DP Country Alignment Studies: Alignment of the Brazilian High School Curriculum (BHSC)

Submitted by Ecctis to the IB

Commercial in confidence

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Ecctis

Acronyms

AA	mathematics: analysis and approaches
AHL	additional higher level
AHSS	Applied Human and Social Sciences
AI	mathematics: applications and interpretation
AO	Assessment Objectives
BGE	Basic General Education
BHSC	Brazilian High School Curriculum
BNCC	(Brazilian) National Common Curricular Base
BSS	Brazilian social studies
CAS	Creativity, activity, service
CP	Career-related Programme
DP	Diploma Programme
ENEM	Exame Nacional do Ensino Médio (National High School Exam)
FI	Formative Itinerary
HL	higher level
IB	International Baccalaureate
IBO	International Baccalaureate Organisation
LAT	Language and Technology
LA:LL	Language A: language and literature
MAT	Mathematics and Technology
MoE	Ministry of Education (Brazil)
MYP	Middle Years Programme
NST	Natural Sciences and Technology
PYP	Primary Years Programme
RfP	Request for Proposal

RQ	Research Question
RJRC	Rio de Janeiro Referential Curriculum
SL	standard level
TOK	theory of knowledge
WIAIBE	What is an IB education?

Contents

1. Executive Summary

Project Aims and Context

The International Baccalaureate (IB) Organization is a not-for-profit educational foundation offering four programmes across the world. One of them – the Diploma Programme (DP) – is a two-year upper secondary programme, primarily intended to prepare students for university matriculation and higher education.

Following previous studies focused on the education systems of Australia (Victoria), Canada (Ontario), the US, Singapore, South Korea, Finland, France and Spain,[1] Ecctis has been commissioned by the IB to deliver two critical and in-depth alignment studies to assess the level of alignment between the DP and comparison points within the upper secondary education systems of Brazil and Mexico.[2] More specifically, the studies aim to identify areas of similarity and difference between the DP and these educational systems by comparing philosophical underpinnings, structure, requirements, assessment methods, learning pathways, content, and specifically to determine how the DP compares to the selected comparisons in terms of intended student learning outcomes at subject level. These studies include, for both countries, a focus on DP mathematics, DP sciences, and DP language A: language and literature, as well as an additional focus on DP history, DP philosophy, and DP Brazilian social studies for Brazil.

The report aims to specifically evaluate alignment between the DP and the upper-secondary programme of education in Brazil. The *National Guidelines for High School Education*, *National Common Curricular Base (BNCC)*, and *Curricular References for the Preparation of Formative Itineraries* are key to the organisation and structure of high school education in Brazil and are referred to collectively as the Brazilian High School Curriculum (BHSC) throughout the report. Moreover, the *Rio de Janeiro Referential Curriculum (RJRC)* was also consulted to provide additional insights into Brazilian high school education, being primarily used to inform the subject-level content analysis of BHSC subjects.

Research Questions and Methods

All comparative studies in this series have been framed by responses to Research Questions (RQs), both at programme and subject levels. For this study, these RQs were the following:

RQ1: To what degree does the DP curriculum align with the Brazilian upper secondary curriculum? In what way are the curricula similar and in what way are they different in demand and difficulty? To what degree are the curricula compatible?

RQ2: To what degree do the curricula align with regards to their:
2.1: Philosophical underpinnings

[1] The full reports can be accessed at: www.ibo.org/research/curriculum-research/dp-studies/dp-country-alignment-studies-2023/

[2] The series of studies responds to the following Request for Proposals (RFP), issued by the IB: *The International Baccalaureate Diploma Programme: Alignment With Upper Secondary Education In Brazil and Mexico.*

- Objectives
- Principles
- Values.

2.2: Structure

- Learning areas
- Subject offerings
- Degree of specialization
- Time allocation.

2.3: Requirements

- Programme entry requirements
- Time requirements (i.e. programme duration, teaching hours, study hours)
- Certificate requirements (i.e. credits, passing and failing conditions, compensation options).

2.4: Assessment

- Nature of assessment (i.e. number, type, duration, question types, availability of marks)
- Assessment model (i.e. relative weighting of assessments to overall grades).

2.5: Student learning pathways

- Degree of specialization
- Options in subject (area) choice (i.e. compulsory subjects, electives).

RQ3: To what degree do the subjects align with regards to:

3.1: Content

- Topics (i.e. scope of content area, breadth, depth)
- Learning activities (i.e. difficulty, demand).

3.2: Expected learning outcomes

- Knowledge
- Competences (i.e. subject-specific, 21st century competences).

To answer the above RQs, Ecctis developed and applied a bespoke methodology.

At programme-level, this involved the comparative analysis of key components of the DP and the BHSC, including: philosophical underpinnings, structure, requirements and associated outcomes, student learning pathways, and assessment methods (where possible). At subject-level, it involved the comparative analysis of key components of the DP and the BHSC subjects, including: learning outcomes, content, and demand.

Where appropriate, Ecctis complemented its standard comparative methodology with a comprehensive mapping method, extracting themes from the DP to evaluate their presence in the comparison point(s). Additionally, to assess demand at subject level, Ecctis designed and deployed an expert panel approach, scoring each individual subject against a common set of demand criteria.[3]

Key Findings

Programme-level

The philosophical underpinnings constitute the most significant point of similarity between the DP and BHSC. In all other respects, there are notable differences. Some key differences

[3] Each individual subject was scored for: cognitive skills evidenced in the learning outcomes (based on the Revised Bloom's Taxonomy), depth of knowledge (adapted from Webb's Depth of Knowledge levels), volume of work (a tri-factor score considering breadth, depth and allocated timeframe), and outstanding areas of subject demand (stretch areas).

include the emphasis on subject integration vs single-subject study, the number of subjects studied, the nature of specialisation, the degree of optionality, the prescriptiveness of entry requirements, and the degree of assessment centralisation.

- **Philosophical underpinnings**: the DP and BHSC share very similar philosophical underpinnings. Indeed, themes of conceptual thought and understanding, independence and self-management, critical inquiry and reasoning, and principled and community-oriented are evident in both curricula. The main difference between the programmes lies in the BHSC's stronger focus on the Brazilian, rather than international, context and its emphasis on work and professional contexts. That said, students or teachers moving between the two programmes would find a high level of consistency between their philosophical underpinnings.

- **Programme structure**: there are some similarities between the DP and BHSC structures. For example, both encourage breadth of study and require students to study subjects from broadly similar subject areas. Overall, however, the structures of the DP and BHSC differ significantly. One key difference is that the DP is organised into single-subject courses, whereas the BHSC is organised into broader areas of knowledge that are used for basic general education and formative itineraries. Moreover, it can be noted that the BHSC requires basic general education to span a greater number of subjects than what is studied by students in the DP. Also, the DP is shorter in duration (two years) than high school in Brazil (three years) and is more prescriptive with regard to curricular organsiation and the allocation of teaching hours per subject. The BHSC includes the additional component of the life project, which has some similar aims to the DP core, but less extensive requirements. Finally, the BHSC includes the option to pursue technical and professional training, which is not the case for the DP – as this is instead the focus of the IB Career-related Programme (CP).

- **Entry requirements**: the DP and BHSC differ with respect to entry requirements. Indeed, the IB encourages students and teachers to consult subject guides around expected prior learning but does not provide fixed entry requirements. In contrast, entry to high school in Brazil is dependent on the successful completion of elementary school – students who are not able to demonstrate the expected abilities must repeat the grade or year.

- **Student learning pathways**: DP student pathways have more optionality and single-subject specialism, whereas BHSC student pathways include a broader range of subjects and offer integrated-subject specialism. Indeed, DP students choose all their subjects, whereas the BHSC offers a choice of subject areas for the formative itinerary component (students study all areas in basic general education). Moreover, specialisation in the BHSC (i.e. formative itineraries) integrates subjects within one or more areas of knowledge, whereas specialisation in the DP (i.e. HL courses) is comprised of distinct single subjects.

- **Assessment methods:** the assessment leading to the Brazilian High School Graduation Certificate is decentralised, as the BHSC allows local education systems to make decisions regarding the assessment of student learning. In contrast, the DP follows a more homogenised approach, with assessment (including assessment objectives, methods, and weightings) being set centrally. Hence, unlike the DP, the BHSC does not require students

to sit the same standardised external examinations, though Brazilian students will experience this form of assessment if they take the entrance exam for higher education – the Exame Nacional do Ensino Médio (ENEM). However, it can be noted that there is scope in the BHSC for students to experience similar assessment activities to those included in the DP (e.g. written exams and projects). Lastly, there are some similarities between the subject-specific assessment objectives of the DP and the BHSC's competencies and skills for its areas of knowledge.

Subject-level

In this study, Ecctis carried out subject-level comparative analysis between the DP and BHSC for mathematics, physics, chemistry, biology, language and literature, history, philosophy, and Brazilian social studies. The analysis focused on the following DP and BHSC subjects:

Table: Subjects/courses for comparison of the DP and the BHSC (per DP subject group)

<table>
<tr><th>DP subjects</th><th colspan="2">BHSC subjects</th></tr>
<tr><td colspan="3">MATHEMATICS</td></tr>
<tr><td>mathematics: analysis and approaches (AA) SL & HL</td><td colspan="2" rowspan="2">Mathematics and Technology (MAT)
• Basic general education (BGE)
• Formative itinerary (FI)</td></tr>
<tr><td>mathematics: applications and interpretation (AI) SL & HL</td></tr>
<tr><td colspan="3">SCIENCES</td></tr>
<tr><td>physics SL & HL</td><td rowspan="3">Natural Sciences and Technology (NST)
• Basic general education (BGE)
• Formative itinerary (FI)</td><td>Physics-focus</td></tr>
<tr><td>chemistry SL & HL</td><td>Chemistry-focus</td></tr>
<tr><td>biology SL & HL</td><td>Biology-focus</td></tr>
<tr><td colspan="3">STUDIES IN LANGUAGE AND LITERATURE</td></tr>
<tr><td>language A: language and literature (LA: LL) SL & HL</td><td>Language and Technology (LAT)
• Basic general education (BGE)
• Formative itinerary (FI)</td><td>Portuguese language-focus</td></tr>
<tr><td colspan="3">INDIVIDUALS AND SOCIETIES</td></tr>
<tr><td>history SL & HL</td><td rowspan="3">Applied Human and Social Sciences (AHSS)
• Basic general education (BGE)
• Formative itinerary (FI)</td><td>History-focus</td></tr>
<tr><td>philosophy SL & HL</td><td>Philosophy-focus</td></tr>
<tr><td>Brazilian social studies (BSS)</td><td>History and geography-focus*</td></tr>
</table>

*Following a review of DP Brazilian social studies, Ecctis judged that a focus on history and geography in the BHSC would result in the best comparison.

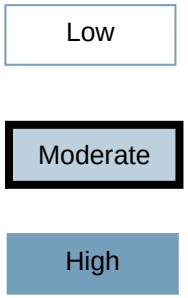
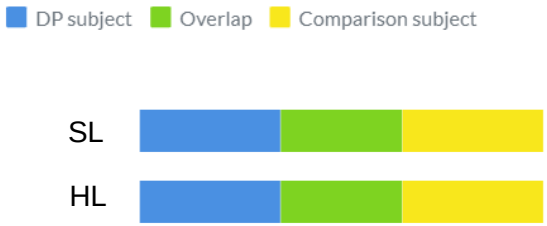
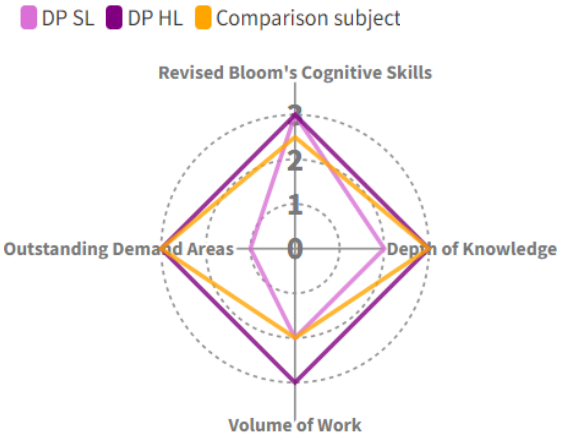
Visual and written summaries of the subject-level analysis between the DP and respective comparison points in the BHSC are provided in this section. The summaries include key findings on learning outcomes alignment, content alignment and demand alignment.

NB: It should be noted that the Rio de Janeiro high school curriculum (RJRC) was used to inform the content and demand analysis of BHSC subjects. Therefore, due to Brazil's decentralised approach to education (both with regard to curriculum and assessment), these findings may differ across education institutions and states.

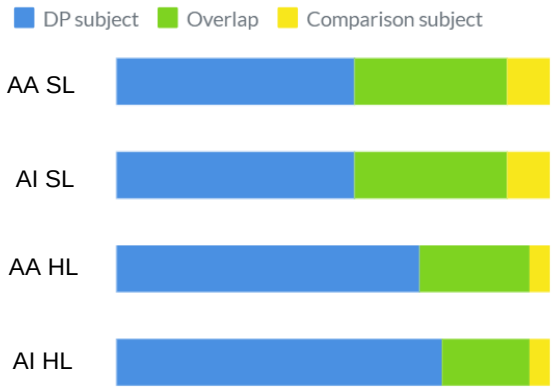
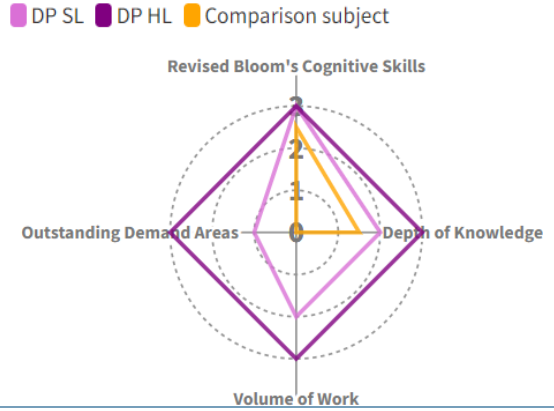
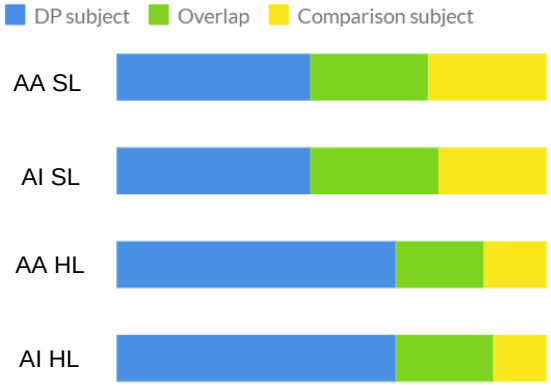
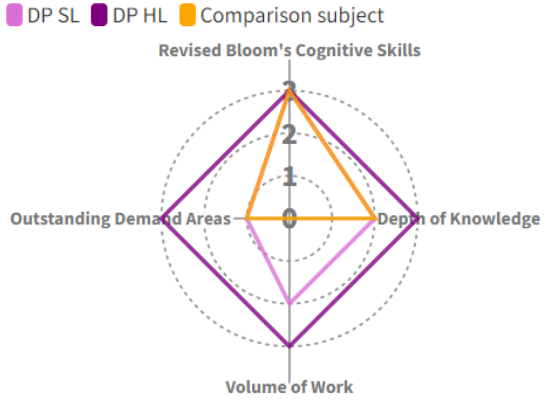
The findings from the subject-level analysis are summarised in the following tables:

Figures: Visual representation of alignment between DP subjects and comparison subjects

Key:

Comparison subject	Learning outcomes alignment	Content alignment	Demand alignment
Displays the name of the comparison subject	 This represents the learning outcome alignment between the DP subject and the comparison subject. A black border is placed around the selected judgement – 'Moderate' in this example.	 These bars represent the content alignment between the DP subject and the comparison. There is one bar showing alignment with SL content and another for HL content (inclusive of SL content). The **green** section of the bar represents the overlap of content between the subjects. The **blue** section represents content which was in the DP subject only. The **yellow** section represents content which was in the comparison subject only. Therefore, if, say, the blue section was larger than the yellow, this can be interpreted as DP subject having more content unique to itself than the comparison did. A large green bar would indicate that a substantial proportion of content overlaps between the DP and the comparison subject.	 This radar diagram displays the demand judgement scores for the comparison subject(s) and the DP subject – both SL and HL.

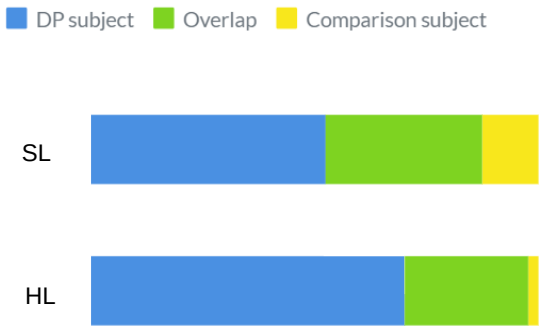
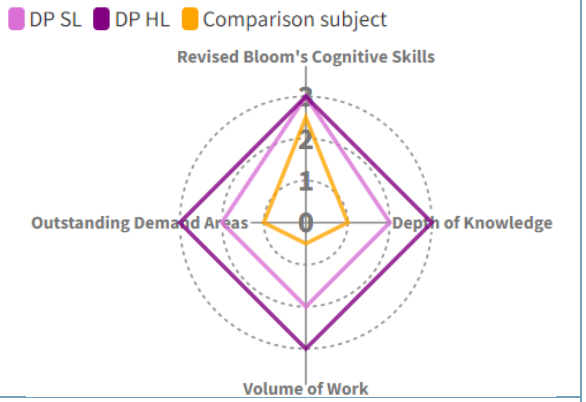
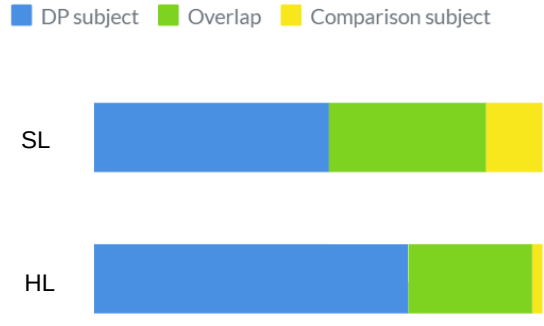
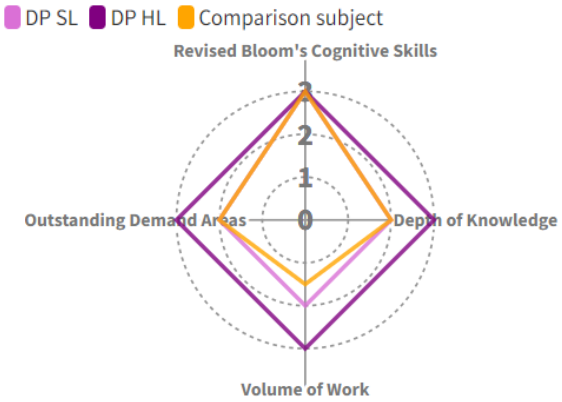
The subject level alignment between DP **mathematics** (AA and AI, SL and HL) and BHSC Mathematics and Technology (MAT) is represented below:

Comparison subject	Learning outcomes alignment	Content alignment	Demand alignment*
BHSC Mathematics and Technology (Basic General Education) *BHSC MAT (BGE)*	Low Moderate **High**		
BHSC Mathematics and Technology (Formative Itinerary) *BHSC MAT (FI)***	Low Moderate **High**		

* DP mathematics: analysis and approaches (AA) and mathematics: applications and interpretation (AI) score the same as each other for SL and the same as each other for HL.

** BHSC MAT (FI) represents the pathway of studying MAT in basic general education and then specialising in a MAT formative itinerary.

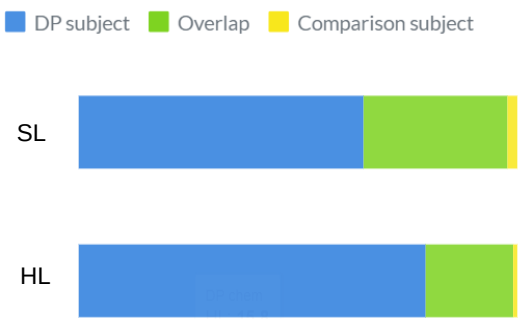
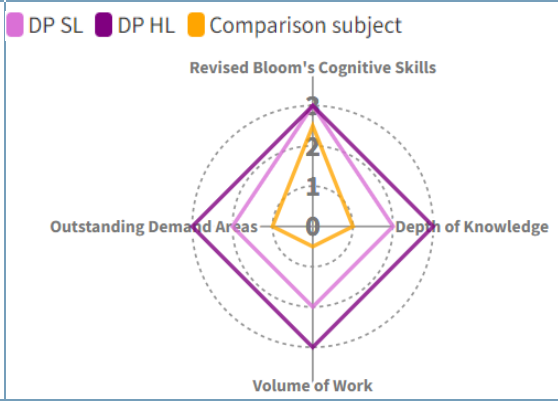
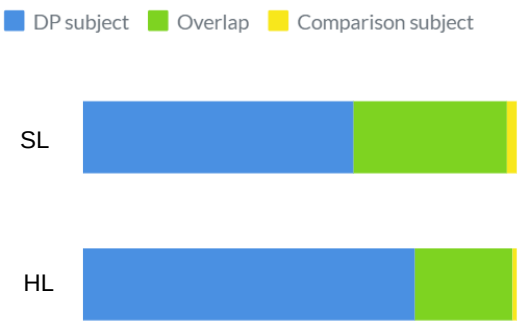
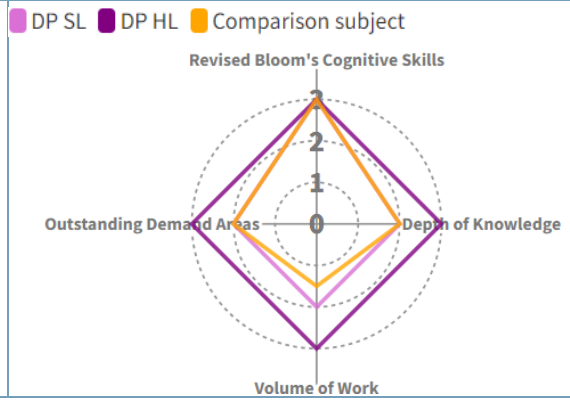
The subject level alignment between DP **physics** (SL and HL) and BHSC Natural Sciences and Technology (NST) is represented below:

Comparison subject	Learning outcomes alignment	Content alignment*	Demand alignment
BHSC Natural Sciences and Technology (Basic General Education) *BHSC NST (BGE) Physics-focus*	Low Moderate **High**		
BHSC Natural Sciences and Technology (Formative Itinerary) *BHSC NST (FI) Physics-focus***	Low Moderate **High**		

* Physics content was broadly described in the documentation for BHSC NST. As such, specific concepts mentioned in DP physics topics were often not identifiable. Where there was limited reference to specific concepts, but broader evidence of coverage, it was concluded that the DP topic/subtopic was 'partially present' in BHSC NST. Therefore, the actual level of alignment may be slightly stronger, or weaker, than what is presented in these key findings.

** BHSC NST (FI) here represents the pathway of studying physics in basic general education and then specialising in an NST formative itinerary. The learning outcomes and demand conclusions for this pathway have considered the NST formative itinerary as a whole, whereas the content judgements only consider the physics content specifically (chemistry and biology content is not considered).

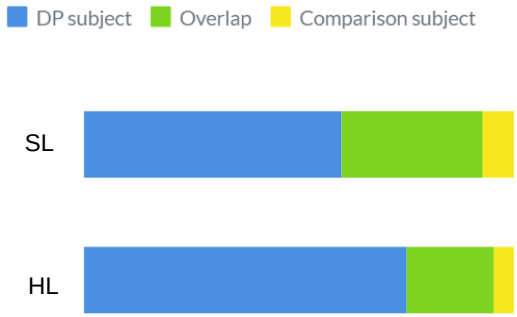
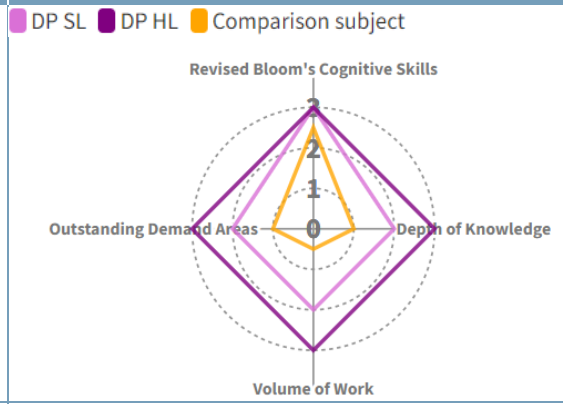
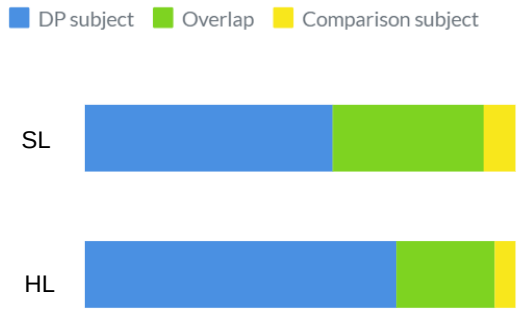
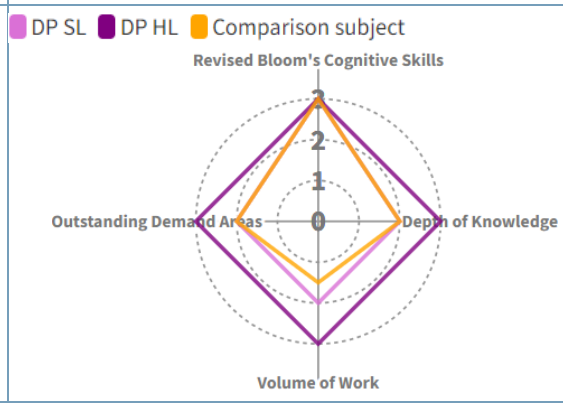
The subject level alignment between DP **chemistry** (SL and HL) and BHSC Natural Sciences and Technology (NST) is represented below:

Comparison subject	Learning outcomes alignment	Content alignment*	Demand alignment
BHSC Natural Sciences and Technology (Basic General Education) *BHSC NST (BGE) Chemistry-focus*	Low Moderate **High**		
BHSC Natural Sciences and Technology (Formative Itinerary) *BHSC NST (FI) Chemistry-focus***	Low Moderate **High**		

* Chemistry content was broadly described in the documentation for BHSC NST. As such, specific concepts mentioned in DP chemistry topics were often not identifiable. Where there was limited reference to specific concepts, but broader evidence of coverage, it was concluded that the DP topic/subtopic was 'partially present' in BHSC NST. Therefore, the actual level of alignment may be slightly stronger, or weaker, than what is presented in these key findings.

** BHSC NST (FI) here represents the pathway of studying chemistry in basic general education and then specialising in a NST formative itinerary. The learning outcomes and demand conclusions for this pathway consider the NST formative itinerary component as a whole, whereas the content judgements only consider its chemistry content specifically (physics and biology content is not included).

