/Diploma programme	Biology: First examinations 2009	136	IB, 2007
16-19/Diploma programme	Language B guide (Spanish): First examinations 2013	79	IB, 2011
Subtotal	5 Documents	480	
16-19/Oberstufe	Bildungsstandards für Mathematik Gymnasium	12	KM, 2004
16-19/Oberstufe	Bildungsstandards für Geschichte Gymnasium	18	KM, 2004
16-19/Oberstufe	Bildungsstandards für Geographie im Rahmen des Fächerverbundes Geographie, Wirtschaft, Gemeinschaftskunde	11	KM, 2004
16-19/Oberstufe	Bildungsstandards für Biologie Gymnasium	14	KM, 2004
16-19/Oberstufe	Bildungsstandards für Spanisch (3. Fremdsprache) Gymnasium	10	KM, 2004
16-19/Oberstufe	Rahmenlehrplan für die gymnasiale Oberstufe: Mathematik	54	SENBJs, 2006
16-19/Oberstufe	Rahmenlehrplan für die gymnasiale Oberstufe: Geschichte	39	SENBJs, 2006
16-19/Oberstufe	Rahmenlehrplan für die gymnasiale Oberstufe: Geografie	30	SENBJs, 2006
16-19/Oberstufe	Rahmenlehrplan für die gymnasiale Oberstufe: Biologie	36	SENBJs, 2006
16-19/Oberstufe	Rahmenlehrplan für die gymnasiale Oberstufe: Spanisch	35	SENBJs, 2006
Subtotal	10 Documents	259	
Total	15 Documents	739	

IB: International Baccalaureate Organization

KM: Ministerium für Kultus, Jugend und Sport Baden-Württemberg

SENBJs: Senatsverwaltung für Bildung, Jugend und Sport Berlin

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