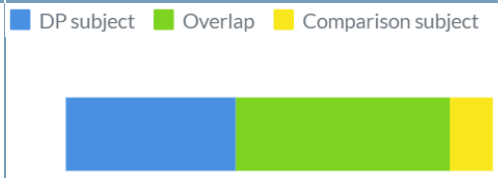
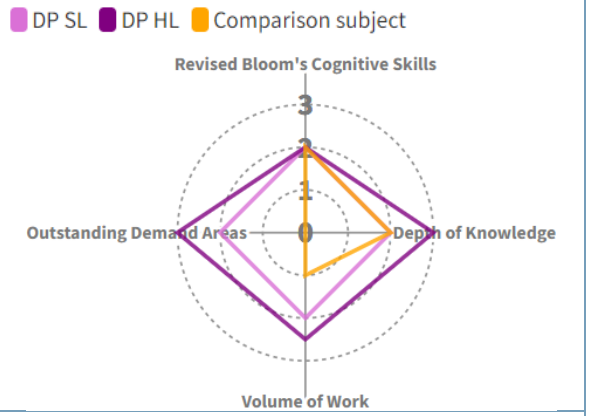
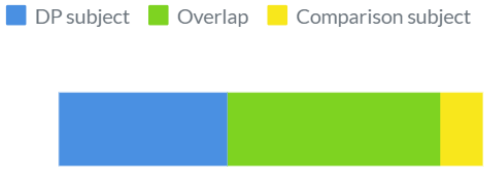
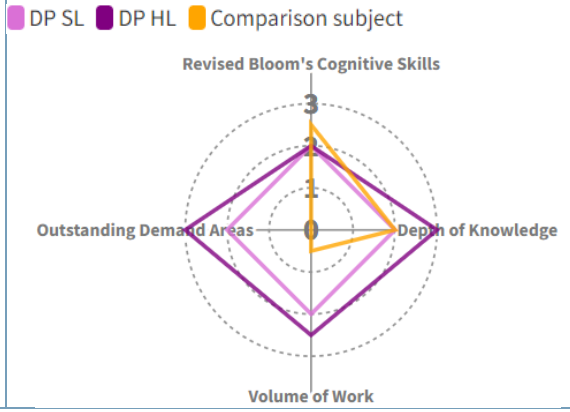
The subject level alignment between DP **biology** (SL and HL) and BHSC Natural Sciences and Technology (NST) is represented below:

Comparison subject	Learning outcomes alignment	Content alignment*	Demand alignment
BHSC Natural Sciences and Technology (Basic General Education) *BHSC NST (BGE) Biology-focus*	Low Moderate **High**		
BHSC Natural Sciences and Technology (Formative Itinerary) *BHSC NST (FI) Biology-focus***	Low Moderate **High**		

* Biology content was broadly described in the documentation for BHSC NST. As such, specific concepts mentioned in DP biology topics were often not identifiable. Where there was limited reference to specific concepts, but broader evidence of coverage, it was concluded that the DP topic/subtopic was 'partially present' in BHSC NST. Therefore, the actual level of alignment may be slightly stronger, or weaker, than what is presented in these key findings.

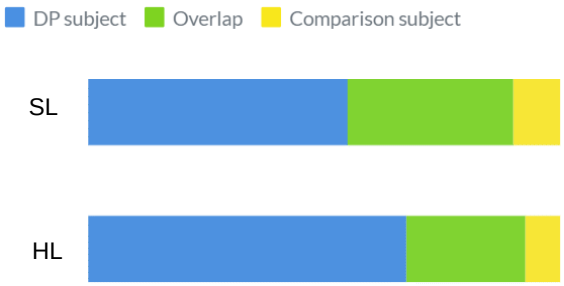
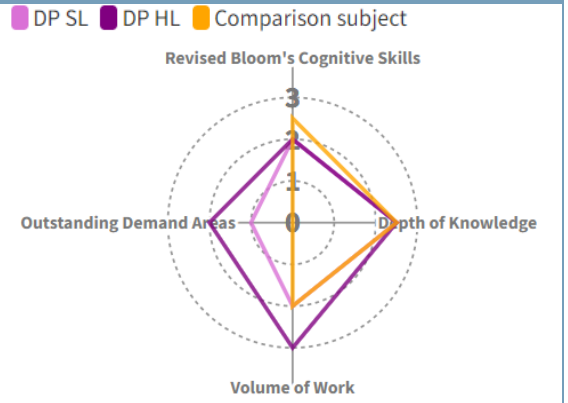
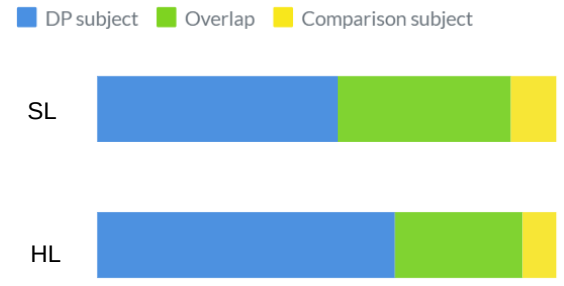
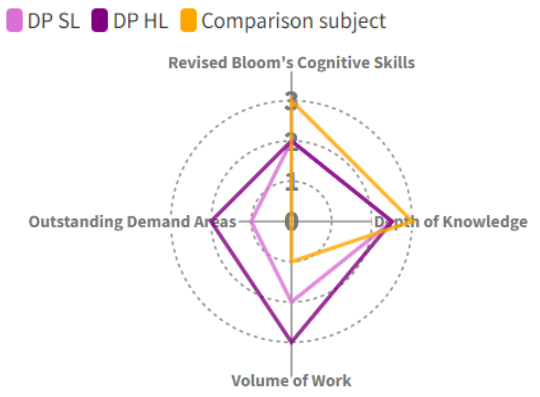
** BHSC NST (FI) here represents the pathway of studying biology in basic general education and then specialising in a NST formative itinerary. The learning outcomes and demand conclusions for this pathway consider the NST formative itinerary component as a whole, whereas the content judgements only consider its biology content specifically (physics and chemistry content is not included).

The subject level alignment between DP **language A: language and literature** (LA:LL) (SL and HL) and BHSC Language and Technology (LAT) is represented below:

Comparison subject*	Learning outcomes alignment	Content alignment	Demand alignment
BHSC Language and Technology - Portuguese Language (Basic General Education) *BHSC LAT-PL (BGE) Portuguese Language-focus*	Low Moderate **High**	 The bar represents the areas and conceptual questions that may be considered, rather than the number of texts studied – as this is not specified in BHSC LAT. The areas of exploration and conceptual questions are the same for DP LA:LL SL and HL, hence only one bar is presented here.	
BHSC Language and Technology (Formative Itinerary) *BHSC LAT (FI) Portuguese Language-focus*	Low Moderate **High**	 The bar represents the areas and conceptual questions that may be considered, rather than the number of texts studied – as this is not specified in BHSC LAT. The areas of exploration and conceptual questions are the same for DP LA:LL SL and HL, hence only one bar is presented here.	

* While BHSC Language and Technology (LAT) encompasses several different subjects (Portuguese Language, English Language, Physical Education, and Art) the analysis and key findings judgements for BHSC LAT focus on Portuguese Language.

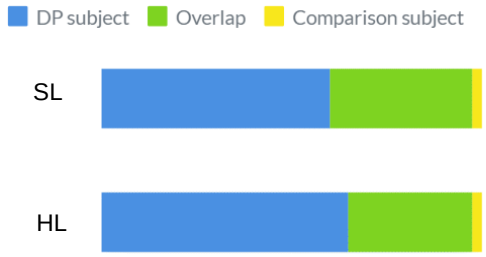
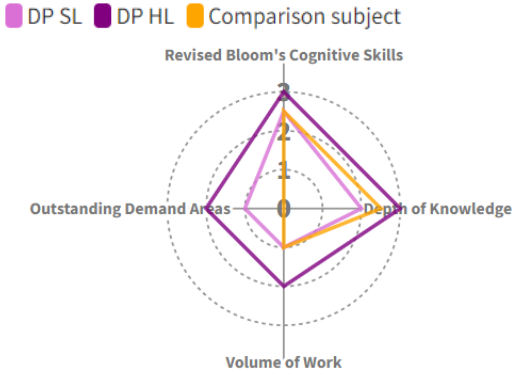
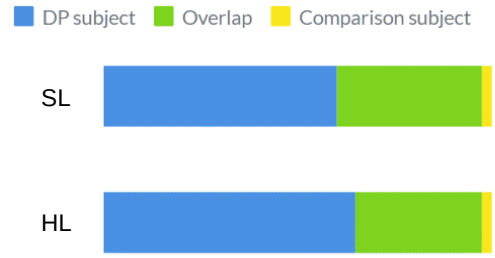
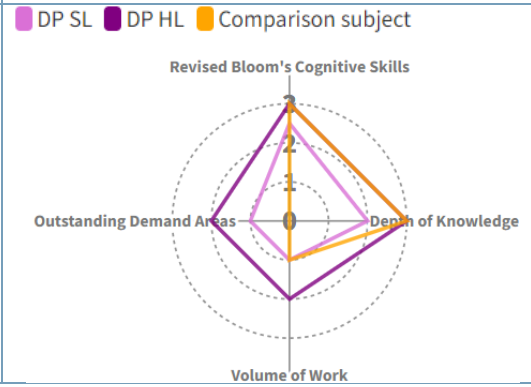
The subject level alignment between DP **history** (SL and HL) and BHSC Applied Human and Social Sciences (AHSS) is represented below:

Comparison subject	Learning outcomes alignment	Content alignment*	Demand alignment
BHSC Applied Human and Social Sciences (Basic General Education) *BHSC AHSS (BGE) History-focus*	Low Moderate **High**	 Each of the bars above represents the overlap that BHSC AHSS has with all the DP history topics available in SL and in HL. In practice, DP students only study a selection of these topics.	
BHSC Applied Human and Social Sciences (Formative Itinerary) *BHSC AHSS (FI) History-focus***	Low Moderate **High**	 Each of the bars above represents the overlap that BHSC AHSS has with all the history topics available in SL and in HL. In practice, DP students only study a selection of these topics.	

* History content was broadly described in the documentation for BHSC AHSS. As such, specific concepts mentioned in DP history topics were often not identifiable. Where there was limited reference to specific concepts, but broader evidence of coverage, it was concluded that the DP topic/subtopic was 'partially present' in BHSC AHSS. Therefore, the actual level of alignment may be slightly stronger, or weaker, than what is presented in these key findings.

** BHSC AHSS (FI) here represents the pathway of studying history in basic general education and then specialising in an AHSS formative itinerary. The learning outcomes and demand conclusions for this pathway reflect the whole AHSS formative itinerary component, whereas the content judgements only consider history content specifically (other humanities content is excluded).

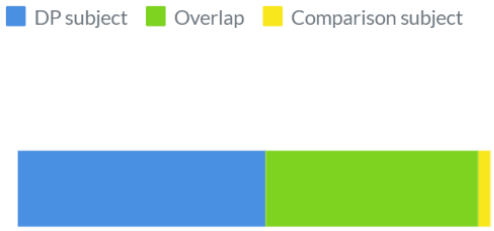
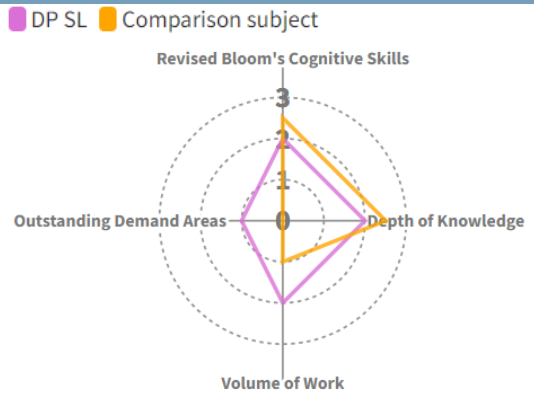
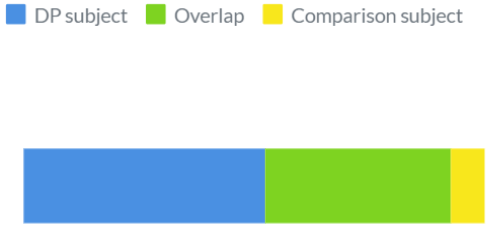
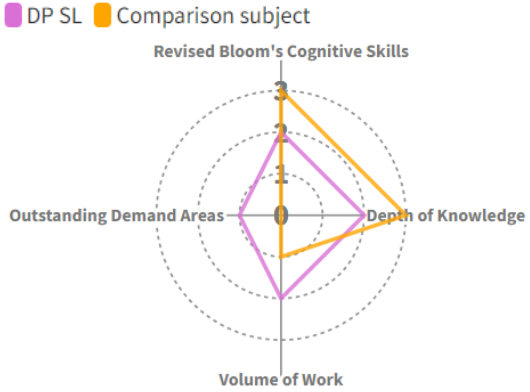
The subject level alignment between DP **philosophy** (SL and HL) and BHSC Applied Human and Social Sciences (AHSS) is represented below:

Comparison subject	Learning outcomes alignment	Content alignment*	Demand alignment
BHSC Applied Human and Social Sciences (Basic General Education) *BHSC AHSS (BGE) Philosophy-focus*	Low Moderate **High**	 Each of the bars above represents the overlap that BHSC AHSS has with all the DP philosophy topics available in SL and in HL. In practice, DP students study a selection of these topics.	
BHSC Applied Human and Social Sciences (Formative Itinerary) *BHSC AHSS (FI) Philosophy-focus***	Low Moderate **High**	 Each of the bars above represents the overlap that BHSC AHSS has with all the DP philosophy topics available in SL and in HL. In practice, DP students study a selection of these topics	

* Philosophy content was broadly described in the documentation for BHSC AHSS. As such, specific concepts mentioned in DP philosophy topics were often not identifiable. Where there was limited reference to specific concepts, but broader evidence of coverage, it was concluded that the DP topic/subtopic was 'partially present' in BHSC AHSS. Therefore, the actual level of alignment may be slightly stronger, or weaker, than what is presented in these key findings.

** BHSC AHSS (FI) here represents the pathway of studying philosophy in basic general education and then specialising in an AHSS formative itinerary. The learning outcomes and demand conclusions for this pathway reflect the whole AHSS formative itinerary component, whereas the content judgements only consider philosophy content specifically (other humanities content is excluded).

The subject level alignment between DP **Brazilian social studies** (BSS) and BHSC Applied Human and Social Sciences (AHSS) is represented below:

Comparison subject	Learning outcomes alignment	Content alignment*	Demand alignment
BHSC Applied Human and Social Sciences (Basic General Education) *BHSC AHSS (BGE) Brazilian history and geography focus*	Low Moderate **High**		
BHSC Applied Human and Social Sciences (Formative Itinerary) *BHSC AHSS (FI) Brazilian history and geography focus***	Low Moderate **High**		

* History and geography content was broadly described in the documentation for BHSC AHSS. As such, specific concepts mentioned in DP BSS topics were often not identifiable. Where there was limited reference to specific concepts, but broader evidence of coverage, it was concluded that the DP topic/subtopic was 'partially present' in BHSC AHSS. Therefore, the actual level of alignment may be slightly stronger, or weaker, than what is presented in these key findings.

** BHSC AHSS (FI) here represents the pathway of studying history and geography in basic general education and then specialising in an AHSS formative itinerary. The learning outcomes and demand conclusions for this pathway reflect the whole AHSS formative itinerary component, whereas the content judgements only consider Brazilian history and geography content specifically (other humanities content is excluded).

Key highlights of the subject-level analysis are summarised below. Nonetheless, there are some notable factors worth considering with regard to the content and demand alignment findings. Firstly, the different structure of the BHSC – which focuses on integrated areas of knowledge – naturally results in a lower degree of content and demand alignment with the single-subject courses in the DP. Secondly, subject content was often described in limited detail in the documentation reviewed for BHSC subjects, which restricted the ability to clearly ascertain content alignment, breadth, and depth – as well as determine the appropriate demand scores.

Mathematics

- **Learning outcomes alignment**: there is a high level of alignment between the learning outcomes of DP mathematics and BHSC MAT. Both have a strong emphasis on using mathematics with respect to wider contexts (such as local and global issues) and developing critical thinking, technological, communication, and transferable learning skills.

- **Content alignment**: the curriculum documentation indicates a low-moderate level of content alignment between DP mathematics and BHSC MAT. Indeed, BHSC MAT (BGE) covers some DP AA and AI SL content, but overall has less breadth and depth than the DP mathematics subjects. BHSC MAT (FI) involves furthering mathematical application and does not present any stronger alignment with DP subjects than BHSC MAT (BGE). Generally, the breadth and depth of BHSC MAT (FI) are similar to those of DP SL subjects, but with differences in the content covered.

- **Demand alignment**: the documentation reviewed indicates a low-moderate alignment between the demand scores of DP mathematics (AA and AI) and BHSC MAT. BHSC MAT (BGE) scores lower than DP SL subjects, whereas BHSC MAT (FI) has stronger alignment with DP SL subjects – scoring the same in most demand categories. BHSC MAT subjects score lower overall compared to DP HL subjects.

Physics, chemistry, and biology

The DP science subjects – physics, chemistry and biology – have been individually analysed and compared against BHSC NST. However, due to DP sciences sharing learning outcomes and BHSC NST articulating competencies and skills applicable to all sciences – the findings for all subjects were similar and are, thus, collectively presented below.

- **Learning outcomes alignment**: the level of alignment between the learning outcomes of DP sciences and BHSC NST is high. Indeed, the DP themes of applying the elements that characterise science, using creativity and critical thinking, developing technological skills, and being aware of the issues and impacts of science, are all well-evidenced in the learning outcomes for BHSC NST. The DP themes of developing conceptual understanding and making connections, and of collaboration and communication, are also partially present.

- **Content alignment**: the documentation reviewed indicates that there is low-moderate content alignment between each DP science subject (physics, chemistry, biology) and BHSC NST. Indeed, BHSC NST (BGE) appears to cover some SL content from each

of these DP science subjects and likewise expects students to conduct experiments. BHSC NST (FI) does not significantly increase the alignment with each DP science subject beyond what is observed for BHSC NST (BGE), but often a few further DP SL and AHL subtopics are present. Instead, BHSC NST (FI) offers specialisation in science generally and provides an opportunity for students to extensively apply scientific concepts to a variety of contexts and issues. Overall, BHSC NST content has less breadth and depth in physics, chemistry, and biology compared to each respective DP subject (both SL and HL). Notably, this is at least partially due to BHSC NST content spanning all these sciences.

- **Demand alignment:** the documentation reviewed indicates an overall low-moderate alignment between the scores of DP science and BHSC NST subjects. BHSC NST (BGE) scores lower than each of the DP SL subjects, whereas BHSC NST (FI) has stronger alignment with DP SL subjects – scoring the same in most demand categories. BHSC NST subjects score lower overall compared to DP HL subjects.

Language A: language and literature

- **Learning outcomes alignment**: there is a high level of alignment between the learning outcomes of DP LA:LL and BHSC LAT (Portuguese Language focus). Indeed, both DP LA:LL and BHSC LAT learning outcomes require the development of reading, writing, speaking, and listening skills, and expect students to study a broad range of texts, consider wider contexts and their influence, understand and analyse authors' choices, develop an appreciation of intertextuality and interdisciplinarity, and to develop their identity through the study of language and literature.

- **Content alignment**: the documentation reviewed indicates that there is moderate language and literature content alignment between DP LA:LL and BHSC LAT. Indeed, students likely consider a significant number of DP LA:LL conceptual questions from the areas of exploration within BHSC LAT-PL (BGE). BHSC LAT (FI) does not significantly increase the alignment with DP LA:LL beyond what is observed for BHSC LAT-PL (BGE), as the LAT formative itinerary does not solely focus on the study of further texts. Lastly, the documentation indicates that a similarly broad range of text types may be studied in BHSC LAT; however, without specifying the number of different text types covered, it is difficult to meaningfully compare the breadth and depth of language and literature content between DP LA:LL and BHSC LAT.

- **Demand alignment**: the documentation reviewed indicates that there is low-moderate alignment between the demand scores of DP LA:LL and BHSC LAT subjects. Indeed, BHSC LAT subjects score similarly to DP LA:LL (SL and HL) for Bloom's cognitive skills and DP SL for depth of knowledge. However, BHSC LAT subjects score lower for volume of work and outstanding demand areas, particularly compared to DP LA:LL HL.

History, philosophy, and Brazilian social studies

The DP subjects – history, philosophy, and BSS – have been individually analysed and compared against BHSC AHSS. However, due to BHSC AHSS articulating competencies and

skills applicable to history, philosophy, and geography – the findings for all subjects were similar and are, thus, collectively presented below.

- **Learning outcomes alignment**: there is a high level of alignment between the learning outcomes of DP Individuals and societies subjects (history, philosophy, and BSS) and BHSC AHSS. Indeed, BHSC AHSS includes most of the learning outcome themes extracted from these DP subjects and similarly requires students to analyse, critically evaluate, engage with various sources and perspectives, formulate arguments, and understand various historical contexts, philosophical concepts, and Brazilian culture.

- **Content alignment**: the documentation reviewed suggests that BHSC AHSS generally has low-moderate content alignment with each DP subject reviewed (history, philosophy, and BSS). Indeed, BHSC AHSS (BGE) appears to align to some degree with a good number of the topics offered in these subjects, including a small amount of AHL content from philosophy. BHSC AHSS (FI) does not significantly increase the alignment with each DP subject beyond what is observed for BHSC AHSS (BGE), but it does show alignments with a few additional DP SL and AHL subtopics. Instead, BHSC AHSS (FI) offers specialisation in humanities and social sciences generally and provides an opportunity for students to extensively apply concepts from this subject area to a variety of real-world topics and issues. It can be noted that BHSC AHSS's alignment with DP BSS is overall slightly higher compared to other DP subjects, though this is likely because DP BSS does not have a range of optional topics. Due to the significantly more limited detail featured in the documentation for BHSC AHSS, it is difficult to draw meaningful comparisons regarding breadth and depth. It can be noted that BHSC AHSS appears to cover a breadth of history, philosophy, and BSS content, though its documentation does not cover the topics shared with DP subjects in as much depth. This is to be somewhat expected, given that BHSC AHSS content spans history, philosophy, geography and sociology.

- **Demand alignment**: the documentation reviewed indicates that BHSC AHSS subjects have moderate alignment with the demand scores of DP history and philosophy, and low-moderate alignment with DP BSS. BHSC AHSS (BGE) scores similarly to DP history and philosophy SL, whereas BHSC AHSS (FI) does not align strongly with any DP subjects (SL or HL) – scoring the same or higher in certain categories, and lower in others.

Summary

The programme-level features of the DP and BHSC are low-moderately aligned. The two programmes observe similar philosophical underpinnings, though differ somewhat with regard to programme structure, student learning pathways, entry requirements, and assessment methods. At subject-level, alignment between the DP and BHSC is similar across subjects. Indeed, the level of learning outcome alignment is high for all subjects, whereas content alignment and demand alignment are usually of a low-moderate level. Notably, these subject-level findings are due, in part, to the different structure and pathways of the BHSC, which are based on integrated areas of knowledge, rather than individual subjects.

2. Introduction

2.1 Context and Scope

The International Baccalaureate (IB) Organization is a not-for-profit educational foundation offering four programmes across the world, including the Primary Years Programme (PYP), Middle Years Programme (MYP), Diploma Programme (DP) and the Career-related Programme (CP). The DP – the IB's two-year upper secondary Diploma Programme – is conceived as a preparatory programme for university matriculation and higher education, aimed at developing students with 'excellent breadth and depth of knowledge' who 'flourish physically, intellectually, emotionally and ethically'.[4]

Following previous studies focused on the education systems of Australia, Canada, the US, Singapore, South Korea, Finland, France, and Spain,[5] Ecctis has been commissioned by the IB to deliver a series of critical and in-depth alignment studies to assess the level of alignment between the DP and comparison points within the upper secondary education systems of Brazil and Mexico.[6] More specifically, the studies aim to identify areas of similarity and difference between the DP and these educational systems by comparing philosophical underpinnings, structure, requirements, assessment methods, learning pathways, content, and specifically to determine how the DP compares to the selected comparisons in terms of intended student learning outcomes at subject level. These studies include, for both countries, a focus on DP mathematics, DP sciences, and DP language A: language and literature, as well as an additional focus on DP history, DP philosophy, and DP Brazilian social studies for Brazil.

Ultimately, this series of comparative studies aims to inform the IB's development of tools and resources for IB teachers, helping them navigate between the IB and the local curriculum in the target countries where needed. In doing so, it also contributes to further supporting fair recognition of the DP by institutions, employers, and other key stakeholders, supporting progression and mobility for DP graduates.

This report constitutes one of the project's deliverables and aims to specifically answer the research questions pertaining to how the DP aligns with the Brazilian upper secondary programme of education (high school). The *National Guidelines for High School Education*, *National Common Curricular Base* (BNCC), and *Curricular References for the Preparation of Formative Itineraries* are key to the organisation and structure of high school education in Brazil and are referred to collectively as the Brazilian High School Curriculum (BHSC) in this report. Moreover, as agreed with the IB, the *Rio de Janeiro Referential Curriculum* (RJRC) has been consulted as an additional source to provide further insights into Brazilian high

[4] International Baccalaureate. (2022). *Diploma Programme*. Available from: https://www.ibo.org/programmes/diploma-programme/

[5] The full reports can be accessed at: www.ibo.org/research/curriculum-research/dp-studies/dp-country-alignment-studies-2023/

[6] The series of studies responds to the following Request for Proposals (RFP), issued by the IB: *The International Baccalaureate Diploma Programme: Alignment With Upper Secondary Education In Brazil and Mexico*.

school education and has been primarily used to inform the subject-level content analysis of BHSC subjects.

2.2 Research Questions

All comparative studies in this series have been framed by responses to Research Questions (RQs), both at programme level and subject level. For this study specifically, the RQs are as follows:

Table 1: Brazil research questions

RQ1: To what degree does the DP curriculum align with the Brazilian upper secondary curriculum? In what way are the curricula similar and in what way are they different in demand and difficulty? To what degree are the curricula compatible?

RQ2: To what degree do the curricula align with regards to their:

2.1: Philosophical underpinnings
- Objectives
- Principles
- Values.

2.2: Structure
- Learning areas
- Subject offerings
- Degree of specialization
- Time allocation.

2.3: Requirements
- Programme entry requirements
- Time requirements (i.e. programme duration, teaching hours, study hours)
- Certificate requirements (i.e. credits, passing and failing conditions, compensation options).

2.4: Assessment
- Nature of assessment (i.e. number, type, duration, question types, availability of marks)
- Assessment model (i.e. relative weighting of assessments to overall grades).

2.5: Student learning pathways
- Degree of specialization
- Options in subject (area) choice (i.e. compulsory subjects, electives).

RQ3: To what degree do the subjects[7] align with regards to:

3.1: Content
- Topics (i.e. scope of content area, breadth, depth)
- Learning activities (i.e. difficulty, demand).

3.2: Expected learning outcomes
- Knowledge
- Competences (i.e. subject-specific, 21st century competences).

With regards to subjects to be compared in the subject-level comparative analysis, the following table indicates the agreed scope.

[7] With regards to subjects within scope, see Table 2.

Table 2: Subjects/courses for comparison of the DP and the BHSC (per DP subject group)

<table>
<tr><th>DP subjects</th><th colspan="2">BHSC subjects</th></tr>
<tr><td colspan="3">MATHEMATICS</td></tr>
<tr><td>mathematics: analysis and approaches (AA) SL & HL</td><td colspan="2" rowspan="2">Mathematics and Technology (MAT)
• Basic general education (BGE)
• Formative itinerary (FI)</td></tr>
<tr><td>mathematics: applications and interpretation (AI) SL & HL</td></tr>
<tr><td colspan="3">SCIENCES</td></tr>
<tr><td>physics SL & HL</td><td rowspan="3">Natural Sciences and Technology (NST)
• Basic general education (BGE)
• Formative itinerary (FI)</td><td>Physics-focus</td></tr>
<tr><td>chemistry SL & HL</td><td>Chemistry-focus</td></tr>
<tr><td>biology SL & HL</td><td>Biology-focus</td></tr>
<tr><td colspan="3">STUDIES IN LANGUAGE AND LITERATURE</td></tr>
<tr><td>language A: language and literature (LA: LL) SL & HL</td><td>Language and Technology (LAT)
• Basic general education (BGE)
• Formative itinerary (FI)</td><td>Portuguese language-focus</td></tr>
<tr><td colspan="3">INDIVIDUALS AND SOCIETIES</td></tr>
<tr><td>history SL & HL</td><td rowspan="3">Applied Human and Social Sciences (AHSS)
• Basic general education (BGE)
• Formative itinerary (FI)</td><td>History-focus</td></tr>
<tr><td>philosophy SL & HL</td><td>Philosophy-focus</td></tr>
<tr><td>Brazilian social studies (BSS)</td><td>History and geography-focus*</td></tr>
</table>

*Following a review of the DP Brazilian social studies subject, Ecctis judged that a focus on history and geography in the BHSC would result in the best comparison.

2.3 Report Structure

In responding to the above RQs, this report included the following sections:

- 3. Methodology: this section provides a brief overview of the methodology applied in this study. This includes details of how the document selection and identification of comparison points for the study took place; a definition of 'alignment'; an outline of the methodology used for comparisons at both programme and subject levels; and an outline of the methodology used to assess demand.

- 4. Programme-Level Alignment: this section presents the synthesised analysis from the programme-level comparisons between the DP and the BHSC. In doing so, it includes brief programme overviews for both, followed by the comparative analysis on their philosophical underpinnings, structure, requirements and associated outcomes, student learning pathways and the general nature of assessment practices.

- 5. Subject-Level Alignment: this section presents the synthesised analysis from the subject-level comparisons between DP and BHSC subjects. For each comparison subject, this includes the comparative analysis on their learning outcomes, content, and demand.

- 6. Key Findings: this section outlines the key findings from both the programme- and subject-level comparisons undertaken in this study. In doing so, it provides a top-level

conclusion on alignment at both programme and subject levels, and a succinct summary of key similarities and key differences.

- 7. Bibliography: this section references all sources cited in the study, including the documents used for both programme- and subject-level curriculum analyses.

3. Methodology

3.1 Document Selection and Identification of Comparison Points

To undertake these comparative analyses, the following core documentation was reviewed (supplemented by additional documentation – detailed in the Bibliography – where relevant and available):

DP Documentation

- What is an IB education? (WIAIBE)
- WIAIBE Teacher Support Material
- DP: From Principles into Practice
- Programme Standards and Practices
- DP subject guides:
  - mathematics: analysis and approaches
  - mathematics: applications and interpretation
  - physics
  - chemistry
  - biology
  - language A: language and literature
  - history
  - philosophy
  - Brazilian social studies

Brazil Documentation

- Ministry of Education updates to the National Curriculum Guidelines for High School Education.
- National Common Curricular Base (BNCC) for high school:
  - Mathematics and Technology
  - Natural Sciences and Technology
  - Language and Technology
  - Applied Human and Social Sciences
- Curricular References for the Preparation of Formative Itineraries
- Rio de Janeiro Referential Curriculum (RJRC)
- Rio de Janeiro specialisation pathways for formative itineraries in:
  - Mathematics and Technology
  - Natural Sciences and Technology
  - Language and Technology
  - Applied Human and Social Sciences

Philosophical Underpinnings Comparison

For the programme-level comparisons between the philosophical underpinnings of each programme, Ecctis used the following elements of the curriculum documentation:

Table 3: Philosophical underpinnings for comparison of the DP and the BHSC

Documentation containing philosophical underpinnings	
DP	**BHSC**
'What is an IB Education', particularly the following sections: ○ IB learner profile ○ International-mindedness ○ Approaches to teaching and approaches to learning.[8]	Ministry of Education legislation - Resolution No. 3, 2018.[9] Particularly: ○ Art. 5 regarding specific principles ○ Art. 27 regarding pedagogical proposal Also, the National Common Curricular Base (BNCC), in particular the General Competencies[10]

The document 'What is an IB Education?' provides detailed information about the IB's educational philosophy. For the BHSC, the philosophical underpinnings can be determined from legislation and curriculum documentation. Indeed, the specific principles and the pedagogical proposal described in Resolution No. 3 in 2018, as well as the BNCC's General Competencies, provided sufficient detail for meaningful comparison between the DP and BHSC in terms of philosophical underpinnings and were used as such.

For more information on the mapping process, see the Measuring Alignment section below.

Learning Outcomes Comparison

For the Learning Outcomes comparisons, as neither of the two programmes explicitly defines 'learning outcomes' in their curriculum documentation, Ecctis used the following categories of the curriculum documentation for comparison:

[8] International Baccalaureate. (2017). *What is an IB Education?*

[9] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018.* Available from: http://portal.mec.gov.br/docman/novembro-2018-pdf/102481-rceb003-18/file

[10] Brazil, Ministry of Education. (2018). *National Common Curricular Base*. Available from: National Common Curriculum Base - Education is the Base (mec.gov.br)

Table 4: Learning outcomes for comparison of the DP and the BHSC

DP subject (group)	Categories utilised as learning outcomes
MATHEMATICS	
mathematics: analysis and approaches	DP Mathematics subject group – aims and assessment objectives
mathematics: applications and interpretation	
SCIENCES	
physics	DP Sciences subject group – aims and assessment objectives
chemistry	
biology	
LANGUAGE AND LITERATURE	
language A: language and literature	DP Studies in language and literature group – aims and assessment objectives
INDIVIDUALS AND SOCIETIES	
history SL and HL	DP Individuals and societies group – aims DP history – aims and assessment objectives
philosophy SL and HL	DP Individuals and societies group – aims DP philosophy – aims and assessment objectives
Brazilian social studies	DP Individuals and societies group – aims DP Brazilian social studies – aims and assessment objectives

BHSC subjects	Documentation and sections
AREAS OF KNOWLEDGE	
Mathematics and Technology (mathematics)	BNCC (High School) Mathematics and Technology – Specific Competencies and Specific Skills Curricular References for the Preparation of Formative Itineraries – 'Formative Itinerary Skills Associated with the BNCC General Competencies' and 'Specific Skills of the Formative Itineraries Associated with the Structuring Axes' (Mathematics and Technology).
Natural Sciences and Technology (physics, chemistry and biology)	BNCC (High School) Natural Sciences and Technology – Specific Competencies and specific skills BNCC – General Competencies Curricular References for the Preparation of Formative Itineraries – 'Formative Itinerary Skills Associated with the BNCC General Competencies' and 'Specific Skills of the Formative Itineraries Associated with the Structuring Axes' (Natural Sciences and Technology).
Language and Technology (Portuguese Language)	Competencies BNCC (High School) Language and Technology: Portuguese Language – Specific Skills Curricular References for the Preparation of Formative Itineraries – 'Formative Itinerary Skills Associated with the BNCC General Competencies' and 'Specific Skills of the Formative Itineraries Associated with the Structuring Axes' (Language and Technology).

Applied Human and Social Sciences (history, philosophy, geography)	BNCC (High School) Applied Human and Social Sciences – Specific Competencies and Specific Skills Curricular References for the Preparation of Formative Itineraries – 'Formative Itinerary Skills Associated with the BNCC General Competencies' and 'Specific Skills of the Formative Itineraries Associated with the Structuring Axes' (Applied Human and Social Sciences).

Although not labelled as learning outcomes per se, the above categories were chosen as they were deemed to provide the most complete picture of the skills and knowledge that students should obtain upon completion of each subject.

Content Comparison

For the content comparison, each DP subject's content was drawn from the syllabus outlined within the DP subject guide. For BHSC subjects, the analysis drew upon a range of sources to establish a more detailed picture of the subject content used in high school education (for a visual representation of the Brazilian high school curriculum, see Figure 5). The primary document used for basic general education (BGE) subjects is the BNCC. The BNCC merges skills and content into specific skills for each area of knowledge. Notably, these specific skills are articulated for the overarching area (e.g. Natural Sciences and Technology); they make no distinctions between the different disciplines that each respective area encompasses. Moreover, the specific skills emphasise skills rather than describing content through the outlining of topics and subtopics. As such, to provide a more concrete picture of the content covered, the Rio de Janeiro Referential Curriculum (RJRC) for high school was used to complement the BNCC for the content analysis of BGE subjects. This source was particularly relevant for comparisons with science and individual and societies subjects, as basic general education in the RJRC is organised into distinct subjects (e.g. history, physics, etc), facilitating comparison with the DP.

The RJRC was also used to analyse the content of formative itineraries (FI). Indeed, neither the BNCC nor the Curricular References for the Preparation of Formative Itineraries provide detailed information regarding the content of the formative itineraries. As such, while the formative itineraries offered can vary from state to state, the RJRC provided insight into the type of content that these can cover for different areas of knowledge. Indeed, the analysis reviewed the specialisation pathways offered in Rio de Janeiro for each area of knowledge.[11]

The following table shows the documentation and sections that were used to inform the content analysis of each BHSC subject.

[11] Formative itineraries which integrated several areas of knowledge were not reviewed.

Table 5: Documentation and sections used for the content analysis of BHSC subjects.

	Document: BNCC	Document: Curricular references for FI	Document: RJRC
BHSC subjects	**Section**	**Section**	**Section**
BHSC MAT (BGE)	Specific competencies and skills for MAT	N/A	Mathematics (for BGE)
BHSC MAT (FI)	N/A	Specific skills associated with structuring axis	MAT Specialisation Pathways (for the FI)
BHSC NST (BGE)	Specific competencies and skills for NST were reviewed for physics, chemistry and biology content	N/A	Physics (for BGE) Chemistry (for BGE) Biology (for BGE)
BHSC NST (FI)	N/A	Specific skills associated with structuring axis	NST Specialisation Pathways (for the FI) were reviewed for physics, chemistry and biology content
BHSC LAT-PL (BGE)*	Specific skills for Portuguese Language	N/A	Portuguese Language (for BGE)
BHSC LAT (FI)	N/A	Specific skills associated with structuring axis	LAT Specialisation Pathways (for the FI) were reviewed for Portuguese language and literature content
BHSC AHSS (BGE)	Specific competencies and skills for AHSS were reviewed for history, philosophy, and geography content	N/A	History (for BGE) Philosophy (for BGE) History and Geography (for BGE)
BHSC AHSS (FI)	N/A	Specific skills associated with structuring axis	AHSS Specialisation Pathways (for the FI) were reviewed for history, philosophy and geography content

*PL – Portuguese Language

For more information on the mapping process, see the Measuring Alignment section below.

3.2 Measuring Alignment (Similarities and Differences)

Alignment is a key concept for this series of studies. The aim of this study is to ascertain the level of alignment between the DP and the BHSC. Although Ecctis has sought to represent the alignment findings as straightforwardly as possible in this report, alignment is not a simple concept, so it is important to establish Ecctis' approach in this regard.

Alignment, as a term, is often used in education circles to refer to *internal* coherence between learning outcomes, assessment methods, teaching practices and other features of teaching

and learning. This report does not consider *internal* alignment, but what might appropriately be labelled *external* alignment. Alignment of this type looks at the extent to which a programme (in this case, the DP) aligns with other educational programmes (in this case, Brazilian high school). This form of external alignment is particularly key to understand for an organisation like the IB which operates in so many international contexts, often alongside national curricula, where teachers and students may seek to move back and forth between IB and national pathways of education.

Within this narrower definition of *external* alignment, the idea is still broad and could be viewed from any number of perspectives. In this series of studies, the IB has specifically asked Ecctis to consider alignment from the specific perspectives outlined by the RQs. The RQs thereby define the limits of the type of alignment that will be considered within the reports. Namely:

- At the programme level:
    - Alignment of philosophical underpinnings
    - Alignment of structure
    - Alignment of requirements and associated outcomes
    - Alignment of student learning pathways
    - Alignment of approaches to assessment.

- At the subject level (in selected subjects):
    - Alignment of learning outcomes
    - Alignment of content
    - Alignment of demand.

To form a comprehensive picture of alignment, Ecctis' approach has used multiple repeating steps within each report. For Brazil, it sought to:

- Analyse to what extent the BHSC has similarities with the DP.
- Analyse to what extent the BHSC lacks features contained within the DP.
- Analyse to what extent the DP lacks features contained within the BHSC.

In this respect, **alignment is a measure of the extent to which there are similarities and differences between key selected criteria of two educational programmes**. High alignment indicates significant similarities, with few differences in key areas, whereas low alignment results from many differences in important aspects, with perhaps only few or non-impactful similarities. Alignment judgements in this study took a holistic view of similarities and differences and the likely impact these will have on what skills and knowledge students possess upon completion of a programme of study. As such, the study did not use fixed quantitative criteria to differentiate high from low alignment, but rather utilised the expert panels to produce informed, holistic judgements drawing on an outcomes-focused perspective.

Mapping

To accurately measure the alignment of the DP to the BHSC, it is necessary to map the similarities and differences across the selected alignment criteria. This necessitates identification of the same structural features in the DP and in the BHSC (the comparison programme) so that a mapping process can be undertaken.

Mapping, in this case, refers to detailed analysis of a feature of an education programme (generally as represented within that programme's documentation). Specifically, mapping applies the same analytical method to two separate sets of data (for example, the learning outcomes of two different curricula), enabling similarities and differences between those two data sets to be understood through the different results of applying the same mapping method to both. Another important feature of mapping is that there is a paper trail of the analysis, as the approach is methodical, testable, and repeatable.

For more information on how mapping has been applied in this study, see sections 3.2.1 and 3.2.2.

3.2.1 Method: Programme-Level Comparison

Each aspect of the programme-level comparison is achieved through slightly different approaches to mapping and assessing alignment, the results of which inform the overall alignment evaluation. Each method is described in the appropriate subsection below.

Philosophical Underpinnings

In the DP, the approaches to teaching, approaches to learning, IB learner profile, and framework of international-mindedness were used to represent the philosophical underpinnings, while the 'Specific Principles', 'Pedagogical Proposal' and the BNCC's general competencies were used for the BHSC.

In order to carry out the comparative analysis, six themes were extracted from the DP's philosophical underpinnings:

Table 6: Philosophical underpinning themes

Philosophical underpinning themes
• International outlook, diversity, and intercultural understanding • Grounded in real world contexts • Principled and community-oriented • Independence/self-management, critical inquiry, and reasoning • Communicative and collaborative competence • Conceptual thought and understanding.

This list of themes was mapped against both the DP's philosophical underpinnings and the philosophical underpinnings of the BHSC to identify what aspects of the DP's philosophical underpinnings are shared with the BHSC and what aspects are unique to either the BHSC's philosophical underpinnings or the DP's. The detail of this mapping was carried out in the mapping spreadsheets, while a visual summary and written explication of the findings can be found in the Philosophical Underpinnings section below (see section 4.2).

Structure

Comparing the structures of the DP and a national programme does not require a mapping process. Instead, subject offerings, how duration interacts with subjects/progression, and the general structure of the qualification (including exit points) have been represented with visuals

for each programme. These curriculum structure diagrams use block colours and simple box and arrow graphics to demonstrate structure and progression.
Curriculum structure diagrams have been placed next to each other in this report to show the similarities and differences at a glance. The visual presentation is followed by a short write-up of the key similarities and differences, to maintain analytical focus on the alignment of the two programmes.

Requirements and Associated Outcomes

The requirements and associated outcomes of each programme are, like the structure, also simple, core features which do not require a mapping process in order to be compared. Comparisons and contrasts are drawn between the different requirements (e.g. entry requirements, pass/fail requirements) linked to both programmes and the associated outcomes of both.

Student Learning Pathways

By 'student learning pathways', we refer to the learning route that each student can take through a programme – with focus on scope for subject-specific specialisation. As with the comparative analysis of structure, diagrams resembling flow charts have been used to visually demonstrate the core and optional subject choices, providing an example to indicate how students follow different potential learning pathways in both programmes. A short textual write-up has been included after the diagrams to highlight and discuss the key similarities and differences – maintaining analytical focus on the issue of alignment.

Assessment Methods

Although detailed comparative analysis of assessment is not a main component of the analysis of alignment, Ecctis has briefly considered the high-level assessment features within the programmes being compared.

A simple table has been used, followed by a short textual description of the key similarities and differences. The types/numbers of assessment used in the programme are a source of comparison, and the subjects analysed in the subject-level alignment analysis in each report have been used as examples to consider assessment in more detail (i.e. question types and marking approaches, where this information is available).

3.2.2 Method: Subject-Level Comparison

As previously described, a number of subjects has been selected by the IB for a closer look at alignment at the subject level. This includes a closer look at the learning outcomes for each subject, the subject content, and the demand level. Each approach is outlined below.

Learning Outcomes

To analyse the alignment of learning outcomes at the subject level, the process began by extracting six to eight themes from the DP's subject-level learning outcomes for each subject being analysed, encompassing both skills and knowledge areas. This thematic code was then mapped onto the learning outcomes of the DP subject and the comparison subject from the BHSC.

The top-level results of the mapping process are represented with a table per subject area. Following the tables, a written commentary is provided regarding the presence of DP knowledge areas and skills (represented by themes) in the BHSC, and any knowledge areas and skills found in the BHSC but not in DP.

Content

To compare the content of the DP subject and the comparison BHSC subject, both are first presented next to each other in the document in a simple tabular format. Additionally, content mapping took place through a simple process of establishing whether each content subtopic covered by the DP subject in question has 'clear alignment' with any content in the BHSC comparison subject. The mapping spreadsheets demonstrate the full logic of all judgements. A commentary is provided on DP subject content not found to have alignment points in the BHSC subject and on BHSC subject content topics not found to have alignment points in the DP subject.

Demand

Comparing the demand of subject curricula is perhaps the most complex mapping and alignment analysis within this report. Ecctis' approach views demand from multiple perspectives to capture its relationship to skills as well as to the detail and scope of content.

To allow for a comprehensive assessment of the level of demand of the DP selected subjects against the respective comparison points, Ecctis has created a Demand Profile for each subject in the study. Each Demand Profile comprises four criteria designed to judge complexity, depth, breadth, workload levels and potential for intellectual stretch. These criteria have been applied uniformly across all subjects in the study, using an expert panel-approach (as outlined below).

Demand Profile – Subject-level Judgement

The Demand Profile is comprised of four scores (each between zero and three) based on specific criteria. Each score within each category has a specific definition which is listed in Appendix A. A panel of subject, teaching, and curriculum design experts analysed each subject curriculum and arrived at a consensus on which score descriptor in each category best matched with the curriculum in question. The categories which comprise the Demand Profile are as follows:

- **Revised Bloom's Cognitive Skills** score (0-3): this is an overall score of course demand, based entirely on a review of learning outcomes. Levels have been defined based on increasing emphasis of higher order cognitive skills taken from Bloom's Revised Taxonomy.[12]
- **Depth of Knowledge** (adapted from Webb's) score (0-3): this is an overall score evaluating the depth of knowledge or complexity of knowledge and skills required by curriculum standards and expectations. The score is focused on subject content and learning outcomes, complemented by assessment where relevant/possible. Levels have been defined based on the level of detail studied per topic, as well as the levels of thinking described in Webb's depth of knowledge framework.[13]

[12] Krathwohl, D. (2002). A Revision of *Bloom's taxonomy: An Overview*. Theory Into Practice, Vol 41(4). Available from: www.tandfonline.com/doi/abs/10.1207/s15430421tip4104_2?journalCode=htip20
[13] Webb, N. L. (2002). *Depth-of-knowledge levels for four content areas*. Available from: Microsoft Word - Webb DOK all content.doc (pbworks.com)

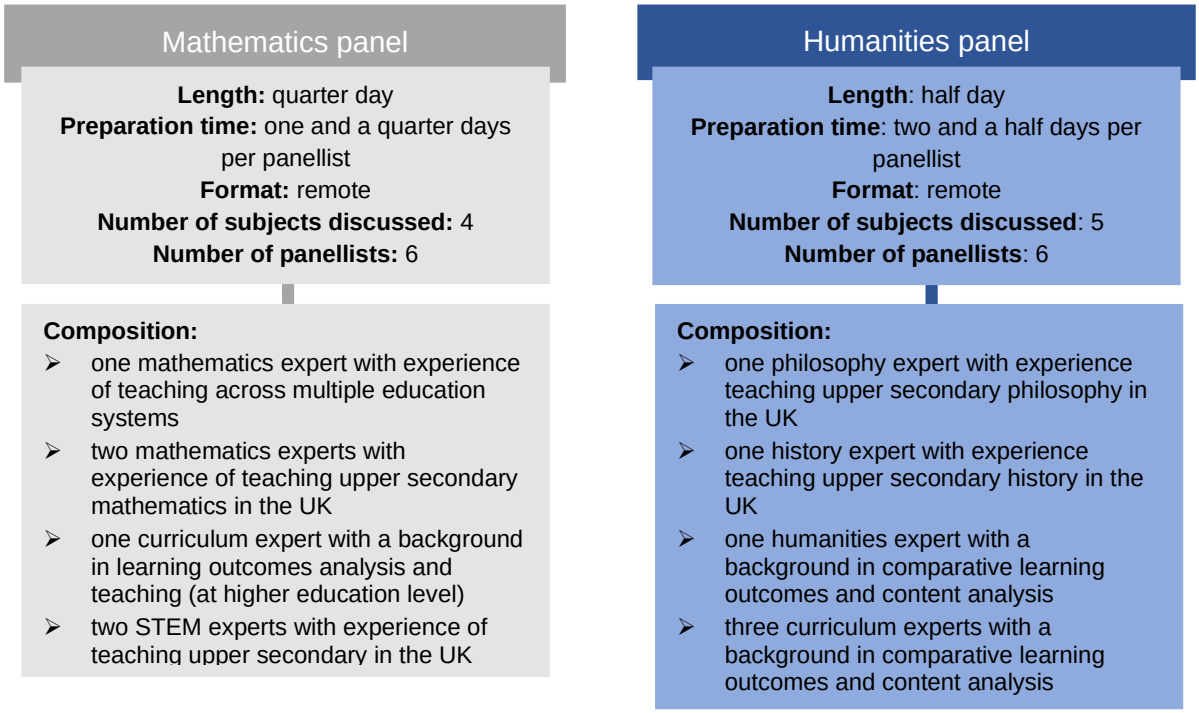
- **Volume of Work** score (0-3): this is a trifactor score, considering:
  a. breadth of content – i.e. how many topic and subtopics are covered
  b. depth of content – i.e. the extent to which the topics and subtopics are focused upon, amplified and explored.[14]
  c. specified timeframe – i.e. the time allocated for studying the subject.

  The three factors – breadth, depth, and time – were all considered in defining the levels.
- **Outstanding Areas of Subject Demand** score (0-3): this score reflects the number of content areas viewed as more challenging and/or conducive to intellectual stretching of students. Levels have been defined on a scale of increasing number of 'stretch areas'.

Demand Panel: Expert Judgement Procedure

Demand analysis and judgements against the above criteria rested with a panel of experts comprised of both curriculum and teaching experts – i.e. international education researchers experienced in comparative secondary curriculum evaluation – and subject experts – i.e. researchers and consultants with a subject specialism in the relevant subject areas. For both expert types, teaching experience, understanding of appropriate national/international teaching contexts, and experience of curriculum and learning outcomes comparisons were prioritised.[15] For the panels discussing the demand level of the DP subjects and respective comparison subjects in the Brazil and Mexico reports, the composition of each panel was as follows:

Figure 1: Demand panels details



[14] Note: 'depth of content' primarily describes what is on the curriculum (i.e. the level of detail comprised in each topic), whereas 'depth of knowledge' describes what the students need to be able to do (i.e. how complex and extensive the thinking processes involved are).
[15] To minimise potential biases and subjectivity, Ecctis' recruitment procedure excluded candidates with experience of teaching any of the comparison qualifications in this study.

Science panel

Length: half day
Preparation time: three and a half days per panellist
Format: remote
Number of subjects discussed: 10
Number of panellists: 6

Composition:

- three science experts with experience of teaching across multiple education systems
- two science experts with experience of teaching upper secondary science in the UK
- two curriculum experts with a background in learning outcomes analysis and teaching (one at secondary level and one at higher education level)

Languages panel

Length: half day
Preparation time: two days per panellist
Format: remote
Number of subjects discussed: 4
Number of panellists: 4

Composition:

- one language expert with experience of teaching language in the South Korean system
- one language expert with a background in teaching language at upper secondary level in the UK
- two curriculum experts with a background in comparative learning outcomes and content analysis

All panellists were provided with the relevant extracts from the appropriate qualifications' specifications,[16] including (where available):

- Learning outcomes and aims of the qualification
- Assessment structure and objectives
- Information about guided learning hours or curriculum time
- Content.

The experts were also provided with a document containing:

- An introduction to the comparative analysis task
- Descriptions of the demand taxonomies
- The demands instrument (used to record findings).

Panellists conducted between one and three and a half days of panel preparation, reviewing the appropriate curriculum documentation in detail and scoring each subject against the demand criteria provided (the template utilised for this has been included in Appendix C). Following this preparation, participants then took part in their respective panels, which were all hosted remotely on Microsoft Teams.

All judgements resulted in scores from 0-3 for each demand criterion mentioned above, with each score for each criterion being pulled into each course's demand profile. The panel approach was used to debate the findings and scores reached by each member of the panel and arrive at an evidence-based consensus on every demand score for every subject.[17]

Visually, each demand profile is represented by radar diagrams to facilitate demand comparison between subjects. All demand scores produced should be interpreted as approximate judgements given the varying degrees of documentation and detail available for each curriculum, as well as likely variation on how the curricula are implemented in practice.

[16] The documents were shared both in their original languages and in English.
[17] Note: each score was debated by the panel until a unanimous agreement was reached.

4. Programme-Level Alignment

This section focuses on answering RQ2 and the sub-questions associated with it, namely:

Table 7: Research question 2

RQ2: To what degree do the curricula align with regards to their: 2.1: Philosophical underpinnings • Objectives • Principles • Values? 2.2: Structure • Learning areas • Subject offerings • Degree of specialization • Time allocation? 2.3: Requirements • Programme entry requirements • Time requirements (i.e. programme duration, teaching hours, study hours) • Certificate requirements (i.e. credits, passing and failing conditions, compensation options)? 2.4: Assessment • Nature of assessment (i.e. number, type, duration, question types, availability of marks) • Assessment model (i.e. relative weighting of assessments to overall grades)? 2.5: Student learning pathways • Degree of specialization • Options in subject (area) choice (i.e. compulsory subjects, electives)?

It starts by offering top-level overviews of both the DP and the Brazilian High School Curriculum (BHSC), followed by presenting the results from the programme-level comparative analysis for each core aspect outlined above.

4.1 Programme Overviews

4.1.1 The International Baccalaureate Diploma Programme

The Diploma Programme (DP) was established in 1968 as a two-year pre-university programme for 16–19-year-old students.[18]

Students who aim to achieve the Diploma award must generally select one subject from each of the six subject groups:

- Studies in language and literature
- Language acquisition
- Individuals and societies
- Sciences
- Mathematics

[18] International Baccalaureate. (2015). *Diploma Programme: From principles into practice*. p. 5.

- The arts.[19]

Students who do not wish to take a subject from the arts subject group may opt to study an additional Sciences, Individuals and societies, or languages course instead.

All subjects are studied concurrently over the two-year duration of the programme and most subjects can be taken at either HL or SL. In terms of teaching hours, the DP's documentation recommends 150 teaching hours for individual subjects at SL and 240 teaching hours at HL.[20]

In addition to the six subjects taken from these groups, DP students will also need to complete three further curriculum components. Theory of knowledge (TOK) allows students to reflect on the nature of knowledge by considering their subjects from a broader perspective.[21] The extended essay is a self-directed piece of research which results in a 4000-word essay.[22] Creativity, activity, service (CAS) is not formally assessed but requires that students undertake a creative endeavour, take part in something physically active, and participate in a voluntary or unpaid activity.[23] Together, these three components comprise the DP 'core'.

To achieve the IB Diploma a student must take at least three HL subjects.[24] The maximum number of subjects that can be taken at higher level is four. HL subjects are intended to prepare learners for the discipline specialisation of higher education, whilst the SL subjects balance this by broadening the range of subjects studied.[25]

The DP curriculum framework is based on a concentric circle model (see below), whereby the learner profile is positioned at the centre to represent its relevance to all aspects of the programme. The next circle comprises the core requirements of TOK, The extended essay, and CAS. The six subject groups are then encircled by international-mindedness and the programme title – indicating that everything students study is unified by the underpinning philosophy of encouraging thinking from a perspective that embraces points of view outside one's own frame of reference.

[19] International Baccalaureate. (2024). *DP curriculum*. Available from: https://ibo.org/programmes/diploma-programme/curriculum/
[20] Ibid.
[21] International Baccalaureate. (2021). *Theory of knowledge*. Available from: https://www.ibo.org/programmes/diploma-programme/curriculum/theory-of-knowledge/
[22] International Baccalaureate. (2023). *Extended Essay. Available from:* https://www.ibo.org/programmes/diploma-programme/curriculum/dp-core/extended-essay/
[23] International Baccalaureate. (2022). *CAS projects.* Available from: https://www.ibo.org/es/programmes/diploma-programme/curriculum/dp-core/creativity-activity-and-service/cas-projects/
[24] International Baccalaureate. (2024). *DP curriculum*.
[25] International Baccalaureate. (2015). *Diploma Programme: From principles into practice*. p. 6.

Figure 2: IB Diploma Programme curriculum model[26]

Both internal and external assessment methods are used in the DP. In most subjects, students take written examinations at the end of the programme that are marked by external IB examiners. Internally assessed tasks normally comprise between 20-30% of the total mark in each subject.[27]

Question types used in DP assessment vary from subject to subject. Essays, structured problems, short-response questions, data-response questions, case-study questions, and multiple-choice questions are some of the external assessment question types deployed.[28] Coursework forms part of the assessment for areas of the DP such as the extended essay and TOK.[29] This is normally carried out over an extended period under teacher supervision. Where students complete internally assessed tasks, these are marked by teachers and moderated by the IB.[30] Some of the internal assessment methods used include oral work in languages, fieldwork in geography, laboratory work in the sciences, and artistic performances in the arts.[31]

Each DP subject, whether taken at SL or HL, is graded from 1-7 (with 7 representing the highest achievement level).[32] If a student has taken enough subjects at the correct level to be

[26] International Baccalaureate. (2016). *Guide to the International Baccalaureate Diploma Programme*. p. 2.
[27] International Baccalaureate. (2021). *Understanding DP assessment*. Available from: https://www.ibo.org/programmes/diploma-programme/assessment-and-exams/understanding-ib-assessment/; International Baccalaureate. (2014). *Diploma Programme: A guide to assessment*. p. 3.
[28] International Baccalaureate. (2021). *Assessment and Exams*. Available from: https://www.ibo.org/programmes/diploma-programme/assessment-and-exams/
[29] International Baccalaureate. (2021). *Understanding DP assessment*.
[30] Ibid.
[31] International Baccalaureate. (2021). *Assessment and Exams*.
[32] International Baccalaureate. (2021). *Understanding DP assessment*.

in contention for the Diploma award, a minimum of 24 points is needed to achieve the qualification. A minimum grade of 3 is also needed in at least four subjects to achieve the qualification.[33]

Additionally, 42 total points are available from the combination of the grades for six subjects and a further three points are available to students for successful completion of the core elements of TOK and The extended essay. The TOK and extended essay components of the DP are each marked on an A-E scale, where an A grade is the highest award, and an E grade the lowest.[34] Their combined results can contribute up to three additional numerical points to the overall DP score (see Table 8 below). CAS does not constitute a graded part of the DP, although its completion is mandatory to be awarded the Diploma.

HL and SL subjects are assessed against the same grade descriptors;[35] however, HL candidates are expected to demonstrate the various elements of the grade descriptors across a greater range of knowledge, skills, and understanding.

A bilingual Diploma is awarded to students who achieve:

- Grade 3 or higher in two language subjects from the Studies in language and literature group; or,
- Grade 3 or higher in a language subject from the Studies in language and literature group and a grade 3 or higher in a subject from the Individuals and societies group or Sciences group taken in a different language.

Certificates are awarded to students that have taken individual subjects but not enrolled on the full Diploma, or DP candidates who do not achieve the full DP.[36] Prospective candidates can enrol in as many individual subjects as permitted by their school; these are graded with the same 1-7 system used in the full DP.

Table 8: Letter-Grade: numerical score conversion matrix[37]

		Theory of knowledge (TOK)				
	Grade awarded	A	B	C	D	E
The extended essay	A	3	3	2	2	Failing condition
	B	3	2	2	1	
	C	2	2	1	0	
	D	2	1	0	0	
	E	Failing condition				

No formal entrance requirements are stipulated as the IB envisages numerous educational pathways leading to the DP.[38] However, the IB recommends consulting the subject guides prior to enrolment to ensure an adequate understanding of programme expectations.[39]

[33] International Baccalaureate. (2016). *Guide to the International Baccalaureate Diploma Programme*. p. 4.
[34] Ibid.
[35] International Baccalaureate. (2021). *Understanding DP assessment*.
[36] International Baccalaureate. (2016). *Guide to the International Baccalaureate Diploma Programme*. p. 4.
[37] International Baccalaureate. (2018). *Assessment principles and practices: Quality assessments in a digital age*. p. 220.
[38] International Baccalaureate. (2015). *Diploma Programme: From principles into practice*. p. 22.
[39] Ibid.

4.1.2 The Brazilian High School Curriculum

The education system in Brazil is structured into several levels and stages, overseen by the Ministry of Education (*Ministério da Educação*, MoE). Broadly, the education system is divided into basic education (*educação básica*) and higher education (*ensino superior*). Basic education is compulsory and spans three stages: early childhood education (*ensino infantil*); elementary school (*ensino fundamental*) – which encompasses both primary and lower secondary; and high school (*ensino médio)*.

Altogether, basic general education spans 14 years, with early childhood education being for ages 4-5 years, elementary school being for ages 6-14 years, and high school being for ages 15-18 years.[40] Education is provided by both public and private institutions, and public education is free at all levels. The upper secondary stage of education, known in Brazil as *Ensino Médio* (high school) takes place over three years (grades 1-3) in general or technical institutions.[41] This stage acts as a continuation from primary education, and as a preparatory stage prior to higher education or vocational training. The structure of high school education is flexible to accommodate various educational and career paths.

The Brazilian High School Curriculum (BHSC) is comprised of the National Guidelines for High School Education, National Common Curricular Base (BNCC), and Curricular References for the Preparation of Formative Itineraries. The Brazilian National Common Curricular Base (*Base Nacional Comum Curricular*, BNCC) describes the essential learning for all students and the minimum standards to be achieved at each stage of basic education, including high school. At school level, the curriculum is set by state education secretariats and municipal education authorities. Providing they meet the standards outlined in the BNCC, educational institutions and networks may construct their curriculum as they feel is pertinent to their context. The BNCC thus underpins all curriculum offerings, but rather than being a curriculum in itself, it provides guidance for content planning, allowing for flexibility at the state and school-level.[42]

Structure and requirements

The BHSC is structured into basic general education and formative itineraries. Basic general education is guided by the BNCC, which arranges the essential learning into the four areas of knowledge below:

- Language and Technology (including Portuguese)
- Mathematics and Technology.
- Natural Sciences and Technology.
- Applied Human and Social Sciences.[43]

[40] OECD. (2021). *Education in Brazil: An International Perspective*. *The Brazilian education system*. OECD Publishing, Paris. Available from https://doi.org/10.1787/c61f9bfb-en.
[41] OECD. (2021). *Education Policy Outlook in Brazil: With a focus on national and subnational policies*. *OECD Education Policy Perspectives, No. 38.* OECD Publishing, Paris. Available from: Education Policy Outlook in Brazil: With a focus on national and subnational policies | OECD
[42] OECD. (2021). *Education in Brazil: An International Perspective*. *The Brazilian education system*. OECD Publishing, Paris.
[43] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018*. p. 5-6 (art.11).

The organisation into areas of knowledge is not intended to exclude specific disciplines, but rather to support the strengthening of relationships between disciplines as well as the contextualisation of knowledge in the real world. [44] For each area of knowledge, the BNCC outlines specific competencies and associated specific skills , which correspond to the broader general competencies of basic education. Likewise, the specific competencies for high school are linked to those of elementary school, ensuring the consolidation and deepening of knowledge.

All students will study the essential learning from the four areas of knowledge outlined in the BNCC, which should be organised in an interdisciplinary and transdisciplinary way. Basic general education must incorporate the following mandatory subjects:[45]

- "I - Portuguese language, with indigenous communities also being guaranteed the use of their respective mother tongues.
- II - Mathematics.
- III - knowledge of the physical and natural world and social and political reality, especially in Brazil.
- IV - Art, especially in its regional expressions, developing the languages of visual arts, dance, music and theatre.
- V - Physical education, with optional practice for the student in the cases provided for by Law.
- VII - Afro-Brazilian and indigenous history and culture, especially in studies of art and Brazilian literature and history.
- VIII - Sociology and philosophy.
- IX - English language, other foreign languages may be offered optionally, preferably Spanish, according to the availability of the institution or educational network."[46]

Specific legislation and standards also mandate that students must encounter the themes of the aging process and respect and appreciation of the elderly; the rights of children and adolescents; traffic education; environmental education; food and nutritional education; human rights education; and digital education. Again, these themes should be included throughout the curriculum in an integrated fashion.

The other component of the BHSC is the formative itineraries, which schools may offer based on regional and local needs, interests and resources. Formative itineraries focus on deepening and expanding learning in one of the areas of knowledge, or on technical and professional training.[47] Integrated itineraries may also be offered which combine the study of one area of knowledge with another area, or with technical and professional training. Formative itineraries must be organised around one or more of the following four structuring axes:[48]

[44] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018*. p. 6 (art.11)
[45] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018*. p. 6 (art.11)
[46] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018*. p. 6 (art.11)
[47] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018*. p. 7 (art.12)
[48] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018*. p. 7 (art.12)

- Scientific research
- Creative processes
- Mediation and sociocultural intervention
- Entrepreneurship

Each municipality must offer multiple formative itineraries in different areas, allowing students to choose based on their interests and aspirations. Schools may also consider the provision of electives to expand upon the workload of the formative itinerary. Finally, students are required to pursue a life project as part of the formative itinerary. In the life project, students are expected to reflect upon their experiences and aspirations for the future, whether in relation to their academic and professional training, or more broadly to their future role in society. In the process of conducting this project, students are also expected to develop socio-emotional skills such as critical awareness and reflection.

A total minimum of 3,000 hours (over three years) is specified for high school education, with 1,800 hours (60%) allocated for basic general education and 1,200 hours (40%) allocated for formative itineraries. Education systems are given the autonomy to adapt their curriculum to better suit their local context and the students' needs. Consequently, the distribution of hours for basic general education and formative itineraries over high school is flexible, being able to be arranged in any or all grades of high school. This is except for Mathematics and Portuguese, which must be studied in each of the three years of high school.[49] Finally, students may pursue more than one formative itinerary within a high school course, which can be studied at the same time or sequentially.

State example: Rio de Janeiro

The structure of the high school curriculum in Rio de Janeiro is provided here as an example of how a state may organise its curriculum based on the guidelines provided by Brazil's Ministry of Education.

Rio de Janeiro organises basic general education and the areas of knowledge into separate disciplines. Basic general education subjects include Art, Physical Education, Portuguese Language, English language, Mother Tongue (for indigenous populations), Mathematics, Biology, Physics, Chemistry, Philosophy, History, Geography, and Sociology [50]

The formative itinerary consists of the integrated core and specialisation pathways.

- The integrated core consists of three elective subjects and the life project.
  - Elective 1: Religious Education.
  - Elective 2: Guided Studies or Foreign Languages such as: Spanish, French, Italian or German, depending on the teachers in the school.
  - Elective 3: chosen from a 'Catalogue of Electives'. Electives can be for an area of knowledge or technical and professional training. The syllabus of Elective 3 changes every six months.[51]

[49] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018*. p. 10.
[50] Secretary of state Rio De Janeiro (2022). *Guidelines for the implementation of the Curricular Matrices for Basic Education in the School Units of the Public Network*. SEEDUC Resolution No. 6035. Available from: Matrizes Curriculares (educacao.rj.gov.br)
[51] Rio de Janeiro State Department of Education. (2024). *What is the New High School like?* Available from: Como é o Novo Ensino Médio? (educacao.rj.gov.br)

- Specialisation pathways, organised into curricular components, are offered for each area of knowledge and also technical and professional training. Integrated specialisation pathways are also available.[52]

Assessment

Regional education systems are required, as part of high school education, to establish criteria for recognising students' competencies in basic general education and in the formative itineraries.[53] Student competency may be evidenced through assessment, practical demonstration, or through certification issued by the education system – for example, documentation to certify the knowledge and skills acquired during professional training.

The assessment methodologies themselves are also expected to facilitate the development of the skills and abilities expressed in the BNCC. Assessments should accordingly be organised to include the following activities [54]:

- Theoretical and practical activities
- Oral and written tests
- Seminars
- Online projects and activities
- Problem solving
- Classroom diagnoses
- Innovative learning projects
- Guided activities
- Authorship

Within the guidelines for the national curriculum for high school, assessment is recommended to be a diagnostic, formative and continuous process; aimed at facilitating and enhancing the development of skills and abilities expressed in the BNCC.

Therefore, obtaining a High School Graduation Certificate (*Certificado de Conclusão de Ensino Médio*) does not require standardised national assessments. However, many of Brazil's states and municipalities administer their own standardised assessments of student learning for their school networks.[55] National examinations are conducted for university admission purposes and measuring the quality of provision – see following section.

National assessments and examinations

In addition to the assessments administered by individual education systems, there are multiple national assessments that are carried out in Brazil for different purposes.

- **National Examination of High School** (*Exame Nacional do Ensino Médio, ENEM*): The ENEM, administered in the final year of high school, is the primary tool for selection into higher education, although individual institutions may apply alternative or additional entrance criteria.[56] The ENEM is designed in accordance with the BNCC

[52] Rio de Janeiro State Department of Education. (2024). *What is the New High School like?*
[53] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018.* p. 10. (art.8).
[54] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018.* p. 10. (art.8).
[55] OECD. (2021). *National assessment reform: Core considerations for Brazil*. OECD Education Policy Perspectives, No. 34, OECD Publishing, Paris. Available from: National assessment reform: Core considerations for Brazil | OECD
[56] OECD. (2021). *National assessment reform: Core considerations for Brazil*. OECD Education Policy Perspectives, No. 34, OECD Publishing, Paris.

and the guidelines for the formative itineraries. As such, the exam is delivered in two stages, the first corresponding to basic general education and the second to formative itineraries. For the second stage, students have a choice of tests in different areas and will take the exam in the area relating to the higher education course they aspire to apply to. Higher education institutions consider the results of each stage for access purposes. [57]

- **Basic Education Assessment System** (Sistema de Avaliação da Educação Básica, SAEB): SAEB are a group of large-scale external assessments used to measure student performance for the purposes of monitoring the education system. The SAEB uses item response theory and includes background questionnaires which helps to provide important information about student achievement. The SAEB is administered to students in the final year of high school every two years. The SAEB has changed over time to better align with PISA, and has incorporated other standardised tests, previously administered separately, allowing for greater coherence of standardised tests nationally.[58] Education systems must use the results of the SAEB as a basis for evaluating and reviewing basic education provision, as well as to guide policy recommendations.[59]

Curriculum Design Principles

The Ministry of Education (MOE) states that the aim of high school education is to develop students personally, to prepare students to exercise citizenship, and for qualification for work.[60] Accordingly, the Ministry asserts that all forms of high school education should, in addition to the general principles established for national education, be guided by further specific principles. The specific principles, which guide high school education, are outlined below:

Table 9: Specific principles for high school education[61]

Specific Principles for High School Education
I - Comprehensive training of the student, expressed by values, physical, cognitive and socio-emotional aspects:
II - Life project as a strategy for reflection on the school trajectory in the construction of the student's personal, civic and professional dimensions;
III - Research as a pedagogical practice for innovation, creation and construction of new knowledge;
IV - Respect for human rights as a universal right;
V - Understanding the diversity and reality of subjects, forms of production, work and cultures;
VI - Environmental sustainability;
VII - Diversification of the offer in order to enable multiple trajectories for students and the articulation of knowledge with the historical, economic, social, scientific, environmental, local cultural context and the world of work;

[57] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018.* p. 15. (art. 31).
[58] OECD. (2021). *National assessment reform: Core considerations for Brazil*. OECD Education Policy Perspectives, No. 34, OECD Publishing, Paris.
[59] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018.* p. 13. (art. 23).
[60] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018.*
[61] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018.* p. 2. (art. 5).

Specific Principles for High School Education
VIII - Inseparability between education and social practice, considering the historicity of knowledge and protagonists of the educational process;
IX - Inseparability between theory and practice in the teaching-learning process.

Furthermore, the BNCC lists ten general competencies which are integral to and embodied within each stage and area of basic education. These overarching competencies are described as the knowledge (such as concepts and procedures), skills (practical, cognitive and socio-emotional), and attitudes and values necessary for success in daily life, to exercise citizenship, and to enter the world of work. The ten general competencies are outlined below:[62]

Table 10: General competencies defined in the BNCC

BNCC General Competencies
Value and use historically constructed knowledge about the physical, social, cultural and digital world to understand and explain reality, continue learning and collaborate to build a fair, democratic and inclusive society.
Exercise intellectual curiosity and use the approach specific to science, including investigation, reflection, critical analysis, imagination and creativity, to investigate causes, develop and test hypotheses, formulate and solve problems and create solutions (including technological ones) with based on knowledge from different areas.
Value and enjoy diverse artistic and cultural manifestations, from local to global, and also participate in diverse practices of artistic and cultural production.
Use different languages – verbal (oral or visual-motor, such as Libras, and written), body, visual, sound and digital –, as well as knowledge of artistic, mathematical and scientific languages, to express oneself and share information, experiences, ideas and feelings in different contexts and produce meanings that lead to mutual understanding.
Understand, use and create digital information and communication technologies in a critical, meaningful, reflective and ethical way in different social practices (including school ones) to communicate, access and disseminate information, produce knowledge, solve problems and exercise protagonism and authorship in life personal and collective.
Value the diversity of knowledge and cultural experiences and appropriate knowledge and experiences that enable you to understand the relationships specific to the world of work and make choices aligned with the exercise of citizenship and your life project, with freedom, autonomy, critical awareness and responsibility.
Argue based on facts, data and reliable information, to formulate, negotiate and defend ideas, points of view and common decisions that respect and promote human rights, socio-environmental awareness and responsible consumption at a local, regional and global level, with positioning ethical in relation to caring for oneself, others and the planet.
Knowing yourself, appreciating yourself and taking care of your physical and emotional health, understanding yourself in human diversity and recognizing your emotions and those of others, with self-criticism and the ability to deal with them.
Exercise empathy, dialogue, conflict resolution and cooperation, ensuring respect and promoting respect for others and human rights, welcoming and valuing the diversity of individuals and social groups, their knowledge, identities, cultures and potential, without prejudice of any kind.
Act personally and collectively with autonomy, responsibility, flexibility, resilience and determination, making decisions based on ethical, democratic, inclusive, sustainable and supportive principles.

In addition to the specific principles and the BNCC's general competencies, BHSC curriculum design is also guided by the considerations provided in the national guidelines for the

[62] Brazil, Ministry of Education. (2018). *National Common Curricular Base*.

pedagogical proposal. Indeed, each school is required to prepare a pedagogical proposal which aligns with the curriculum document outlined by their education system. This pedagogical proposal should outline the curricular arrangements, as well as the approach to formative itineraries. The MOE has produced a set of principles which institutions providing high school education must consider when creating their pedagogical proposals. As such, all schools offering high school education will consider the following when designing their curriculum: [63]:

Table 11: Considerations for the design of high school pedagogical proposals

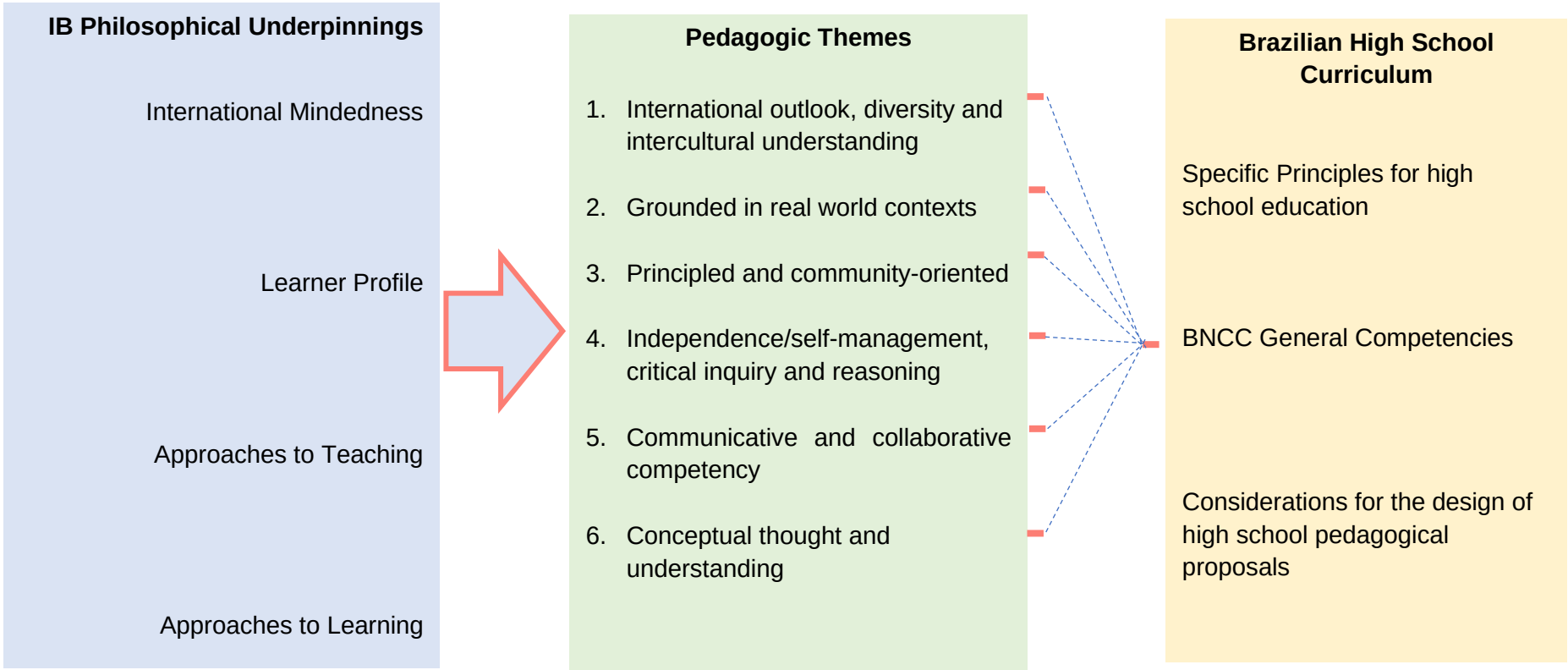
Considerations for the Design of High School Pedagogical Proposals
I - Integrative artistic-cultural, technological and scientific initiation activities, linked to work, the environment and social practice;
II - Problematization as an instrument to encourage research, curiosity about the unusual, and the development of an inventive spirit;
III - Learning as a process of significant appropriation of knowledge, overcoming learning limited to memorization;
IV - Appreciation of reading and written production in all fields of knowledge;
V - Ethical behavior, as a starting point for the recognition of human rights and citizenship, and for the practice of contemporary humanism expressed by recognition, respect and acceptance of the identity of others and the incorporation of solidarity;
VI - Articulation between theory and practice, linking intellectual work to activities practical or experimental;
VII - Integration with the world of work through internships, professional learning, among others, in accordance with specific legislation, considering the needs and demands of the world of work in each region and Federation Unit;
VIII - Use of different media as a process of dynamizing work environments learning and building new knowledge;
IX - Permanent ability to learn to learn, developing student autonomy;
X - Social activities that encourage human coexistence;
XI - Learning assessment, with preliminary diagnosis, and understood as a formative, permanent and cumulative process;
XII - Monitoring students' school life, promoting performance, analysing results and communicating with the family;
XIII - Complementary activities and overcoming learning difficulties so that the student is successful in their studies;
XIV - Recognition and attention to diversity and different nuances of inequality and exclusion in Brazilian society;
XV - Promotion of Human Rights through the discussion of issues related to race and ethnicity, religion, gender, gender identity and sexual orientation, people with disabilities, among others, as well as practices that contribute to equality and the confrontation of prejudice, discrimination and violence in all forms;
XVI - Analysis and critical reflection of the Brazilian reality, its social and productive organization in the complementary relationship between urban and rural areas;
XVII - Study and development of socio-environmental activities, leading to environmental education as an integrated, continuous and permanent educational practice;
XVIII - Sporting practices and body expression, which contribute to health, sociability and cooperation;

[63] Ministry of Education. National Education Council. Basic Education Chamber. (2018). *Resolution No.3, of November 21, 2018.* p. 13. (art. 27)

Considerations for the Design of High School Pedagogical Proposals
XIX - Intersectoral activities, among others, to promote physical and mental health, sexual health and reproductive health, and drug use prevention;
XX - Production of media in schools through the promotion of activities that promote reading skills and analysis of the cultural, political and economic role of the media in society;
XXI - Social participation and protagonism of students, as agents of transformation of their teaching units and their communities;
XXII - Material, functional and didactic-pedagogical conditions, so that school professionals can implement the project's propositions;
XXIII - The student's life and career project as a pedagogical strategy whose objective is to promote the student's self-knowledge and their citizenship dimension, in order to guide the planning of the desired professional career, based on their interests, talents, desires and potential.

4.2 Philosophical Underpinnings

Figure 3: Philosophical underpinnings comparative analysis diagram



The IB learner profile, which is used across all IB programmes including the DP, outlines 10 attributes that all students should strive towards.[64] Linked to these attributes, there are five categories of approaches to learning skills that all IB programmes aim to develop as well as six categories of approaches to teaching principles. The table in Appendix B presents these qualities of the IB's underpinning philosophy along with the overview used in IB documentation to describe the quality of international-mindedness that also encircles all IB teaching and learning.

The six themes identified within the IB literature have relatively consistent presence across all component parts (learner profile, approaches to teaching, approaches to learning, and international mindedness). As a result, these themes present a 'boiled-down' version of the DP's philosophical underpinnings.

To identify the level of alignment in relation to the philosophical underpinnings between the DP and the BHSC, the project team mapped the philosophical underpinnings of the BHSC against six themes extracted from the DP's philosophical underpinnings.

Table 12: Philosophical underpinning themes

Philosophical underpinning themes
• International outlook, diversity, and intercultural understanding • Grounded in real world contexts • Principled and community-oriented • Independence/self-management, critical inquiry, and reasoning • Communicative and collaborative competence • Conceptual thought and understanding

When mapping the six DP themes onto the specific principles for high school education, the BNCC general competencies and the considerations for pedagogical proposals, it is apparent that all six DP themes are present in the Brazilian context. Many of the DP themes featured across each of the components that underpin the BHSC, indicating that it operates on similar philosophical underpinnings to the IB's DP curriculum. The themes that are most strongly evident are 'International outlook, diversity, and intercultural understanding', 'Grounded in real world contexts', 'Principled and community-oriented' and 'Independence/self-management, critical inquiry, and reasoning'.

Indeed, as in the DP, the BHSC encourages respect for the identity of others, including understanding and valuing the diversity of individuals and cultures both locally and globally. Moreover, citizenship and the recognition of human rights is likewise emphasised in the BHSC. Therefore, the DP's theme of 'International outlook, diversity, and intercultural understanding' is present in the BHSC. Notably, however, developing an international outlook is a less significant focus within the BHSC. Rather, the BSHC places a larger emphasis than the DP on diversity and intercultural understanding between cultures within the student's local context. For example, students are expected to recognise and understand the nuances of diversity, equality, and inclusion within Brazilian society.

[64] International Baccalaureate. (2017). *What is an IB education?*

In addition to the principles of respecting others, promoting human rights, and demonstrating citizenship, the BHSC encourages students to care for others and the planet, and to make positive contributions to their communities and to society, which are beneficial and transformative. As such, the BHSC reflects the DP's 'Principled and community orientated' theme. Although both curricula refer to caring for the planet, the BHSC makes more explicit reference to promoting environmental sustainability within its philosophical underpinnings.

Furthermore, the BHSC highlights the importance of the relationship between theory and practice, emphasising that these should be linked during teaching and learning. Also, it is expected that students can understand and explain reality, particularly in the Brazilian context. As such, the principles indicate the presence of the DP theme 'Grounded in real-world contexts'. While the DP emphasises contextualised learning and applying knowledge to real-life contexts and examples, there is less reference to applying knowledge to a specifically professional context. In contrast, the BSHC specifies that the offer is intended to enable multiple trajectories for students, including with respect to work. Accordingly, learning activities should be linked to work and students should be afforded opportunities to be involved with the world of work such as internships or professional learning. The life project is also described as an opportunity for students to reflect on their professional aspirations. Preparation for work is therefore a clear aim of the BSHC, and professional contexts are emphasised more strongly than in the DP.

There is a similar focus on independence and self-management in the DP and the BHSC. Indeed, the BHSC aims to develop student autonomy and responsibility, as well as to ensure students learn how to learn. Furthermore, intellectual curiosity, critical analysis and reflection are likewise highlighted, indicating a similar focus on critical inquiry. Consistent with the DP, the BHSC expects students to use facts, data and reliable information to defend ideas and points of view, indicating a similar emphasis on reasoning.

The BHSC emphasises being able to express oneself in different modalities and in different contexts, including being able to reach common decisions and achieve mutual understanding. This, along, with an emphasis on cooperation, indicates that the DP's theme of 'Communicative and collaborative competency' is also present in the BHSC. The DP curriculum promotes strong communication and the ability of students to express themselves confidently in many ways, which is also the case for the BHSC. However, in contrast to the DP, the BHSC specifically refers to the development of reading skills, in particular including appreciating reading and written media, and promotion of activities that promote reading skills.

As in the DP, there is evidence in the BHSC that students are intended to develop conceptual thought and understanding. For example, students are expected to use knowledge to understand and explain reality, draw upon knowledge from different areas, and conduct critical analysis – all of which require more complex reasoning. Likewise, there is an expectation that learning goes beyond memorisation, and for students to recognise the relationship between theory and practice, including in practical or experimental contexts. There is therefore evidence of higher order thinking and an intention to develop a deep understanding of content. Thus, the philosophical underpinnings of the BHSC indicate that the DP's theme of 'Conceptual thought and understanding' is present.

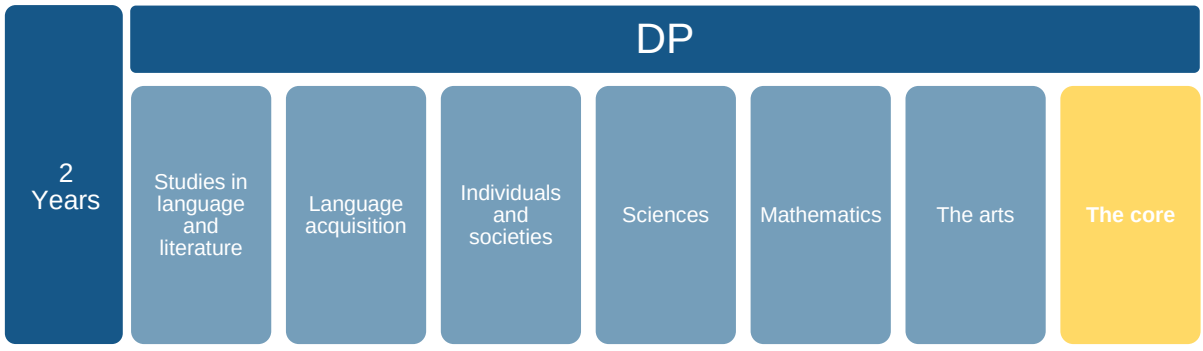
Overall, there is strong alignment between the philosophical underpinnings of the DP and the BHSC. Themes of 'Conceptual thought and understanding', 'Independence/self-management, critical inquiry, and reasoning' and 'Principled and community-oriented' are evident in both curricula. The theme of 'International outlook, diversity, and intercultural understanding' is also present in both curricula, though the BHSC has a larger focus on the local Brazilian context. Moreover, both curricula aim for learning that is 'Grounded in real world contexts', though the BHSC emphasises preparation for work, and thus has a larger focus than the DP on professional contexts. Finally, 'Communicative and collaborative competency' is also present in both curricula, though the BSHC places a greater focus on reading skills.

4.3 Structure

There are six subject groups comprising the DP and students pursuing the Diploma award are normally required to select one subject from each of the six groups.[65] The DP also has three core components which are compulsory and are carried out alongside the grouped subjects. The BHSC comprises basic general education and formative itineraries. Basic general education includes the essential learning outlined in the BNCC; which is organised into four areas of knowledge. The four areas of knowledge span a range of disciplines, which must be encompassed in basic general education – see figure 5. For their formative itinerary, students specialise in one of the areas of knowledge or in technical and professional training (integrated itineraries may also be offered). All students will undertake their life project as part of the formative itinerary, which may also comprise electives.

The figures below present the structural overviews of the DP and BHSC. Furthermore, a structural overview of the Rio de Janeiro high school curriculum is also provided, as an example of how the structure may look at the state-level.

Figure 4: Structural overview of the DP



[65] International Baccalaureate. (2021). *How the Diploma Programme Works*. Available from: https://www.ibo.org/programmes/diploma-programme/what-is-the-dp/how-the-diploma-programme-works/

Figure 5: Structural overview of the Brazilian high school curriculum

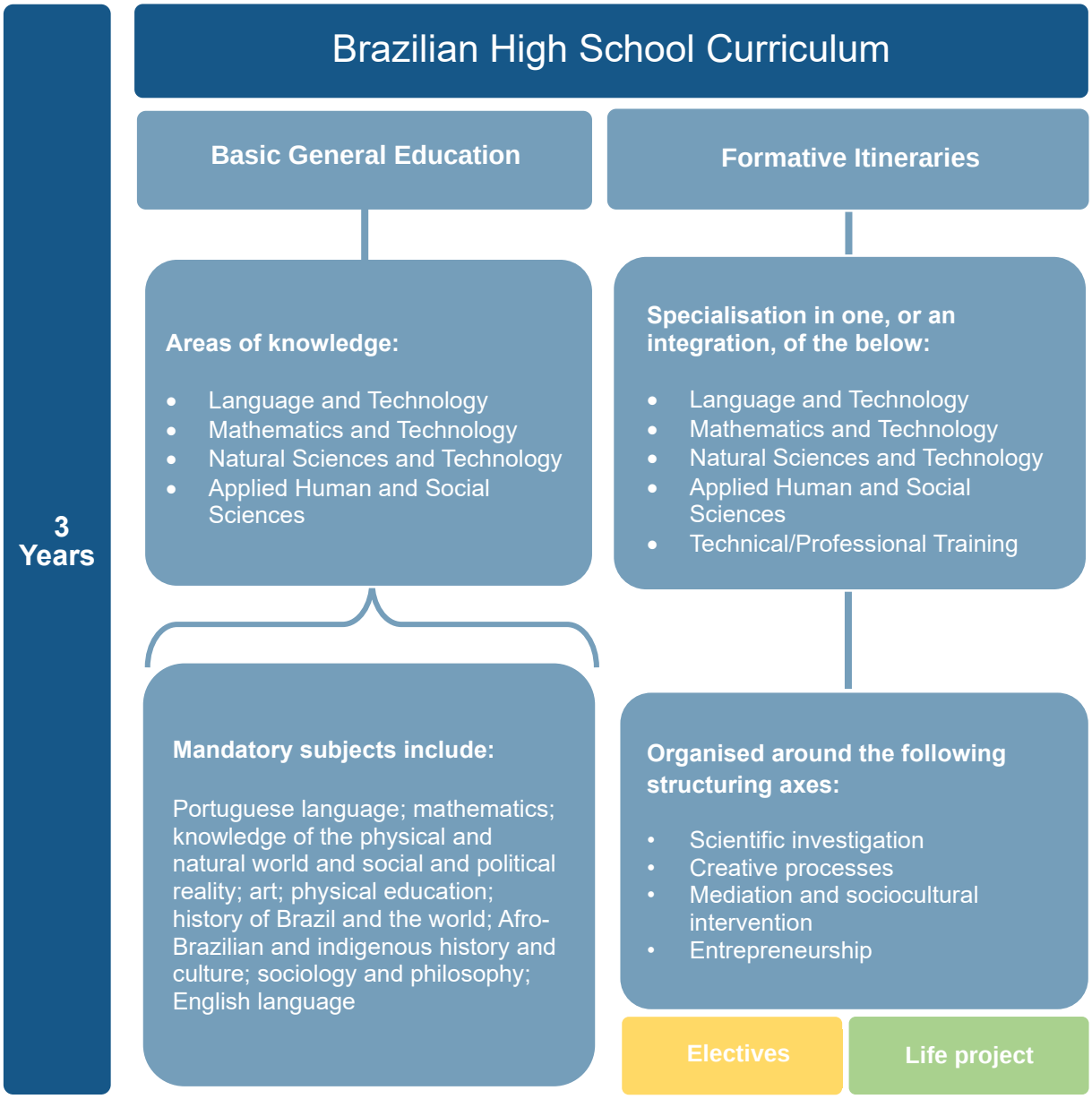
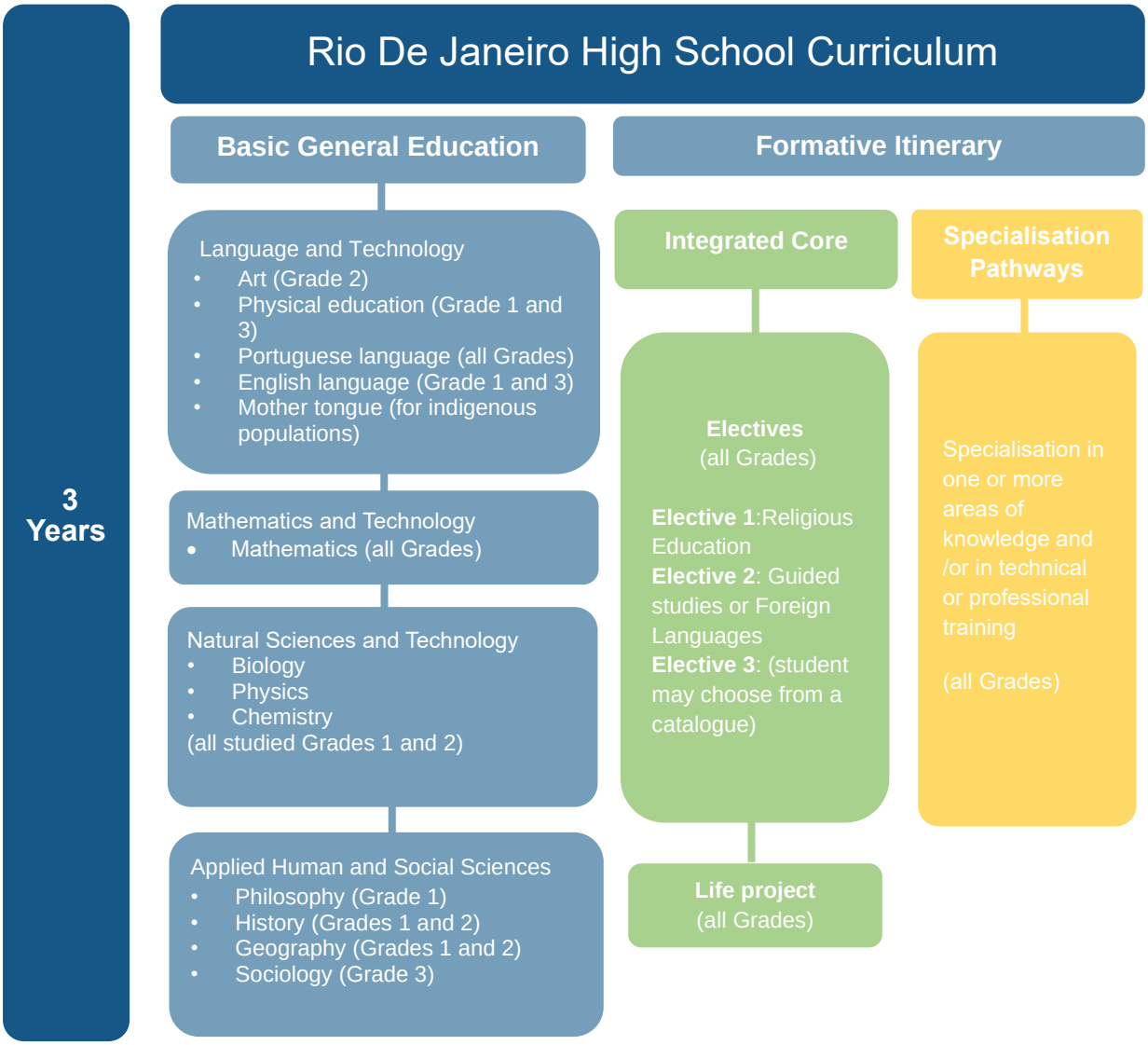


Figure 6: Structural overview of the high school curriculum in Rio de Janeiro



With regards to the subject offering, the programmes contain a similar breadth of subject areas and each follow a baccalaureate-style approach. The use of subject areas is a point of simialrity between the programmes, as well as the focus of these subject areas. Indeed, both programmes contain a science-focused area, a humanities-focused area, a language-focused area and a mathematics-focused area. As such, students in both programmes will study science, maths, languagues and humanities. Subjects which are common to both curricula include the sciences, history, geography, art, physical education, philisophy, and sociology.

A key difference between the programmes is that in the DP students choose to study one subject from each of the six subject areas (groups). In contrast, BHSC students study all of the subjects that are encompassed by each of the four areas of knowledge. For example, whereas DP students may opt to study history from from the Individuals and societies subject group, Brazillian high school students will study Applied Human and Social Sciences which encompasses the study of history, philosophy, geography, and sociology. As such, basic education in Brazil may encompass a broader range of subjects in comparison to the DP.

Another point of difference is the nature of specialisation in the programmes. Indeed, DP students study subjects at standard or higher level (SL or HL), and are required to study at least three of the six chosen subjects at HL. In comparison, Brazilian high school students specialise in an integrated subject area (e.g. Applied Human and Social Sciences) rather than in individual subjects (e.g. history) through the formative itinerary. Where the DP requires the study of three HL courses from different subject areas, the BHSC only requires that students specialise in one subject area – though states may offer integrated itineraries, which combine multiple areas. Overall, the DP offers more opportunity for individual-subject specialisation than the BHSC.

With regards to the general structure and duration, the DP is shorter and more prescriptive.. The DP takes place over two years, whereas the BHSC spans three years. The DP requires that all subjects are studied over these two years and states the teaching hours per subject. In contrast, the overall required hours for basic general education and for formative itineraries are specified, but the distribution of these teaching hours is flexible and determined by regional education systems. Basic general education subjects may be included in all or some years of high school (with the exception that mathematics and Portoguese must be studied at each year), and formative itineraries may be delivered sequentially or concurrently. For example, in Rio de Janeiro science subjects are only studied in grades one and two, but Physical Education is studied in Grades one and three. Likewise, in contrast to the DP where SL is 150 and HL is 240, the teaching hours for subjects may vary between education systems in Brazil.

To receive a Diploma, all DP students must complete the DP core, which consists of TOK, CAS, and the extended essay. These components are specific to the DP and the BHSC generally does not contain similar requirements. However, some similarities to these components may be drawn from aspects of the BHSC. Indeed, formative itineraries may present an opportunity to explore and undertake an independent investigation, which may involve similar activities to those involved in the extended essay. Moreover, the life project provides students the opportunity to reflect on developing socio-emotional and cognitive skills and their experiences in school, and how this has prepared them for their future. As such, the purpose of the life project is personal development, which has similarities with the aims of CAS. Moreover, physical education and physical health is included in the BHSC, which also draws similarities to CAS. Further, the philosphical underpinnings of the BHSC indicate that students are expected to be aware of how knowledge is generated, as well as to learn how to learn (indicating the development of metacognitive skills), which is reflective of the aims of TOK. Overall, some elements of the DP core are somewhat reflected in the BHSC, but are generally not required to be demonstrated to a similar extent.

The BHSC includes the option to pursue technical and professional training, as part of the formative itineray. This may be in combination with an area of knowledge, or in isolation. In contrast, technical/professional training is not offered in the DP. Instead, IB students prefering this type of pathway would study the IB's Career-Related Programme (CP), which offers a vocational pathway for upper-secondary education.

In summary, both programmes have similarities in their curricular organisation and adopt a baccaluareate approach. Although similar subjects areas are present in each programme, the requirement to study areas of knowledge which span several subjects in the BHSC means that students will study a greater breadth of subjects than the DP. Instead, the DP offers

greater opportunities for individual-subject study and specialisation than the BHSC, which offers specialisation in integrated subject areas. The DP has a shorter duration and is more prescriptive in its curricular organsiation and the allocation of teaching hours.There are some similarities in the BHSC to the DP core, though the BHSC has less extensive requirements compared to these components. Finaly, the BHSC inludes the option to persue technical and professional training, which is not the case for the DP – as this is instead the focus of the IB's CP.

4.4 Requirements and Associated Outcomes

There are no formal entrance requirements stipulated for the DP as the IB envisages numerous educational pathways leading to upper secondary education.[66] However, the IB recommends consulting the subject guides prior to enrolment to ensure an adequate understanding of programme expectations.[67] In contrast, entry to high school in Brazil is dependent on the successful completion of elementary school. Those who are not able to successfully demonstrate the expected abilities must repeat the grade or year. Notably, grade repetition is common in Brazil, particularly in high school.[68]

In terms of associated outcomes, according to the DP documentation, although the DP is conceived as a preparatory programme for university and higher education focusing primarily on rigorous academic study, the programme can also prepare students for employment. Similarly, the BHSC also intends to prepare students for further education or employment and will also prepare students for higher education entrance examinations such as the ENEM.

The IB diploma can often be used to grant direct entry into higher education institutions. In Brazil, high school students will likely need, in addition to the High School Graduation Certificate, to present their results from the ENEM or other entrance exam to access higher education institutions. High school students In Brazil may also be awarded a diploma for a secondary level technical qualification or a certificate for a professional qualification course which grants entry to further secondary level technical courses (*curso técnico de nível médio subsequente*). This, alongside the scores for the ENEM, grants entry into higher education courses such as a technical degree (*Graduação Tecnológica*).[69]

Overall, the entrance requirements for Brazilian high school are more prescriptive than those for the DP, as the former specifies successful completion of the previous education stage. Both courses can serve as preparatory programmes for higher education courses. However, whereas the DP can enable entry directly, the High School Graduation Certificate in Brazil also needs to be accompanied by scores in national assessments and often university admission tests. Finally, Brazilian high school students may be awarded a technical or vocational qualification, which is not offered in the DP.

[66] International Baccalaureate. (2015). *Diploma Programme: From principles into practice*. p. 22.
[67] Ibid.
[68] OECD. (2021). *Education in Brazil: An International Perspective*. *The Brazilian education system*. OECD Publishing, Paris.
[69] Ibid.

4.5 Student Learning Pathways

In terms of learning pathways, both programmes include compulsory and optional elements. See the programme overviews in section 4.1 for further details on subject selection. To understand the levels of optionality and potential specialisation in each programme, it is instructive to look at what an individual student would be able to choose in practice. The following diagrams demonstrate the subject options available to an imagined student who knows that they would like to study physics at university after the completion of their upper secondary studies.

Figure 3: DP imagined pathway for a student wishing to study physics at university

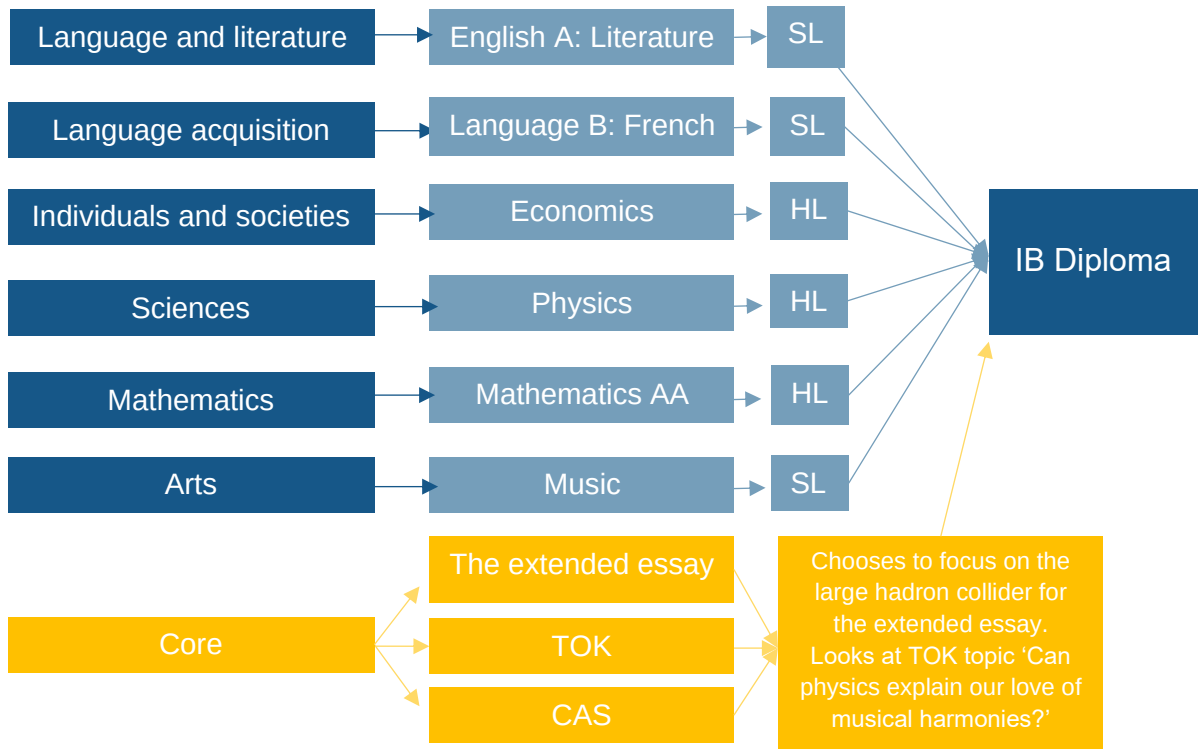
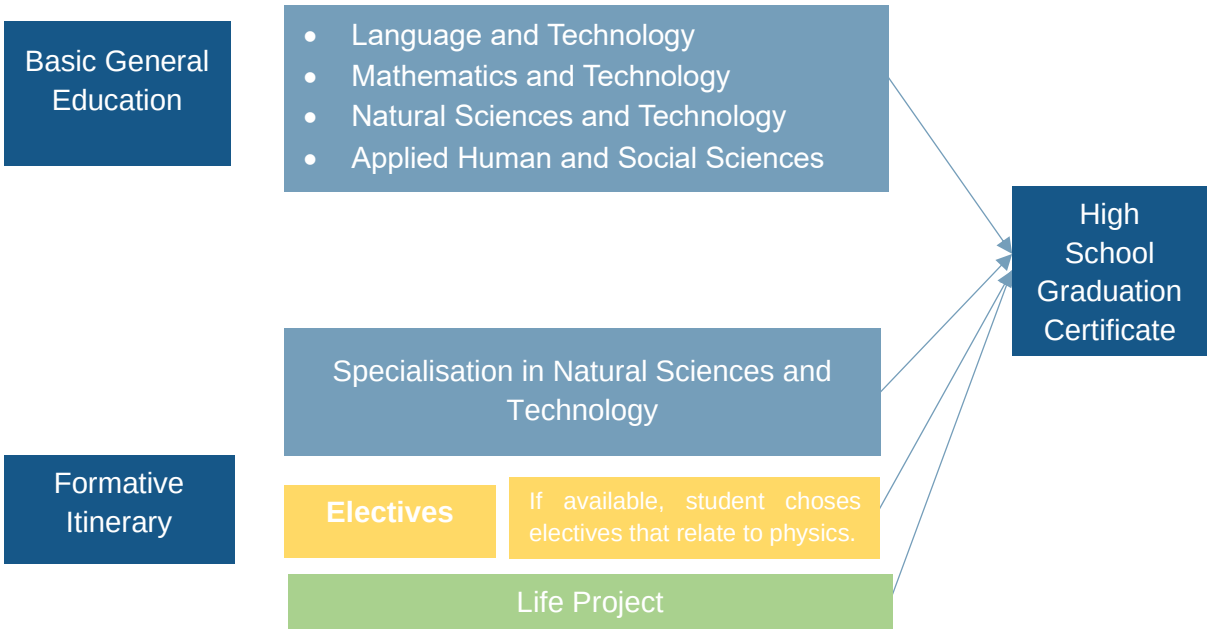


Figure 4: Imagined pathway for a Brazilian high school student wishing to study physics at university



As can be seen from the diagrams above, students studying the BHSC study a similar breadth of subject areas to the DP. However, a key difference in student learning pathways is that there is a greater degree of optionality afforded by the DP, compared to the BHSC.

DP students are required to select a subject from each of the six subject areas – thus, they choose all their subjects. In contrast, basic general education, as part of the BHSC, outlines essential leaning for all high school students, who are not able to opt to study specific subjects. The only optionality available in the BHSC is in the formative itineraries. However, students choose an area of knowledge (i.e. subject area) to specialise in, rather than specific subjects. Formative itineraries may allow students to choose electives, though, as in the case of Rio de Janeiro, these may not be specific to a single subject.[70]

Moreover, as shown in the diagrams above, the DP allows students wishing to pursue physics at university to study this as a single subject for the duration of the programme, and to specialise further by taking a HL course. In contrast, Brazilian high school students wishing to pursue physics take an integrated science pathway, specialising in Natural Sciences and Technology, which physics will be part of but not the sole focus. Therefore, there is more opportunity in the DP to choose and specialise in a subject of interest.

Furthermore, it can be noted that the DP requires students to specialise (i.e. take HL courses) in subjects from a range of different subject areas. Whereas students in Brazilian high school can specialise in just one subject area. However, it can be noted that students may be able to specialise in more than one subject area through integrated formative itineraries.

[70] However, it should be noted that the formative itinerary offering and how it is organised is mostly at the discretion of education systems and institutions.

Additional flexibility in student learning pathways may be present in Brazilian high school, as systems and institutions are allowed to arrange the curriculum to best meet their students' needs. In practice, this may mean that schools provide formative itineraries in areas that their students are interested in. Moreover, the High School Graduation Certificate may also be obtained through adult learning programmes (e.g. Educação de Jovens e Adultos, EJA) or by passing the National Examination for Certification of Youth and Adult Skills (Exame Nacional para Certificação de Competências de Jovens e Adultos, ENCCEJA).[71]

In summary, both programmes offer similar subject areas. Students following the BHSC will study a greater number of subjects, but the DP allows for more optionality. The DP likewise offers more opportunities for specialisation in single subjects, whereas the BHSC only allows students to specialise in integrated-subject areas. Both programmes intend for students to learn according to their interests and aspirations. In the DP this is achieved through allowing students to select subjects, whereas in the BHSC, education systems adapt their offering to best suit students in their local context.

4.6 Assessment Methods

This section looks at the key features of assessment in both programmes by using a simple table followed by a short textual description of the key similarities and differences.

Table 13: Top level assessment comparisons

	DP	Brazilian High School Graduation Certificate
External assessment	✓	✗
Weighting	Varies by subject	0%
Mathematics	**SL & HL**: 80%	N/A
Sciences	**SL & HL**: 80%	N/A
Methods	Exam (Typically, two-three exam papers per subject)	N/A
Mathematics	**SL**: 2 papers of 90 minutes in duration each, with 80 marks available in each. **HL**: 3 papers with durations of 120, 120, and 60 minutes. Marks available are 110, 110, and 55. **Question Types**: compulsory short-response and extended response questions, incorporating problem solving in HL paper 3.	N/A
Sciences	**SL**: 2 papers worth 36% and 44% of total assessment weighting, with duration of 1 hour and 30 minutes each. **HL**: 2 papers worth 36% and 44% of total assessment weighting, with duration of 2 hours and 2 hours and 30 minutes respectively. **Question Types**: multiple-choice, short and extended response, and data-based	N/A

[71] OECD. (2021). *Education in Brazil: An International Perspective*. *The Brazilian education system*. OECD Publishing, Paris.

Internal assessment	✓ (Often used)	✓
Weighting	Varies by subject	100%
Mathematics	**SL & HL**: 20%	100% of final grade determined by diverse assessment methodologies according to guidance, outlined in the local curriculum proposal
Sciences	**SL & HL**: 20%	100% of final grade determined by diverse assessment methodologies according to guidance, outlined in the local curriculum proposal
Methods	Vary by subject, but should follow IB guidance	Vary by subject but should be both formative and summative, designed around subject specific objectives and module contents.
Mathematics	**SL & HL**: A 'mathematical exploration' involving a piece of written work for 20 marks.	Combination of approaches designed by schools and teachers.
Sciences	A practical, individual investigation with 10 hours duration and 3000-word write-up.	Combination of approaches designed by schools and teachers.

This table shows substantial differences in the overall approach to assessment methods between the DP and BHSC. The DP prioritises external assessment in the form of exams, whilst internal assessment only accounts for 20-30% of the final mark in each subject.[72] In contrast, assessment leading to the Brazilian High School Graduation Certificate is centred around internal assessments which are delivered flexibly according to different education systems. Assessment of the BHSC is to be diagnostic, formative, and continuous, aiming to provide feedback on and to facilitate the development of specific skills and competencies outlined in the BNCC. The specific details of assessment are outlined by education systems in their curriculum proposal. Although not compulsory for the Brazilian High School Graduation Certificate, many students will also complete the ENEM, a national and externally assessed exam, to demonstrate their proficiency of the knowledge and skills learnt in basic general education and formative itineraries.

Despite a heavy emphasis on internal assessment, the assessment methods used in Brazilian high school may align with those used by the DP. For example, internal assessment in Brazil can include written tests, which has some similarity with the external written examinations used for the DP. Likewise, the DP internal assessments for mathematics and science may be similar to the 'innovative learning projects' described in the BHSC, as each involves some independent investigation. However, as there is a high level of flexibility in how education systems may assess the BHSC, the level of alignment is difficult to conclusively judge.

Furthermore, as subject assessment leading to the Brazilian High School Graduation Certificate is based on flexible internal assessment, comparisons of the question types used, and other aspects of the assessment structure of the DP, are challenging to compare. Indeed, whilst the DP uses clear assessment objectives to demonstrate the nature and proportional importance of the skills assessed, the guidelines for assessment in the BHSC simply specify a requirement to assess key subject-related skills and competences outlined in the BNCC. Specific assessment objectives are determined by education systems in Brazil, though will be based on the specific competencies in the BNCC. The table below presents a comparison of

[72] International Baccalaureate. (2021). *Understanding DP Assessment*.

the DP assessment objectives and the BNCC specific competencies per subject for the various subjects compared in this study.

Table 14: Comparison of DP assessment objectives (AO) and BNCC competencies[73]

DP subject	DP assessment objectives	Mathematics and Technology Specific Competencies
DP mathematics subjects	AO1 – knowledge and understanding	• 'Use strategies, concepts, definitions and mathematical procedures' • 'Understand and use, with flexibility and precision, different mathematical representation registers', 'Apply mathematical concepts'
	AO2 – problem solving	• 'Solve and elaborate problems'
	AO3 – communication and interpretation	• 'Understand and use, with flexibility and precision, different mathematical representations (algebraic, geometric, statistical, computational, etc.), in problem solving and communication' • 'Interpret and compare sets of statistical data',
	AO4 – technology	• 'With or without the support of digital technologies.', 'Use initial concepts of a programming language to implement algorithms written in common language and/or mathematics.'
	AO5 – reasoning	• 'Use strategies, concepts, definitions and mathematical procedures to interpret, build models and solve problems in different contexts, analyzing the plausibility of results and the adequacy of proposed solutions, in order to build consistent arguments.'
	AO6 – inquiry approaches	• 'Investigate and establish conjectures regarding different concepts and mathematical properties, employing strategies and resources, such as observation of patterns, experiments and different technologies, identifying the need, or not, for an increasingly formal demonstration in validating said conjectures.'
DP subject	**DP assessment objectives**	**Natural Sciences and Technology Specific Competencies**
DP science subjects	AO1 – demonstrate knowledge	• 'Using procedures and languages typical of Natural Sciences' • 'Use knowledge about radiation and its origins', • 'Develop explanations, predictions, and calculations'
	AO2 – understanding and application	• 'Apply the principles of biological evolution', • 'Assess the risks involved in everyday activities, applying knowledge from Natural Science'
	AO3 – analyse, evaluate, and synthesise	• 'Analyse biogeochemical cycles'

[73] Brazil, Ministry of Education. (2018). *National Common Curricular Base*.

		• ‘Analyse and discuss models, theories and laws proposed in different times and cultures.’ • ‘Evaluate and predict the effects of interventions in ecosystems’
	AO4 – investigation skills	• ‘Investigate problem situations’ • ‘Construct questions, develop hypotheses, predictions and estimates, employ measuring instruments and represent and interpret explanatory models, data and/or experimental results to construct, evaluate and justify conclusions when facing problem situations from a scientific perspective.’

As is shown in the tables above, many of the same skills are assessed in the DP and the BHSC for mathematics and science subject areas. Although there are no assessment objectives specifically outlined in the BHSC, all education systems are expected to assess students’ competencies in the essential learning outlined in the BNCC. In the area of Mathematics and Technology, it can therefore be said that students would be assessed on their knowledge and understanding, problem solving, communication and interpretation, technology, reasoning, and inquiry. Also, in the area of Natural Sciences and Technology, students would likewise be expected to demonstrate in assessment knowledge, understanding and application, analysis, evaluation, and synthesis, as well as investigative skills.

Overall, whilst both the DP and BHSC feature internal assessment, only the DP uses external assessment. However, while external assessment is not required for the Brazilian High School Graduation Certificate, students will experience external assessment if they take the ENEM and university admission tests. Some similarities can be drawn with regards to some of the internal assessment methods that are used between programmes. However, the BHSC requires continuous assessment, which is not a feature of the DP. Finally, despite not featuring assessment objectives, the skills targeted in the BNCC’s specific competencies for each subject share similarities with those assessed by the DP subjects.

5. Subject-Level Alignment

This section focuses on answering RQ3 and the sub-questions associated to it, namely:

Table 15: Research question 3

RQ3: To what degree do the subjects align with regards to: 3.1: Content • Topics (i.e. scope of content area, breadth depth) • Learning activities (i.e. difficulty, demand). 3.2: Expected learning outcomes • Knowledge • Competences (i.e. subject-specific, 21st century competences).

For each subject area, there is a brief introduction to the subjects being compared, followed by an overview of the findings from the comparative analysis between the DP subjects and the BHSC comparison points regarding learning outcomes, content, and demand.

5.1 Mathematics

The following is the list of subjects used in the mathematics subject comparison analysis.

Mathematics: analysis and approaches[74]
Mathematics: analysis and approaches (AA) is a subject option from the mathematics group in the DP curriculum – offered at both SL and HL. This subject is intended for students who are interested in both real and abstract applications of mathematical concepts and enjoy problem solving and generalisation. SL is suitable for students who want to study a good level of mathematics, but not at an advanced level. Therefore, SL prepares students for further study in areas involving mathematical elements, such as geography. HL is suitable for students who want an in-depth study of mathematics and enjoy solving challenging problems. Therefore, HL prepares students for further study in mathematics, as well as other areas with a strong mathematical focus, such as physics and engineering.

Mathematics: applications and interpretation[75]
Mathematics: applications and interpretation (AI) is a subject option from the mathematics group in the DP curriculum – offered at both SL and HL. This subject is intended for students who are interested in exploring more practical applications of mathematics and would enjoy using mathematical models and technology. SL is most suitable for those who want to obtain a good level of knowledge of mathematics, with a focus on real-world applications. Therefore, SL prepares students for further study in areas with some practical mathematics elements, such as biology and business. HL is suitable for students wishing to gain more in-depth knowledge of mathematics, with a focus on real-world situations and the applications of mathematics.

[74] International Baccalaureate. (2019). *Mathematics: analysis and approaches guide*.
[75] International Baccalaureate. (2019). *Mathematics: applications and interpretation guide.*

BHSC Mathematics and Technology (Basic General Education) – BHSC MAT (BGE)
In the BHSC, Mathematics and Technology is a compulsory area of knowledge for the basic general education component of high school. This area of knowledge is designed to consolidate and deepen the mathematics learnt in elementary school and aims for high school students to become more aware of the interrelatedness of mathematics, through the perspective of application to real-world contexts. BHSC MAT (BGE) is based upon the specific competencies and skills prescribed by the BNCC.[76] To support the content analysis, the Rio de Janeiro Referential Curriculum (RJRC)[77] is also consulted to provide additional insight into the typical mathematics topics and subtopics covered in BHSC MAT (BGE).

BHSC Mathematics and Technology (Formative Itinerary) – BHSC MAT (FI)
In the BHSC, Mathematics and Technology is an area of knowledge that students may choose to specialise in for their formative itinerary component of high school. Formative itineraries are curricular units which are designed for students to deepen their knowledge and prepare for further studies or careers. BHSC MAT (FI) is based upon the 'Curricular references for the preparation formative itineraries', which guide the development of this subject by each state.[78] Again, the RJRC is consulted to provide further insights into the type of content covered in BHSC MAT (FI).[79]

5.1.1 Learning Outcomes – Mathematics

This section compares and contrasts the learning outcomes of curricula falling within the category of mathematics.

For its mathematics learning outcomes, the DP sets out aims and assessment objectives for all subjects within the mathematics subject group – hence the extracted themes are the same for mathematics: analysis and approaches and mathematics: applications and interpretation.

BHSC Mathematics and Technology (MAT) learning outcomes are presented as specific competencies and specific skills. For formative itineraries specifically, additional skills are given, which are based on the formative itinerary structuring axes. Moreover, the BHSC also articulates general competencies for high school education which have also been considered when relevant here.

The following summary table demonstrates the learning outcome themes that were extracted from DP mathematics and indicates if and where they were judged to have presence within the learning outcomes of BHSC Mathematics and Technology (MAT).

[76] Brazil, Ministry of Education. (2018). *5.2.1. The area of Mathematics and Technology: Specific competencies and skills*. BNCC. Available from: National Common Curricular Base - Education is the Base (mec.gov.br)
[77] Rio de Janeiro State Government, Department of Education. (2022). *Mathematics and Technology*. High School Referential Curriculum for the State of Rio de Janeiro. p. 68-70. Available from: 1- Revisão CURRÍCULO ENSINO MÉDIO.cdr (educacao.rj.gov.br)
[78] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. Available from: Referenciais-Curriculares-para-Elaboracao-de-Itinerarios-Formativos-1-1.pdf (sedu.es.gov.br)
[79]. Available from: Trails (educacao.rj.gov.br)

Table 16: Presence of the DP mathematics subject group learning outcome themes in BHSC Mathematics and Technology (MAT)

Themes extracted from the learning outcomes in the DP mathematics subject group	Presence in BHSC Mathematics and Technology (MAT)	
1. Be aware of, and engage with, mathematics in its wider context		Present in BHSC MAT – contexts such as socio-economic issues, sustainability, world challenges, and community issues are considered.
2. Develop learning skills; have a positive and resilient attitude, work both independently and collaboratively, be reflective and evaluate work		Present in BHSC MAT – usually articulated in competencies that are cross-cutting for all areas of knowledge.
3. Use inquiry-based approaches		Investigation and its related skills are present in BHSC MAT.
4. Understand the concepts, principles and nature of mathematics and apply concepts and procedures to a range of contexts		BHSC MAT expects students to understand and apply mathematical concepts and procedures to a diverse range of contexts.
5. Make links and generalisations		Making connections to other areas of knowledge is particularly present in the BHSC MAT.
6. Develop critical/creative thinking skills e.g. problem-solving and reasoning		Present in BHSC MAT – problem-solving and reasoning is featured. Creativity and innovation skills are particularly highlighted for formative itineraries.
7. Communicate mathematics clearly and in various forms		Present in BHSC MAT – for example, accurately using a range of representations is expected.
8. Know how technology and mathematics influence each other and use technology to develop ideas and solve problems		Use of technology is expected during investigations and problem-solving in BHSC MAT.

Key:

	This theme is well-evidenced in the learning outcomes of BHSC MAT		*This theme is partially evidenced in the learning outcomes of BHSC MAT*		*This theme is not evident in the learning outcomes of BHSC MAT*

Presence of the DP's Learning Outcome Themes

There is a strong alignment between the DP's mathematics learning outcomes and the learning outcomes articulated for BHSC Mathematics and Technology (MAT), with all the DP's themes being well-evidenced in the specific competencies and specific skills, and further evidenced in the additional skills for the formative itinerary (FI). The presence of each DP theme is discussed in more detail below.

1. Be aware of, and engage with, mathematics in its wider context

The DP's theme of awareness and engagement with wider contexts is well evidenced in BHSC MAT. Indeed, the BHSC promotes the importance of students engaging with contexts that are relevant and meaningful to their lives, such as socioeconomic situations, sustainability, contemporary world challenges, and community issues. This particularly echoes the DP's aim for its students to apply mathematics skills to local and global developments. Furthermore,

students are expected to engage critically with media and make ethical and socially responsible decisions when investigating world challenges, which has similarities with the DP's aim of developing an awareness of moral, social and ethical questions that have arisen regarding mathematics. Lastly, in line with the DP, the BHSC indicates a consideration of multicultural perspectives as it states that "reflection should also be considered about the different roles that mathematics education can play in socio-political and cultural contexts."[80]

The FI skills further demonstrate this theme, as students are expected to research information regarding how mathematics has contributed to explaining scientific, social, professional, and cultural phenomena. During this, students should consider different points of view, which aligns with the DP's international outlook. Furthermore, several FI skills are dedicated to diverse sociocultural and environmental issues, including identifying and explaining these and proposing and testing mediation/intervention actions and strategies. Overall, Brazilian high school students are similarly expected to engage with mathematics in wider contexts.

2. Develop learning skills; having a positive and resilient attitude, working both independently and collaboratively, being reflective and evaluating work

The DP theme of transferable learning skills is well evidenced in BHSC MAT; however, it can be noted that the learning outcomes relevant to this theme are primarily located in the general competencies for high school, rather than in the specific competencies for MAT. That said, an introduction written in the BHSC for MAT confirms that transferable learning skills are expected to be developed within the area of knowledge. Indeed, self-esteem, perseverance in problem-solving, respectfulness of others, and a pre-deposition to work in groups are identified as attitudes to be developed in mathematics.

The FI skills similarly do not articulate transferable learning skills for MAT specifically, instead these are included in skills which are cross-cutting for all areas of knowledge. These skills include being persistent, working well with others, and reflecting on personal development.

3. Use inquiry-based approaches

The DP theme of using inquiry-based approaches is well-evidenced in the learning outcomes of BHSC MAT. Both the DP and BHSC outline expectations that students will investigate real-life scenarios and analyse information to draw conclusions. Furthermore, both expect students to make and investigate conjectures and to assess the validity of these.

In the FI skills there is further evidence of the use of inquiry-based approaches. Indeed, one of the four structural axes of formative itineraries is scientific research, which in MAT corresponds to students being expected to make hypotheses, propose solutions, and test solutions and strategies - including ethical, creative, and innovative solutions, and mediation and intervention strategies to solve multicultural and environmental problems.

4. Understand the concepts, principles and nature of mathematics and apply concepts and procedures to a range of contexts

The DP theme of understanding and applying mathematics is well-evidenced in MAT. As outlined in the BHSC's specific competencies, students are expected to use mathematical

[80] Brazil, Ministry of Education. (2018). *5.2.1. The area of Mathematics and Technology: Specific competencies and skills.* BNCC.

strategies, concepts, and procedures to interpret, build models, and solve problems in a range of contexts.

This theme is also evidenced in the FI skills, as students are expected to apply mathematical knowledge and skills to sociocultural and environmental issues and to create new knowledge and approaches. This implies that students choosing a formative itinerary in MAT will need to have a deep understanding of mathematical concepts and a strong competency in applying these.

5. Make links and generalisations

The DP's theme of making links and generalisations is evidenced in BHSC MAT. Like in the DP, the BHSC includes an expectation that links will be made to other areas of knowledge, such as Natural Sciences and Humanities, and that students are able to apply mathematics in these areas. Moreover, the BHSC indicates an expectation of making connections between mathematical concepts, such as when making judgements. Making generalisations is also present, as one specific competency includes students observing patterns, and several skills linked to the same competency refer to making conjectures for generalisation.

By design, the formative itineraries can provide opportunities for making links between subjects, as they allow students to pursue studies which integrate more than one area of knowledge. Furthermore, the FI skills include considering possibilities for generalisation when using models and developing new knowledge and approaches.

6. Develop critical/creative thinking skills e.g. problem-solving and reasoning

Similarly to the DP, developing critical and creative thinking skills is a strong focus in BHSC MAT. Indeed, critical and creative thinking skills are clearly shown through expectations for students to critically interpret real-world information, perform analysis, solve problems, evaluate the plausibility of results, make decisions, and build an argument. Notably, in the specific skills, the BHSC often requires students to 'solve and elaborate problems',[81] with the intention that students reflect and question what would happen if a part of the problem was changed.

This theme is also represented in the FI skills. Indeed, students are expected to continue to analyse, evaluate, and make decisions. Moreover, creative thinking, as one of the structuring axes of all formative itineraries, is particularly emphasised, with students expected to use this skill to come up with innovative solutions to real problems.

7. Communicate mathematics clearly and in various forms

Communicating mathematics is a skill to be developed in both DP mathematics and BHSC MAT. Indeed, the BHSC requires students to use different mathematical representations flexibly and accurately in the communication of results to problems. Furthermore, although not highly emphasised in the specific competencies, the introduction to MAT highlights communication as a key competence, stating that students should be able to provide mathematical arguments with correct language and notation, as well as to communicate in reports and oral presentation. Therefore, like the DP, students are expected to communicate in various forms.

[81] Ibid.

Similarly, the FI skills require students to communicate accurately when presenting their actions and reflections regarding findings, interpretations, and arguments.

8. Know how technology and mathematics influence each other and use technology to develop ideas and solve problems

As the name suggests, technology is an important part of BHSC MAT. The BHSC outlines that students are expected to be aware of the implications of technology, including its issues, as well as using it as an alternative method to solve problems, make models, and explore concepts. Indeed, several skills require the use of digital technology.

This theme is also present in the FI skills, as students are required to conduct research into how mathematics has contributed to technology, which aligns strongly with the DP expectation that students should be aware of how mathematics and technology influence one another.

Other Themes in BHSC MAT Learning Outcomes

Most of the themes and skills described for BHSC MAT are in the DP; however, it can be noted that there are a few FI skills which have a greater emphasis. Indeed, the FI skills have a greater focus on proposing mediation and intervention strategies to sociocultural and economic problems than the DP. There is also a greater emphasis on proposing innovative solutions and generating new knowledge and approaches, which reflects the structural axis of entrepreneurship that the formative itineraries are based on.

Summary

Overall, there is a high level of alignment between DP mathematics and BHSC Mathematics and Technology (MAT) with regards to learning outcomes. In particular, the mathematics learning outcomes for BHSC MAT have strong similarities to DP mathematics with regards to considering and using mathematics in wider contexts, such as global challenges, which reflects the international outlook of the DP's mathematics curriculum. Furthermore, both encourage inquiry-based approaches by expecting students to investigate conjectures, analyse information, and draw conclusions. Critical and creative thinking skills are also a key emphasis in both curricula, as well as the use of technology, effective and accurate communication, making connections and generalisations, and understanding and application of mathematical concepts and procedures. Though broadly they share very similar learning outcome themes, it can be noted that the FI skills have a greater focus on involving entrepreneurship and proposing mediation and intervention strategies than DP mathematics.

5.1.2 Content – Mathematics

This section compares the content of DP mathematics subjects with BHSC MAT. For the content analysis of BHSC MAT, several sources have been used. For BHSC MAT (BGE), the BNCC's specific competencies and skills have been used, as well as the Rio de Janeiro Referential Curriculum (RJRC) for mathematics. For BHSC MAT (FI), the RJRC's specialisation pathways for MAT formative itineraries have been used. To support the visual comparison at-a-glance, the mathematics content from the DP, BNCC, and the RJRC are presented in the following diagrams.

Figure 9: DP mathematics: analysis and approaches content visualiser

	Standard level topics	Additional higher level topics
Topic 1 Number and algebra	1.1 Standard form; 1.2 Arithmetic sequences and series; 1.3 Geometric sequences and series; 1.4 Financial applications and geometric sequences and series; 1.5 Integer exponents and intro to logarithms; 1.6 Simple proof; 1.7 Rational exponents and laws of logarithms; 1.8 Sum of infinite convergent geometric sequences; 1.9 Binomial theorem (natural number)	1.10 Counting principles and extended binomial theorem; 1.11 Partial fractions; 1.12 Complex numbers intro; 1.13 Polar and Euler form; 1.14 Complex roots, De Moivre's theorem and powers/roots of complex numbers; 1.15 Proof by counter example, contradiction, and induction; 1.16 Solutions of systems of linear equations
Topic 2 Functions	2.1 Gradients and equations of straight lines; 2.2 Intro to functions; 2.3 Graphing functions; 2.4 Key features of graphs; 2.5 Composite, identity, and inverse functions; 2.6 Quadratic functions; 2.7 Solving quadratic equations and inequalities & the discriminant; 2.8 Reciprocal and rational functions; 2.9 Exponential and logarithmic functions; 2.10 Graphical and analytical solutions; 2.11 Transformations	2.12 Polynomial functions; 2.13 Harder rational functions; 2.14 Odd, even, and inverse functions; 2.15 Graphical and analytical solutions of inequalities; 2.16 Further graphs, including modulus and solutions
Topic 3 Geometry and trigonometry	3.1 Geometry recap; 3.2 Trigonometry recap; 3.3 Applications and diagrams; 3.4 Circles and radians; 3.5 Definitions, exact values, and sine rule for ambiguous case; 3.6 Identities and relationships; 3.7 Functions and transformations of sin, cos, and tan; 3.8 Solving trigonometric equations graphically and analytically	3.9 Reciprocal trigonometric ratios, identities, and inverse functions; 3.10 Compound angle identities and double angle for tan; 3.11 Symmetry properties; 3.12 Intro to vectors; 3.13 Scalar product and application; 3.14 Vector equation of a line and application; 3.15 Coincident, parallel, skew, and intersecting lines; 3.16 Cross product of vectors; 3.17 Planes; 3.18 Intersections and angles (planes)
Topic 4 Statistics and probability	4.1 Sampling; 4.2 Presenting data (tables, histograms, cumulative freq.); 4.3 Measures of central tendency and dispersion; 4.4 Correlation and regression line; 4.5 Intro to probability; 4.6 Diagrams, conditional probability, combined or independent events; 4.7 Discrete random variables; 4.8 Binomial distribution; 4.9 Normal distribution; 4.10 Equation of regression line of x on y; 4.11 Formulae for conditional probabilities and independent events; 4.12 Standardisation of normal variables (z-values)	4.13 Bayes' theorem; 4.14 Continuous random variables
Topic 5 Calculus	5.1 Intro to limits and derivatives; 5.2 Increasing and decreasing functions; 5.3 Derivative of $f(x)=ax^n$; 5.4 Tangents and normal; 5.5 Definite integrals; 5.6 More derivatives and use of product, chain, and quotient rules; 5.7 The second derivative; 5.8 Maximum, minimum and inflection points, and optimization; 5.9 Kinematic problems; 5.10 Indefinite integrals and integration by inspection and substitution; 5.11 Definite integrals and area under and between curves	5.12 Continuity, differentiability, limits, and higher derivatives; 5.13 Evaluation of limits and L'hopitals rule; 5.14 Implicit differentiation; 5.15 Further derivatives and indefinite integrals; 5.16 Integration by substitution and by parts; 5.17 Volumes of revolution; 5.18 First order differential equations; 5.19 Maclaurin series
The toolkit and mathematical exploration	The exploration is a piece of written work that involves investigating an area of mathematics.	

Figure 10: DP mathematics: applications and interpretation content visualiser

	Standard level topics	Additional higher level topics
Topic 1 Number and algebra	1.1 Standard form; 1.2 Arithmetic sequences and series; 1.3 Geometric sequences and series; 1.4 Financial applications of geometric sequences and series; 1.5 Integer exponents and intro to logarithms; 1.6 Approximation, estimation, bounds and errors; 1.7 Amortization and annuities using technology; 1.8 Using technology to solve systems of equations and polynomials	1.9 Laws of logarithms; 1.10 Rational exponents; 1.11 The sum of infinite geometric sequences; 1.12 Complex numbers; 1.13 Euler and Polar form; 1.14 Matrices; 1.15 Eigenvalues and eigenvectors
Topic 2 Functions	2.1 Gradients and equations of straight lines; 2.2 Intro to functions; 2.3 Graphing functions; 2.4 Key features of graphs; 2.5 Modelling with functions; 2.6 Modelling skills	2.7 Composite and inverse functions; 2.8 Transformations; 2.9 Modelling further functions; 2.10 Using logarithms to scale numbers and linearize data
Topic 3 Geometry and trigonometry	3.1 Geometry recap; 3.2 Trigonometry recap; 3.3 Applications and diagrams; 3.4 Circles, sectors, and arcs; 3.5 Equations of perpendicular bisectors; 3.6 Voronoi diagrams	3.7 Radians; 3.8 Sin, Cos, Tan definitions, and Pythagorean identity; 3.9 Matrix transformations; 3.10 Vectors introduction and notation; 3.11 Vector equation of a line; 3.12 Vector application to kinematics; 3.13 Scalar and cross product; 3.14 Graph theory and simple graphs, directed graphs, and subgraphs; 3.15 Adjacency matrices and weighted adjacency tables; 3.16 Decision math
Topic 4 Statistics and probability	4.1 Sampling; 4.2 Presenting data (tables, histograms, cumulative freq.); 4.3 Measures of central tendency and dispersion; 4.4 Correlation and regression line; 4.5 Intro to probability; 4.6 Diagrams, conditional probability, combined or independent events; 4.7 Discrete random variables; 4.8 Binomial distribution; 4.9 Normal distribution; 4.10 Spearman's rank; 4.11 Hypothesis testing, chi-squared and t-tests	4.12 Collecting and organising data and testing for reliability and validity; 4.13 Regression, residuals, coefficient of determination; 4.14 Linear transformations, linear combinations, unbiased estimations; 4.15 Central Limit theorem; 4.16 Confidence Intervals; 4.17 Poisson Distribution; 4.18 Further hypothesis testing; 4.19 Transition matrices and Markov chains
Topic 5 Calculus	5.1 Intro to limits and derivatives; 5.2 Increasing and decreasing functions; 5.3 Derivative of $f(x)=ax^n$; 5.4 Tangents and normal; 5.5 Definite integrals; 5.6 Maximum and minimum points; 5.7 Optimisation; 5.8 Area using trapezoidal rule	5.9 More derivatives and the chain, product, and quotient rule; 5.10 Second derivatives; 5.11 Finding further integrals and integration by inspection and substitution; 5.12 Area of a region and volumes of revolution; 5.13 Kinematic problems; 5.14 Differential equations; 5.15 Slope fields and their diagrams; 5.16 Euler's method and numerical solutions to differential equations and coupled systems; 5.17 Phase portraits; 5.18 Simple second order differential equations
The toolkit and mathematical exploration	The exploration is a piece of written work that involves investigating an area of mathematics.	

Figure 11: Visualiser of BHSC Mathematics and Technology. (Source – BNCC).

Mathematics and Technology		
Specific Competencies		
1. Use mathematical strategies, concepts, and procedures to interpret situations in different contexts, whether they are daily activities or facts of the Natural Sciences and Humanities, of socio-economic issues or disseminated by different means, in order to contribute to the general training.	2. Propose or participate in actions to investigate world challenges and make ethical and socially responsible decisions, based on the analysis of social problems, such as those related to sustainability, the implications of technology in the world of mobilizing and articulating concepts and procedures and languages specific to Mathematics.	3. Use mathematical strategies, concepts, definitions, and procedures to interpret, build models, and solve problems in various contexts, analysing the plausibility of the results and the adequacy of the proposed solutions, in order to build consistent argumentation.
Specific Skills*		
EM13MAT101 - EM13MAT106	EM13MAT201 - EM13MAT203	EM13MAT301 - EM13MAT316
Specific Competencies		
4. Understand and use, flexibly and accurately, different mathematical representations (algebraic, geometric, statistical, computational studies, etc.), in the search for solutions and communication of results.	5. Investigate and establish conjectures regarding different concepts and mathematical properties by employing strategies and resources such as; observing patterns, experiments and different technologies, and identifying the need, or not, for a validation of these conjectures.	
Specific Skills*		
EM13MAT401 - EM13MAT407	EM13MAT501 - EM13MAT511	

*See Appendix D for the Mathematics and Technology Specific Skills in full detail.

Figure 12: Visualiser of BHSC Mathematics and Technology (Source - RJRC)

Basic General Education	Formative Itinerary		
Mathematics (based on the BNCC and organised using the Specific Competencies and Skills)	Integrated Core	Specialisation Pathways	
	Life Project	Connected Mathematics	On Your Own
	Elective 1	Gamification	Fiscal Mathematics
	Elective 2	Robotics	Fiscal Mathematics
	Elective 3 (from Catalogue of Electives)	Logic	Financial Citizenship

Structure

For BHSC MAT (BGE), the BNCC outlines specific competencies and specific skills that all states are required to cover in their curricula. The specific skills are organised under the five specific competencies or are categorised into the topic areas of Number and Algebra, Geometry and Measurements, and Probability and Statistics. The DP also organises content into topic areas (Number and algebra, Functions, Geometry and trigonometry, Statistics and probability, and Calculus). It can be noted that the DP has Functions as a separate topic, while the BNCC includes functions-related content in Number and Algebra. Each state in Brazil can decide how to organise their mathematics curriculum, thus both the BHSC and DP allow for flexibility in how the curriculum is organised, without demanding a particular sequence of teaching.

Like with the option to do a HL course in DP mathematics subjects, there is opportunity for Brazil's high school students to study further mathematics (beyond what is compulsory in basic general education) through choosing to specialise in Mathematics and Technology in their formative itinerary – BHSC MAT (FI). Using Rio de Janeiro as an example (see figure 12), MAT formative itineraries are organised into specialisation pathways that contain curricular components. These curricular components are not as broad as DP topics. For example, one of the curricular components in Rio de Janeiro is Financial Citizenship, which is not covered by DP mathematics and has a narrower scope than DP topics, such as Number and algebra. Furthermore, MAT formative itineraries may not offer routes allowing for a choice of pure or applied mathematics focuses, unlike the DP's offering of AA and AI. Instead, MAT formative itineraries appear to strongly lean towards an applied thematic focus. However, it should be noted that formative itineraries, and overall curriculum structure, can vary from state to state in Brazil.

Content Alignment

This section will analyse the alignment of mathematics content in DP mathematics and BHSC MAT. The tables below present a simplified summary of the extent of content alignment that BHSC MAT (BGE) and BHSC MAT (FI) have at the topic level with DP mathematics.

Table 17: Summary of the content alignment BHSC MAT has with the main topics in DP AA.

DP AA topics		BHSC MAT (BGE)	BHSC MAT (FI)*
SL	1. Number and algebra		
	2. Functions		
	3. Geometry and trigonometry		
	4. Statistics and probability		
	5. Calculus		
AHL	1. Number and algebra		
	2. Functions		
	3. Geometry and trigonometry		
	4. Statistics and probability		
	5. Calculus		

Key:

	Strong presence of this topic in BHSC MAT		*Partial presence of this topic in BHSC MAT*		*Little or no presence of this topic in BHSC MAT*

***** Content alignments found for basic general education (BGE) are carried forwards and combined with, where applicable, new alignments identified in the formative itinerary (FI), to represent the cumulative content covered.

Table 18: Summary of the content alignment BHSC MAT has with the main topics in DP AI.

	DP AI topics	BHSC MAT (BGE)	BHSC MAT (FI)*
SL	1. Number and algebra		
	2. Functions		
	3. Geometry and trigonometry		
	4. Statistics and probability		
	5. Calculus		
AHL	1. Number and algebra		
	2. Functions		
	3. Geometry and trigonometry		
	4. Statistics and probability		
	5. Calculus		

Key:

	Strong presence of this topic in BHSC MAT		*Partial presence of this topic in BHSC MAT*		*Little or no presence of this topic in BHSC MAT*

***** Content alignments found for basic general education (BGE) are carried forwards and combined with, where applicable, new alignments identified in the formative itinerary (FI), to represent the cumulative content covered.

BHSC Mathematics and Technology (Basic General Education) – BHSC MAT (BGE)

The content of BHSC MAT (BGE) shows partial alignment with DP SL content in all main topics except Calculus (which is not an area of mathematics covered in the BHSC). Indeed, the skills cover, or indicate coverage of, several DP SL subtopics in Number and algebra, Functions, Geometry and trigonometry, and Statistics and probability. For the most part, these tend to be subtopics which are common to both DP mathematics subjects (AA and AI), though the strong application focus of the BHSC MAT (BGE) reflects similarities with the applied thematic focus of DP AI. The below discusses how BHSC MAT (BGE) aligns with SL content in each DP topic, distinguishing between DP AA and DP AI content where necessary.

Number and algebra

With regards to Number and algebra SL content, BHSC MAT (BGE) covers mostly subtopics which are common to DP AA and DP AI, such as standard form, arithmetic and geometric sequences, and financial applications. Coverage of exponential and logarithmic functions in BHSC MAT (BGE) indicates that some of the other subtopics in DP AA and DP AI regarding rational exponents and laws of logarithms may be covered, but it is not explicit. Other SL subtopics are not included, as neither are any of the AHL subtopics.

Functions

With regards to Functions SL content, BHSC MAT (BGE) skills cover the concepts of domain and range, graphing of functions, and key features of graphs. The types of functions included are linear, quadratic, exponential and logarithmic. Like DP AI, BHSC MAT (BGE) expects modelling with linear and quadratic functions, and indicates that similar modelling skills are covered, though modelling with other functions listed in DP AI SL (or AHL) is not explicitly included. From DP AA SL, BHSC MAT (BGE) does not cover composite and inverse functions, quadratic inequalities, reciprocal and rational functions, transformations, and only indicates some coverage regarding graphical and analytical solutions. However, it can be noted that BHSC MAT (BGE) often references similar real-life contexts, links to other subjects, and uses of technology, that appear in the suggested ‘Connections’ parts of the DP AA and DP AI syllabuses for Functions.

Geometry and trigonometry

With regards to Geometry and trigonometry content, BHSC MAT (BGE) skills cover mostly subtopics shared between DP AA and DP AI, such as solving problems regarding volume, area, and trigonometry. Again, several real-life contexts are referenced in BHSC MAT (BGE) which are similar to those described in the DP's 'Connections' sections, such as mapmaking and design. BHSC MAT (BGE) skills include comparing phenomena with cosine and sine functions, which are covered in DP AA SL and appear in the 'Connections' suggested for modelling in DP AI Functions. However, BHSC MAT (BGE) does not indicate that sine and cosine functions are covered in as much depth as DP mathematics subjects. BHSC MAT (BGE) also does not indicate that it covers other SL content (such as radians, trigonometric identities, and Voronoi diagrams) or any AHL content.

Statistics and probability

With regards to Statistics and probability content, again BHSC MAT (BGE) skills cover mostly subtopics which are shared between DP AA and DP AI, such as sampling, presenting data, measures of central tendency and dispersion, and basic probability concepts. There is an indication that correlation is covered, as well as further probability concepts (such as tree diagrams). However, BHSC MAT (BGE) does not include other SL content such as linear regression, or binomial and normal distributions, nor any AHL content from DP AA or DP AI.

Other BHSC MAT (BGE) Content

As shown in the following table, BHSC MAT (BGE) does not include a significant amount of content which is not covered in DP mathematics. The only noteworthy difference is that BHSC MAT (BGE) includes some content on algorithms and programming, though this appears to be at an introductory, rather than in-depth, level.

*Table 19: BHSC MAT (BGE) content which is not covered in the DP**

Significant content not in AA (only)	Significant content not in AI (only)
N/A	• Counting principles
Significant content not in either DP mathematics subject	
• Algorithms and programming – two of the skills in BHSC MAT (BGE) relate to this area and include using flowcharts, algorithms, and concepts of programming languages • Conics	

* Significant content does not include topics which are typically studied *prior* to upper secondary.

Summary

Overall, BHSC MAT (BGE) partially aligns with DP SL content and covers a lesser depth and breadth of content. There is no alignment with AHL content, as would be expected from a common curriculum, thus BHSC MAT (BGE) has considerably less breadth and depth compared to DP HL mathematics. It can be noted that BHSC MAT (BGE) often includes similar contexts, interdisciplinary links, and uses of technology to those suggested in the 'Connections' sections of the DP subject guides, which reinforces the learning outcome findings that BHSC MAT places similar importance on these aspects.

BHSC Mathematics and Technologies (Formative Itinerary) – BHSC MAT (FI)

BHSC MAT (FI) represents the pathway of studying MAT in basic general education and then specialising in MAT in the formative itinerary. The Rio de Janeiro curriculum (RJRC) is consulted to provide examples of the types of content covered in BHSC MAT (FI).

Rio de Janeiro offers two specialised pathways for MAT formative itineraries, namely 'Connected Mathematics' and 'On your own'.[82] The 'Connected Mathematics' specialisation pathway offers the three curricular components of Gamification, Robotics, and Logic. The 'On Your Own' specialisation pathway offers the three curricular components of Fiscal Mathematics, Financial Mathematics, and Financial Citizenship.

These components further develop skills which are present in DP mathematics, such as problem-solving, reasoning, logical thinking, evaluation, inquiry-approaches, and use of technology skills. There is also a particular emphasis on decision-making and creating strategies, which is less specifically targeted in DP mathematics. However, the content of MAT formative itineraries in Rio de Janeiro does not align with DP mathematics.

*Table 20: BHSC MAT (FI) content which is not covered in DP mathematics**

Significant content not in AA (only)	Significant content not in AI (only)
N/A	N/A
Significant content not in either DP mathematics subject	
• Logic • Gamification • Robotics • Fiscal mathematics • Financial mathematics (some different coverage to the DP) • Financial citizenship	

*It should be noted that these topics have been drawn from the RJRC and therefore should be considered as examples only. In practice, the content of formative itineraries can vary state to state.

Summary

The examples from Rio de Janeiro indicate that BHSC MAT (FI) does not present a stronger alignment with DP mathematics than BHSC MAT (BGE), as no further SL subtopics or AHL subtopics could be identified. Instead, BHSC MAT (FI) includes a strong focus on application and covering areas that are not a focus of DP mathematics, such as robotics, gamification, logic, fiscal mathematics, and financial citizenship. By thematic focus, BHSC MAT (FI) is more akin to the application focus of DP AI, rather than DP AA. However, the areas of application are different, and a significant amount of DP AI content is not present. Generally, the documentation indicates that BHSC MAT (FI) incorporates more concepts from the area of application, rather than focusing on covering additional and more complex mathematical content.

Overall, it appears that BHSC MATH (FI) has significantly less depth in mathematics content compared to DP HL mathematics subjects. It is particularly notable that DP AHL content was not covered in BHSC MAT (FI). However, it can be noted that the extent of the complexity of mathematical concepts involved in the formative itinerary curricular components is somewhat difficult to confidently ascertain from the level of detail in the documentation.

It is challenging to directly compare the breadth and depth of BHSC MAT (FI) with DP SL mathematics, due to the significant differences in their content and approach. Students who study BHSC MAT (FI) will experience a breadth of mathematics content, focusing on

[82] Rio de Janeiro State Government, Department of Education. (2022). *Curricular Organisation of Formative Itineraries*.

applications, as well as some SL content from most DP topics. However, it can be noted that calculus – a main topic in DP mathematics – is not studied at all in BHSC MAT.

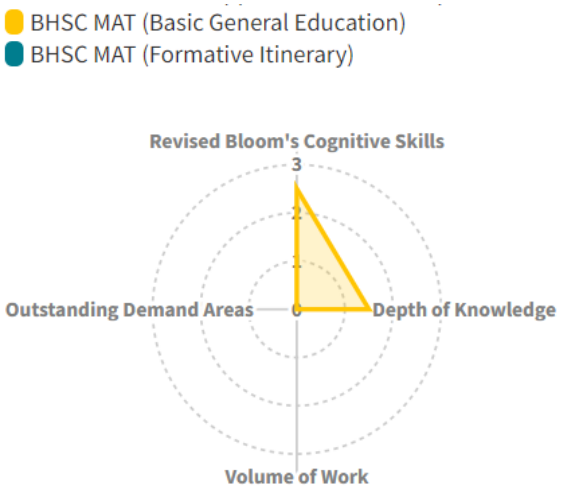
5.1.3 Demand – Mathematics

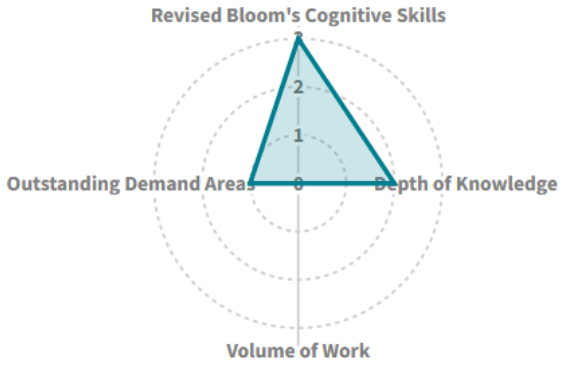
This section considers the alignment between DP mathematics and BHSC Mathematics and Technology in terms of demand.

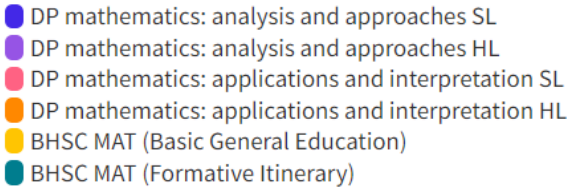
Using the same demand tool for the analysis of all subjects, a demand profile was created for DP AA (SL and HL), DP AI (SL and HL), BHSC MAT (BGE), and BHSC MAT (FI).

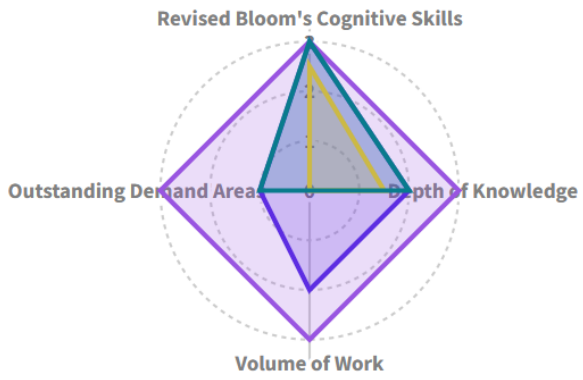
BHSC MAT (FI) represents the cumulative demand of studying mathematics in the basic general education and then specialising in MAT in the formative itinerary. These demand profiles are presented below in the form of radar diagrams, with a superimposed diagram featured to enable the immediate visual comparison of all profiles.

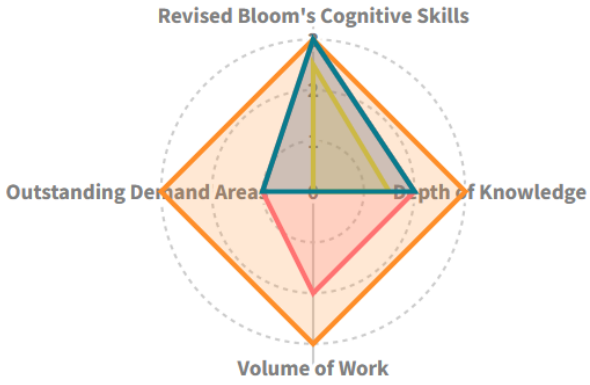
Figure 13: Visual representations of subject demand











The panel of experts carried out a detailed analysis of each course and reached a consensus on the scores shown in the profiles above. The following points were particularly important within the panel discussion:

- Regarding the scores for **Bloom's Cognitive Skills**:
  - The DP mathematics subject group learning outcomes apply to all subjects hence the scores are the same for AA (SL and HL) and AI (SL and HL). These outcomes were given a score of 3 on the basis that they strongly evidence the development of critical and creative thinking skills through their focus on reasoning, inquiry-based approaches, reflection, generalisation, unfamiliar contexts, and consideration of wider implications.
  - The learning outcomes of BHSC MAT (BGE) demonstrate that higher order thinking skills are encouraged throughout, evidenced by skills requiring critical analysis, elaboration of problems, and critical interpretation of economic and social situations. However, there was some doubt with regards to the extent these skills

would be realised considering the somewhat low demand of mathematics content covered, therefore a score of 2.5, rather than 3, was awarded. Building on the skills of BHSC MAT (BGE), there was further evidence of higher order skills for BHSC MAT (FI). Indeed, skills such as developing and evaluating models, proposing creative and innovative solutions, and testing strategies contributed to a score of 3 being given overall.

- Regarding the scores for **Depth of Knowledge**:
  - Both DP mathematics subjects at SL were given a score of 2. Both subjects were judged to cover the topics of 'Number and algebra', 'Functions', 'Geometry and trigonometry', 'Statistics and probability', and 'Calculus' in considerable detail, building in complexity and requiring a substantial amount of pre-requisite knowledge. At HL, both DP mathematics subjects were awarded a score of 3 for depth of knowledge. The subjects were judged to cover topics in a high level of detail, with many subtopics having high complexity and requiring a large amount of pre-requisite knowledge.
  - BHSC MAT (BGE) covers some upper-secondary level content in topics such as functions. However, in contrast to DP SL and HL, not many topics are covered in considerable detail and topics requiring strong pre-requisite knowledge, such as calculus, are not included. Alone, this would merit a score of 1. However, due to the skills that are to be combined with this content, a consensus among panellists was reached that students would be consistently engaging with the content beyond habitual responses and carrying out tasks which require higher cognitive demands, thus a score of 1.5 was awarded to acknowledge this. For BHSC MAT (FI), a score of 2 was deemed appropriate. Whilst it does not appear that this subject covers more complex and abstract mathematical concepts than BHSC MAT (BGE), the skills for formative itineraries suggest that further time would be spent on cognitively demanding tasks such as planning, creating, and extended thinking.

- Regarding the scores for **Volume of Work**:
  - Both DP mathematics subjects at SL were deemed to comprise a moderate-heavy volume of work and were given a score of 2. The panel concluded that the teaching time allotted to cover the different concepts was short (150 hours) but acknowledged that some subtopics contained basic concepts and recapped prior learning, hence 2 was deemed an appropriate score. For HL, both DP mathematics subjects were considered to have a heavy volume of work, due to the short amount of time allocated (240 hours) and the level of complexity of the content, which combined merited a score of 3.
  - For BHSC MAT (BGE), it was deemed that the number of hours allocated to cover its content (400 hours) was generous, given the light number of topics and concepts involved. Similarly, the time allocated for BHSC MAT (FI) was also deemed to be generous. Therefore, both profiles received a score of 0 in this category.[83]

[83] The teaching hours were drawn from the Rio de Janeiro curriculum and may be different to other states.

- Regarding the scores for **Outstanding Areas of Subject Demand**:
  - Both DP mathematics subjects at SL contained one area of outstanding demand, which was the ‘mathematical exploration’. This element of the SL subjects was considered to apply skills typically needed in higher education, such as extended writing and presentation of mathematical concepts, student-led exploration, and academic writing skills. Therefore, a score of 1 was awarded to both SL subjects for the inclusion of this element. In addition to this, both subjects at HL had further areas of outstanding demand. For mathematics: analysis and approaches, some of the identified outstanding areas of demand were proof by induction, complex numbers (De Moivre’s theorem), vectors (cross product, equations of planes and intersections), and Maclaurin series. For mathematics: applications and interpretation, some identified areas of outstanding demand were eigenvalues and eigenvectors, nonlinear regression, Markov chains, second order differential equations, slope fields, Euler’s method, and phase portraits. Overall, there was a high number of outstanding areas of demand and a score of 3 was awarded to both HL subjects.
  - For BHSC MAT (BGE), no areas which went beyond typical upper-secondary mathematics education could be identified, thus a score of 0 was awarded. For BHSC MAT (FI), a score of 1 was tentatively awarded, as the documentation suggested that time will be spent on developing projects, which could have scope for independent research and exploration (similar to the DP mathematical exploration). However, the level of detail on formative itineraries present challenges for assessing the demand of the tasks.

5.2 Sciences

Below is the list of subjects from the science subject area which are used in the comparison analysis of the DP and BHSC.

DP physics[84]
Physics is a subject option from the DP sciences subject group, offered at both SL and HL. This subject has content that is common to both SL and HL, as well as AHL content that is featured only in the HL. Thus, the HL has greater breadth and depth than SL. This subject is intended to prepare students for university courses such as engineering, physics, and others requiring a strong science background. HL is suitable for those intending to pursue further study in an area requiring a strong background in physics.

DP chemistry[85]
Chemistry is a subject option offered within the DP sciences subject group, at both SL and HL. This subject has content that is common to both SL and HL, as well as AHL content that is featured only in the HL. Thus, the HL has greater breadth and depth than SL. This subject is designed to prepare students for university courses such as medicine, biological science and environmental science. HL is suitable for those intending to pursue further study in an area requiring a strong background in chemistry.

DP biology[86]
Biology is a subject option within the DP sciences subject group, offered at both SL and HL. This subject has content that is common to both SL and HL, as well as AHL content for HL. Thus, HL has greater breadth and depth than SL. This subject is designed to prepare students for university courses such as biology, medicine, dentistry, and biomedical engineering. HL is suitable for those intending to pursue further study in an area requiring a strong background in biology.

BHSC Natural Sciences and Technology (Basic General Education) – BHSC NST (BGE)
In the BHSC, Natural Sciences and Technology (NST) is a compulsory area of knowledge for the basic general education (BGE) component of high school. NST encompasses multiple science disciplines (physics, chemistry and biology) and aims to build on the learning of elementary school, deepening students' knowledge in the themes of Matter and Energy, Life and Evolution, and Earth and Universe. Students are also expected to become more aware of the social, historical and cultural contextualization of science and technology; and of research process and practices**.** BHSC NST (BGE) is based upon the specific competencies and skills prescribed by the BNCC for NST.[87] To support the content analysis, the Rio de Janeiro

[84] International Baccalaureate. (2023). *Physics guide*.
[85] International Baccalaureate. (2023). *Chemistry guide*.
[86] International Baccalaureate. (2023). *Biology guide*.
[87] Brazil, Ministry of Education. (2018). *5.3.1. The area of Natural Sciences and their Technologies: Specific competencies and skills*. BNCC. Available from: National Common Curricular Base - Education is the Base (mec.gov.br)

Referential Curriculum (RJRC) was consulted to gain further insights into the physics, chemistry, and biology topics covered in BHSC NST (BGE). [88]

BHSC Natural Sciences and Technology (Formative Itinerary) – BHSC NST (FI)
In the BHSC, Natural Sciences and Technology is an area of knowledge that students may choose to specialise in for the formative itinerary (FI) component of high school. Formative itineraries are curricular units which are designed for students to deepen their knowledge and prepare for further studies or careers. BHSC NST (FI) is based upon the 'Curricular References for the Preparation of Formative Itineraries', which guide the development of this subject by each state.[89] Again, the RJRC is consulted to provide further insights into the type of content covered in BHSC NST (FI). [90]

5.2.1 Learning Outcomes – Sciences

This section compares and contrasts the learning outcomes of curricula falling within the category of science. The learning outcomes articulated by the DP and BHSC are the same for all sciences, therefore these are considered for the science subject area as a whole in this section.

The DP learning outcome themes for science were extracted from the aims and assessment objectives of the DP sciences subject group. BHSC Natural Science and Technology (NST) learning outcomes are presented as specific competencies and specific skills. For formative itineraries specifically, additional skills are given, which are based on the formative itinerary structuring axes. Moreover, the BHSC also articulates general competencies for high school education which have also been considered when relevant here.

The following summary table demonstrates the learning outcome themes that were extracted from DP sciences and indicates if and where they were judged to have presence within the learning outcomes of BHSC Natural Sciences and Technology (NST).

[88] Rio de Janeiro State Government, Department of Education. (2022). *Natural Sciences and Technology*. High School Referential Curriculum for the State of Rio de Janeiro. p. 81-91. Available from: 1- Revisão CURRÍCULO ENSINO MÉDIO.cdr (educacao.rj.gov.br)
[89] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*.
[90] Rio de Janeiro State Government, Department of Education. (2022). *Curricular Organisation of Formative Itineraries*. Available from: Trails (educacao.rj.gov.br).

Table 21: Presence of the DP sciences learning outcome themes in BHSC Natural Sciences and Technology (NST)

Themes extracted from the learning outcomes of the DP sciences subject group	Presence in BHSC Natural Sciences and Technology (NST)	
1. Develop conceptual understanding and make connections		Presence can be inferred from the specific competencies and skills for BHSC NST, though there is less evidence of conceptual understanding or to making connections between science subjects.
2. Use and apply the knowledge, methods, tools, and techniques that characterise science		Present in the specific competencies and skills for BHSC NST, particularly competency 3.
3. Use creative and critical thinking (problem-solving, analysis, evaluation, synthesis)		Present in the specific competencies and skills for BHSC NST, many of which include problem solving, analysis, evaluation and synthesis.
4. Develop skills for scientific inquiry		Scientific inquiry is present in the specific competencies and skills for BHSC NST, though there is limited mention of specific experiments.
5. Develop technological skills		The development of technological skills is implied in the specific competencies and skills for BHSC NST.
6. Collaborate and communicate effectively		Communication skills are present in the specific competencies and skills for BHSC NST, though there is less mention of collaborative skills.
7. Be aware of global and local problems and the environmental, ethical, cultural, and social impact of science		Well-evidenced in the specific competencies and skills for BHSC NST, particularly competence 1.

Key:

	This theme is well-evidenced in the learning outcomes of BHSC NST.		*This theme is partially evidenced in the learning outcomes of BHSC NST.*		*This theme is not evident in the learning outcomes of BHSC NST.*

Presence of the DP's Learning Outcome Themes

There is strong alignment between the learning outcomes of DP sciences and BHSC Natural Sciences and Technology (NST). Indeed, all DP learning outcomes themes for sciences are represented either completely or partially in the BHSC NST specific competencies and specific skills and are further evidenced in the additional skills for the formative itinerary (FI). The extent to which each DP theme is present in BHSC NST is discussed in more detail below.

1. Develop conceptual understanding and make connections

The ability to develop conceptual understanding and make connections is partially evidenced within BHSC NST. Indeed, the specific competencies include higher order skills such as analysis, synthesis and evaluation – all of which require strong conceptual understanding. With regards to making connections, there is evidence that this is expected between science subjects in BHSC NST. For instance, specific skill EM13CNT203 refers to evaluating and predicting the effects of interventions in an ecosystem on organisms, in respect to transformations of matter and energy.[91] This would require students to understand and relate

[91] Brazil, Ministry of Education. (2018). *5.3.1. Natural Sciences and Technology in High School: Specific competencies and skills.* BNCC.

knowledge within and between science subjects. The general competencies also include utilising knowledge from different areas, though this does not specifically refer to making connections between science subjects.

Furthermore, within the FI skills, conceptual understanding is also partially evident, as students are expected to identify and explain issues related to physical, chemical and/or biological phenomena. However, there are no explicit references to conceptual understanding, or to making connections between or within science subjects. In summary, as there are no explicit references to conceptual understanding or to making connections amongst science subjects, this DP theme is only partially present in BHSC NST.

2. Use and apply the knowledge, methods, tools, and techniques that characterise science

Using and applying the knowledge, methods, tools, and techniques that characterise science is evident across BHSC NST. The specific skills refer to using procedures and languages typical of natural sciences and of scientific investigation. It is likewise described that students should develop explanations, make predictions, interpret results, analyse models, theories and laws; and recognise the explanatory limits of science; which encompasses many elements of scientific study. This theme is further evidenced by specific skill EM13CNT301 which outlines how students will not only create hypotheses, use measuring instruments and generate data, but also justify the conclusions they reach from a scientific perspective.[92]

Moreover, multiple FI skills describe mobilising knowledge and resources related to Natural Sciences, which implies an application of scientific knowledge and methods. There is therefore strong evidence of this theme within BHSC NST.

3. Use creative and critical thinking (problem-solving, analysis, evaluation, synthesis)

The DP theme of creativity and critical thinking is evident within BHSC NST. For example, students are expected to propose appropriate solutions to identified problems, whilst considering local and global contexts. Moreover, students are expected to evaluate the applications of scientific knowledge, analyse natural phenomena, recognise the explanatory limits of science, and to build strategies for selecting reliable sources of information such that they can evaluate and justify conclusions.

Additionally, within the FI skills, students are expected to utilise creative resources related to Natural Sciences to solve real environmental and societal problems, exploring and contrasting different sources of information. As such, there is evidence that problem solving, analysis, evaluation and synthesis are present in BHSC NST. However, it can be noted that the DP places more emphasis on evaluation, particularly on the evaluation of experimental procedures.

4. Develop skills of scientific inquiry

The DP theme of applying skills to conduct insightful investigations is present within BHSC NST. As described previously, BHSC NST refers to using procedures and languages typical of Natural Sciences, and of scientific investigation. Students are expected to investigate issues, and more specifically students should be able to: come up with questions, hypotheses, predictions and estimates; use measuring instruments; represent and interpret models, data

[92] Ibid.

and experimental results; as well as to evaluate and justify conclusions.[93] Ethical considerations are also referred to in general, and it can be inferred that this would be applied to conducting investigations.

Furthermore, the FI skills include taking part in a project involving the formulation of concrete proposals, which is suggestive of planning and organising an investigation. There are no specific references to experimental procedure, but it is implied that students will be able to carry out investigations.

There is therefore overall strong evidence of scientific investigation in BHSC NST. However, the DP science curriculum includes a greater amount of detail with regards to the specific experiments and procedures that students should be aware of, which is not the case for the BHSC NST.

5. Develop technological skills

There is clear evidence that the DP theme of developing technological skills is present in BHSC NST. It is described that students should be able to use and communicate through different technologies and evaluate their applications. Moreover, BHSC NST refers to students using digital devices in many different contexts and areas of science. In addition, the FI skills include multiple skills that require students to consider available technologies when proposing solutions to real problems. As such, it is clear that students are required to develop technology skills in a scientific context in BHSC NST.

6. Collaborate and communicate effectively

The DP's theme of effective communication is evident in BHSC NST, as students are expected to communicate to varied audiences and in different contexts. Multiple specific competencies also refer to participating in debate, from which communication skills such as expressing arguments or ideas can be inferred. Moreover, interpreting information from varied sources, distinguishing between different points of view, as well as expressing conclusions are included – all of which relate to effective communication.

There is less evidence of collaborative skills in BHSC NST. However, general competencies for high school education in the BHSC refer to exercising cooperation and respect for others, which is suggestive of collaboration. Moreover, as mentioned previously, the FI skills refer to students taking part in a project, which would potentially involve elements of individual or group work. Overall, as collaboration does not seem to be an explicit focus, this theme is partially evidenced in BHSC NST.

7. Be aware of global and local problems and the environmental, ethical, cultural, and social impact of science

The DP's theme regarding awareness of global and local problems and the environmental, ethical, cultural, and social impact of science is evident in BHSC NST. Indeed, BHSC NST expects students to demonstrate an awareness of prominent issues within science as they participate in and/or promote debates in topics of scientific relevance. Awareness of identified problems among the more local context of Brazilian society is likewise shown, as well as

[93] Brazil, Ministry of Education. (2018). *5.3.1. Natural Sciences and Technology in High School: Specific competencies and skills.* BNCC.

knowledge of the contemporary experiences and challenges of young people. Furthermore, there are multiple references made to the social, cultural, and environmental impacts of science. There are fewer references to the ethical impact of science, though students must debate using ethical and responsible arguments, as well as discuss the misuse of knowledge from Natural Sciences.

Moreover, the FI skills describe that students demonstrate their ability to identify and explain sociocultural and environmental issues and to solve real environmental and societal problems which, although not specified, is suggestive of an awareness of issues that are present in either the local or global context. Students must also evaluate how knowledge and resources related to natural science can be used and the socioenvironmental impacts of this. Overall, there is therefore strong evidence of the DP theme in BHSC NST.

Other Themes in BHSC NST Learning Outcomes

Most of the themes and skills described BHSC NST are in the DP; however, it can be noted that there are few aspects that are highlighted more specifically.

Indeed, the BHSC learning outcomes specifically highlight that students will learn the historic contextualisation of scientific discoveries and discuss models, theories and laws proposed in different times. The DP learning outcomes do not specifically identify historical context of scientific discoveries; however teachers may explore these with students during the course. In addition, the BHSC NST learning outcomes specifically highlight that students should learn about the *misuse* of knowledge regarding natural science in different social and historical contexts. While misuse of knowledge is not specifically mentioned in the DP learning outcomes, considering the impact of scientific knowledge is a key theme and this will likely include exploring negative impacts and unethical practices.

Furthermore, BHSC NST learning outcomes include a larger emphasis on the engagement with scientific literature than the DP sciences learning outcomes. For example, the specific skill EM13CNT303 and the FI skill EMIFCNT03 each state that students should interpret scientific texts.[94] The latter specifies that students should be able to select information from scientific texts such as studies and/or research (bibliographic, exploratory, field, experimental, etc.). The DP does refer to the ability to analyse, evaluate and synthesize scientific information and claims, but does not make specific reference to engaging with scientific texts. The extended essay (EE) in the DP core would provide opportunity for a similar engagement with literature as part of the high-level research. Although EE may be focused on subjects other than science. Likewise, scientific texts may be reviewed as part of the DP's internally assessed science investigation. Therefore, there is scope for students to engage with scientific literature in the DP curriculum, but there is less emphasis specifically on literature within the learning outcomes for science.

Summary

Overall, there is strong alignment between DP sciences and BHSC NST with regards to learning outcomes. The DP learning outcome themes of applying the elements that characterise science, using creativity and critical thinking, developing technological skills, and being aware of the issues and impacts of science, are all evident in BHSC NST. However,

[94] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. p. 11.

there is less emphasis on making connections between and within science subjects and collaboration in BHSC NST than the DP. Moreover, although scientific investigation is present in BHSC NST, there is less detail regarding the specific experiments and experimental skills compared to the DP.

5.2.2 Content – Physics

This section compares and contrasts the physics content of DP physics and BHSC NST. For the content analysis of BHSC NST, several sources have been used. For BHSC NST (BGE), the BNCC's specific competencies and specific skills for NST have been used, as well as the Rio de Janeiro Referential Curriculum (RJRC) for physics in basic general education. For the analysis of BHSC NST (FI), Rio de Janeiro's specialisation pathways for Natural Sciences and Technology formative itineraries have been used.

In order to support visual comparison at-a-glance, the physics content from DP, BNCC and the RJRC are presented in the following diagrams.

Figure 14: DP physics content visualiser[95]

A. Space, time and motion	A.1 Kinematics	A.2 Forces and momentum	A.3 Work, energy and power	A.4 Rigid body mechanics (HL only)	A.5 Galilean and special relativity (HL only)
B. The particulate nature of matter	B.1 Thermal energy transfers	B.2 Greenhouse effect	B.3 Gas laws	B.4 Thermodynamics (HL only)	B.5 Current and circuits
C. Wave behaviour	C.1 Simple harmonic motion (SL + AHL)	C.2 Wave model	C.3 Wave phenomena (SL + AHL)	C.4 Standing waves and resonance	C.5 Doppler effect (SL + AHL)
D. Fields	D.1 Gravitational fields	D.2 Electric and magnetic fields	D.3 Motion in electromagnetic fields	D.4 Induction (HL only)	
E. Nuclear and quantum physics	E.1 Structure of the atom (SL + AHL)	E.2 Quantum physics (HL only)	E.3 Radioactive decay (SL + AHL)	E.4 Fission	E.5 Fusion and stars
Experimental programme	Practical work	Collaborative sciences project	Scientific investigation		

[95] '(HL only)' and '(SL + AHL)' are used to flag, respectively, topics only taught at HL and topics taught at both SL and HL, but which also feature additional higher level content.

Figure 15: Visualiser of BHSC Natural Sciences and Technology. (Source - BNCC).

Natural Sciences and Technology		
Specific Competencies		
1. Analyse natural phenomena and technological processes, based on the interactions and relationships between matter and energy, to propose individual actions and collective actions that improve production processes, minimize impacts on and improve living conditions at the local level, regional and global.	2. Analyse and use interpretations of the dynamics of Life, the Earth and the Cosmos to elaborate arguments, make predictions about the functioning and the evolution of living beings and the Universe, and to ground and defend ethical and responsible decisions.	3. Investigate problem situations and evaluate applications of scientific knowledge and its implications in the world, using procedures and languages of the Natural Sciences, in order to propose solutions that consider local, regional and/or global demands, and communicate their findings and conclusions to a variety of audiences, in a variety of contexts and through different media and digital information technologies and communication (TDIC).
Specific Skills*		
EM13CNT101 - EM13CNT107	EM13CNT201 - EM13CNT209	EM13CNT301 - EM13CNT310

* See Appendix D for the Natural Sciences and Technology Specific Skills in full detail.

Figure 16: Visualiser of BHSC Natural Sciences and Technology. (Source - RJRC).

Basic General Education	Formative Itinerary		
Physics (based on the BNCC and organised using the Specific Competencies and Skills)	**Integrated Core**	**Specialisation Pathways for Natural Sciences and Technology**	
	Life Project	**Energy Solutions**	**Natural Resources**
	Elective 1	Energy and its transformations	Consumption, multiple uses and management
	Elective 2	Energy, environmental impacts, and sustainability	Diversified sustainable practices
	Elective 3 (chosen from Catalogues, such as the Catalogue of Electives for Natural Sciences and Technology)	Energy: Problematisation and awareness raising	Natural resources and sustainable development

Structure

Science in the DP is structured such that physics, chemistry and biology are separate subjects, each with their own distinct content. In contrast, the BHSC combines physics, chemistry, and biology into Natural Sciences and Technology (NST). Where DP students choose one science subject to study at either SL or HL, high school students in Brazil study all sciences as part of NST in basic general education (BGE), and then can choose to specialise in NST in their formative itinerary (FI). As such, unlike the offering of DP physics HL, the BHSC does not offer an option to specialise in physics specifically. Moreover, DP science subjects are studied over the two-year programme, whereas science subjects may be taught in any or all years of high school in Brazil.

Within DP physics, content is organised into five topic areas, namely A. Space, time and motion, B. The particulate nature of matter, C. Wave behaviour, D. Fields, and E. Nuclear and quantum physics – each of which are divided into subtopics.

In contrast, BHSC NST (BGE) content is not organised using physics topics. Indeed, the BNCC articulates specific competencies and skills for NST that are an integration of skills and physics, chemistry, and biology content. Each state in Brazil can decide how to organise their curriculum to ensure that the NST specific competencies and skills are taught in basic general education. For example, the Rio de Janeiro's Referential Curriculum (RJRC) organises basic general education into distinct subjects, with physics being one of these. The RJRC organises its physics content using the NST specific competencies and specific skills and adds topics that should be linked with these.

Content for BHSC NST (FI) is developed by each Brazilian state and combines physics, chemistry, and biology content. As an example, the RJRC organises NST formative itinerary content into two specialisation pathways, namely 'Natural Resources' and 'Energy Solutions', each of which is made up of three curricular components (see figure 16).[96]

Content Alignment

This section will analyse the alignment of physics content in DP physics and BHSC NST. The following tables present a simplified summary of the extent of content alignment that BHSC NST (BGE) and BHSC NST (FI) have at the topic level with DP physics.

[96] Rio de Janeiro State Government, Department of Education. (2022). *Curricular Organisation of Formative Itineraries*.

Table 22: Summary of the content alignment that BHSC NST has with the main topics in DP physics.

DP physics topics	BHSC NST (BGE)		BHSC NST (FI)*	
	SL presence	AHL presence	SL presence	AHL presence
A. Space, time and motion				
A.1 Kinematics		N/A		N/A
A.2 Forces and momentum		N/A		N/A
A.3 Work, energy and power		N/A	**	N/A
A.4 Rigid body mechanics	N/A		N/A	
A.5 Galilean and special relativity	N/A		N/A	
B. The particulate nature of matter				
B.1 Thermal energy transfers		N/A	**	N/A
B.2 Greenhouse effect		N/A	**	N/A
B.3 Gas laws		N/A		N/A
B.4 Thermodynamics	N/A		N/A	**
B.5 Current and circuits		N/A		N/A
C. Wave behaviour				
C.1 Simple harmonic motion				
C.2 Wave model		N/A		N/A
C.3 Wave phenomena				
C.4 Standing waves and resonance		N/A		N/A
C.5 Doppler effect				
D. Fields				
D.1 Gravitational fields				
D.2 Electric and magnetic fields				
D.3 Motion in electromagnetic fields		N/A		N/A
D.4 Induction	N/A		N/A	
E. Nuclear and quantum physics				
E.1 Structure of the atom				
E.2 Quantum physics	N/A		N/A	
E.3 Radioactive decay				
E.4 Fission		N/A		N/A
E.5 Fusion and stars		N/A		N/A
Experimental programme				

Key:

	Strong presence of this topic in BHSC NST		*Partial presence of this topic in BHSC NST, or the extent of presence is unclear*		*Little or no presence of this topic in BHSC NST*

***** Content alignments found for basic general education (BGE) are carried forwards and combined with, where applicable, new alignments identified in the formative itinerary (FI), to represent the cumulative content covered.
** The documentation indicates that the formative itinerary includes some similar content from this DP topic.

BHSC Natural Sciences and Technology (Basic General Education) - BHSC NST (BGE)

The documentation indicates that BHSC NST (BGE) covers some content from most DP physics SL topics. The only DP SL topics which do not appear to be covered in at least some part by BHSC NST (BGE) are from C. Wave Behaviour. Specifically, these are C.1 Simple Harmonic Motion, C.4 Standing waves and resonance, and C.5 Doppler effect.

There is generally little to no presence of DP AHL content in BHSC NST (BGE). However, the documentation suggests that some subtopics from B.4 Thermodynamic and D.4 Induction are present.

It should be noted that, where partial presence has been concluded, this is often based on an assumption that the broadly-described topics for BHSC NST (BGE) can be expected to contain similar content. Thus, the actual degree of alignment may differ to what a judgement of 'partial presence' or 'partial alignment' suggests. The below discusses the presence of each DP topic in BHSC NST (BGE) in more detail.

A. Space, time and motion

Some coverage of A.1 Kinematics content in BHSC NST (BGE) is likely based on skills which involve explanations, predictions, and calculations regarding movements of objects, as well as the analysis and representation of transformations in systems concerning motion.[97] These skills, along with references to Newtonian mechanics, the principles of conservation of energy, and the quantity of motion, indicate coverage of SL content from A.2 Forces and momentum and A.3 Work, energy and power. This is further reinforced by additional references to energy conservation, mechanical work, power, and performance of a system.[98] Overall, it is concluded that there is a partial presence of DP SL content in these topics in BHSC NST (BGE).

There is little evidence to suggest that BHSC NST (BGE) contains similar content to topics A.4 Rigid Body Mechanics and A.5 Galilean and special relativity. There is therefore no presence of AHL content from A. Space, time and motion in BHSC NST (BGE).

B. The particulate nature of matter

Similar content to B.1 Thermal energy transfers may be covered in BHSC NST (BGE), as thermodynamics are studied and involves the understandings of thermal systems and of thermodynamic variables.[99] References to specific concepts such as sensible and latent heat and the emission spectrum, among others, further supports that BHSC NST (BGE) may cover similar concepts to this DP SL topic.[100] In addition, coverage of content from B.2 Greenhouse effect is indicated by the study of the ozone layer and greenhouse effect in BHSC NST (BGE). Moreover, the documentation refers to concepts such as the work of a gas and the kinetic energy of gases, which suggests BHSC NST (BGE) may cover some similar content to B.3 Gas laws.[101] Similarly, coverage of electrical components and conduction in BHSC NST (BGE) is indicated, as well as more specific concepts such as resistors and potential difference.[102] Therefore, some coverage of B.4 Currents and circuits content can be inferred. As such, it is concluded that BHSC NST (BGE) has partial alignment with the DP SL topics in B. The particulate nature of matter.

The same skills and content that indicate that B.1 Thermal energy transfers is present in BHSC NST (BGE) may also indicate that some similar content to the AHL topic of B.4 Thermodynamics is included. Indeed, this is suggested by the references to the first and

[97] Specific skills EM13CNT204 and EM13CNT101 from the BNCC.
[98] These topics have been drawn from the RJRC.
[99] Specific skill EM13CNT102 from the BNCC.
[100] These topics have been drawn from the RJRC.
[101] Ibid.
[102] Ibid.

second law of thermodynamics, as well as understandings around the efficiency of different engines. However, a significant number of the specific concepts covered in B.4 Thermodynamics are not referenced, therefore it's concluded that there is only partial alignment with this DP AHL topic.

C. Wave Behaviour

The electromagnetic spectrum and acoustic conductors are included within BHSC NST (BGE). In addition, the documentation further includes an introduction to wave physics and references to sound and electromagnetic waves, which may indicate that some content relating to wave behaviour is covered – resulting in partial alignment with SL content in C.2 Wave model. Also, the topic of wave phenomena in BHSC NST (BGE) indicates coverage of some SL content from C.3 Wave phenomena. However, very few of the other SL concepts in the remaining subtopics of C. Wave behaviour are included in BHSC NST (BGE).

There is little indicative content to suggest that BHSC NST (BGE) covers any AHL (or SL) content from C.1 Simple harmonic motion, C.4 Standing waves and resonance, or C.5 Doppler effect. Moreover, whilst similarities to SL content in C.2 Wave phenomena have been inferred, this inference is not extended to the AHL content in this topic. Indeed, the AHL content is more advanced and without direct reference to specific content, such as interference or diffraction, a conclusion of partial alignment cannot be given.

D. Fields

Gravitational fields are not explicitly referred to in BHSC NST (BGE), however, similar content to D.1 Gravitational fields may be included within Newtonian mechanics. Gravitation may similarly be encompassed by the previously mentioned skills concerning understanding and representing the movements and behaviours of objects. References to the differences between magnetic and electric fields, as well as electrical force and coulombs law, in BHSC NST (BGE) suggests similarity with a few SL subtopics from D2. Electric and magnetic fields.[103] Electromagnetic forces are also referenced in BHSC NST (BGE), which indicates the potential presence of content relating to D.3 Motion in electromagnetic fields.[104] Based on this, it is concluded that BHSC NST (BGE) partially aligns with the SL content from these topics.

AHL content in D1. Gravitational fields and D2. Electric and magnetic fields cannot be similarly inferred to be present in BHSC NST (BGE), as the concepts go beyond what can be reasonably assumed to be included within the documentation. However, Faraday-Neumann's Law and Lenz's Law are referred to, which suggests that some AHL content from D.4 Induction may feature in BHSC NST (BGE).[105] Notably, as one would require knowledge of the motion of particles in electric and magnetic field in order to understand these laws, subtopics within D.3 Motion in electromagnetic fields are likely to be covered as pre-requisite knowledge for Faraday and Lenz's laws.

E. Nuclear and quantum physics

Atomic and subatomic models are covered in BHSC NST (BGE), which encompasses some similar content to E.1 Structure of the atom. Moreover, the documentation refers to

[103] Ibid.
[104] Ibid.
[105] Ibid.

spectroscopy, which corresponds to other SL subtopics in this area. BHSC NST (BGE) skills include the knowledge of radiation, and the study of radioactive decay and ionising radiation is also indicated,[106] which similarly indicates the likely coverage of a number of SL concepts within E.2 Radioactive decay. Furthermore, nuclear fission and fusion is covered in BHSC NST (BGE), which suggests coverage of similar content to the SL subtopics E.4 Nuclear fission and E.5 Nuclear fusion and stars. Moreover, BHSC NST (BGE) includes stellar evolution and cosmological models, which also suggests alignment with the content in E.5 Nuclear fusion and stars. On this basis, it is concluded that there is partial presence of SL content across all topics in E. Nuclear and quantum physics in BHSC NST (BGE).

While wave-particle duality and the Bohr model are referenced for BHSC NST (BGE), there is limited evidence of further DP AHL content from D.5 Quantum mechanics. There is likewise insufficient evidence to confirm the presence of AHL content from E1. Structure of the atom and E.2 Radioactive decay, particularly as the AHL content is not fundamental to understandings of atomic structure or of radioactive decay.

Experimental programme

BHSC NST (BGE) includes conducting investigations into real-world problems using scientific procedures. Indeed, its competencies and skills refer to developing hypotheses, reaching conclusions, and mention laboratory skills such as employing tools. There are also references to examining models, simulations, and prototypes. There are, therefore, some similarities to the DP's experimental programme. However, BHSC NST (BGE) does not detail the specific experiments to be conducted, nor the specific practical skills to be developed. Furthermore, there is no inclusion of anything similar to the DP's collaborative sciences project. As such, it is concluded that BHSC NST (BGE) partially aligns with this component of the DP physics syllabus.

Other BHSC NST (BGE) Content

BHSC NST (BGE) covers some physics content that is not in DP physics – presented in the following table.

*Table 23: Physics content in BHSC NST (BGE) which is not covered in the DP**

Significant content which is not included in DP physics
• Cosmological models • Wider uses and impacts of radiation • Weather forecast

*These topics have been taken from the BNCC and are detailed further in the RJRC.

DP physics does not cover the origin or evolution of universe, also known as cosmology. In contrast, BHSC NST (BGE) includes cosmological models and requires analysis of different explanations for the emergence of life and the universe, including how these have changed over time and vary across different cultures. For example, students may learn about currently accepted scientific theories such as the Big Bang, as well as non-scientific theories such as Amerindian origin myths.[107]

[106] Ibid.
[107] Ibid.

Furthermore, DP physics has less content relating to the broader impacts and uses of radiation, whereas BHSC NST (BGE) requires using the knowledge of radiation to assess its potential applications and risks. BHSC NST (BGE) also includes knowledge of the biological impacts of ionizing radiation, which would, for instance, allow students to consider the benefits and risks of X-rays.[108] This exploration of the applications of radiation goes beyond that of DP physics. Finally, DP physics does not include any content relating to weather forecasting, which is included in BHSC NST (BGE).

Summary

Overall, BHSC NST (BGE) includes some SL content from most DP physics topics. This indicates that physics in BHSC NST (BGE) has similar breadth to DP physics SL. However, as the coverage of specific physics concepts is often only inferred from broad references in the documentation, it cannot be confidently concluded that the depth of physics content in BHSC NST (BGE) is similar to that of DP physics SL. Indeed, the absence of references to specific concepts in BHSC NST (BGE) may indicate that physics topics are not studied to the same degree of depth as DP SL. Furthermore, with the exception of some induction and thermodynamics concepts, the majority of DP physics AHL content is not represented in BHSC NST (BGE). Therefore, DP physics HL content has greater breadth and depth than physics in BHSC NST (BGE).

BHSC Natural Sciences and Technology (Formative Itinerary) – BHSC NST (FI)

The primary way high school students can further pursue science is by choosing to specialise in Natural Sciences and Technology (NST) in their formative itinerary (FI). The Rio de Janeiro specialisation pathways for NST formative itineraries were consulted to provide examples of the types of content covered in BHSC NST (FI).

A small amount of DP physics content is present within the specialisation pathways for formative itineraries in Rio de Janeiro. Indeed, some coverage of SL content from A.3 Work, energy and power, B.1 Thermal energy transfers, and B.2 Greenhouse effect, is indicated. With regards to AHL content, similar content to B.4 Thermodynamics may be incorporated. No other DP physics SL or AHL content could be identified in the specialisation pathways, nor any other physics content. This can be attributed to the focus on a particular real-world issue or context in NST formative itineraries, and the emphasis on application of knowledge as opposed to introducing additional physics content.

Table 24: Physics content in BHSC NST (FI) which is not covered in the DP.

Significant content which is not included in DP physics
There is no significant physics content in BHSC NST (FI) that is not included in the DP.

Summary

While formative itineraries are developed by each state, the examples from Rio de Janeiro provide useful insights into the content that these may cover and how this aligns with DP physics. Overall, the content of BHSC NST (FI) does not present a stronger alignment with DP physics content than BHSC NST (BGE), as very few further SL subtopics and AHL

[108] Ibid.

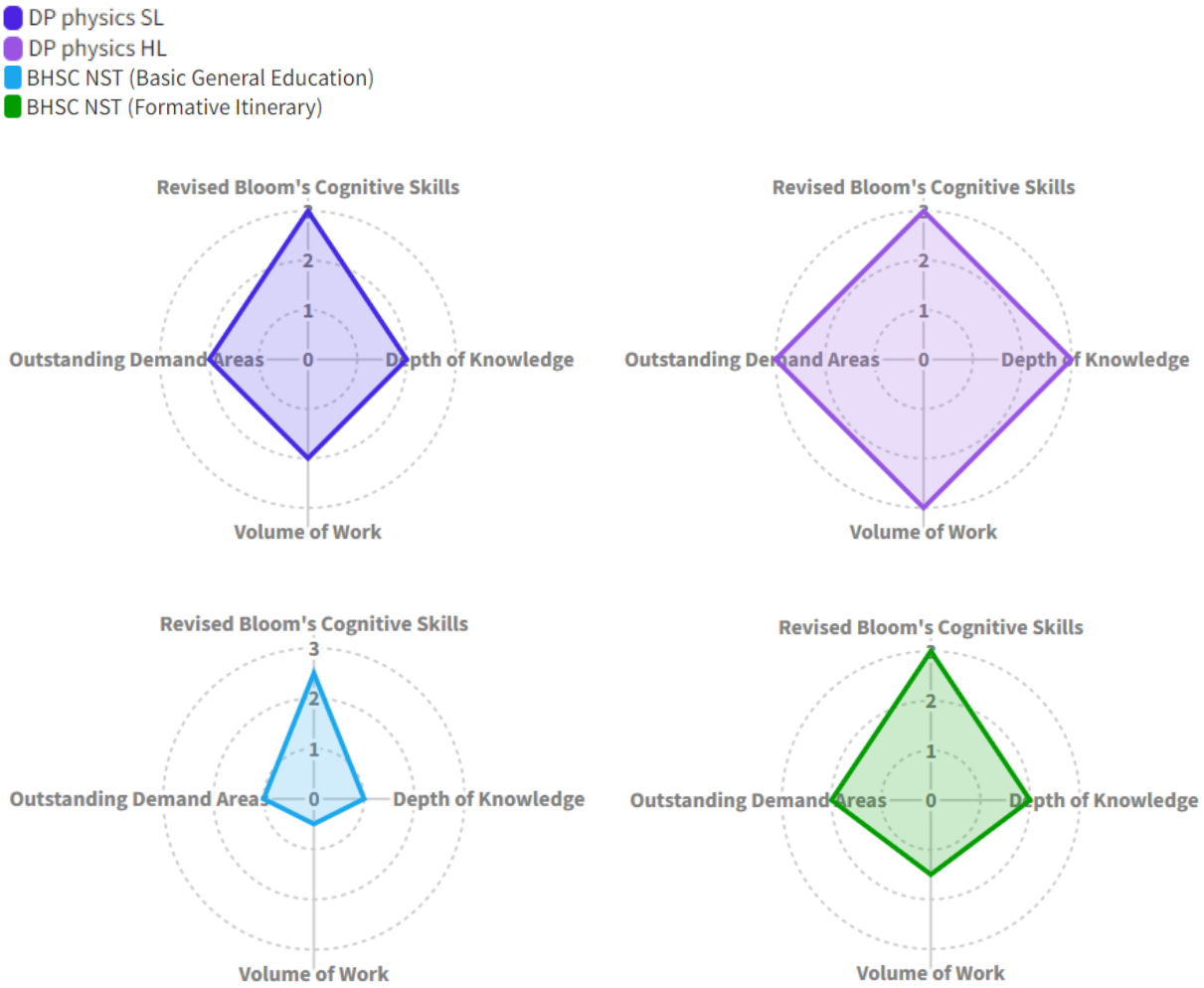
subtopics could be identified. Instead, BHSC NST (FI) provides an opportunity for students to extensively apply physics (and other science) concepts to a variety of contexts and issues, such as renewable energy sources and sustainable resource consumption. Therefore, the breadth and depth of physics content covered in BHSC NST (FI) is less than that of DP physics HL. The breadth in comparison to DP SL may be similar and, as mentioned previously, the depth cannot be confidently ascertained due to the lesser amount of detail in the documentation.

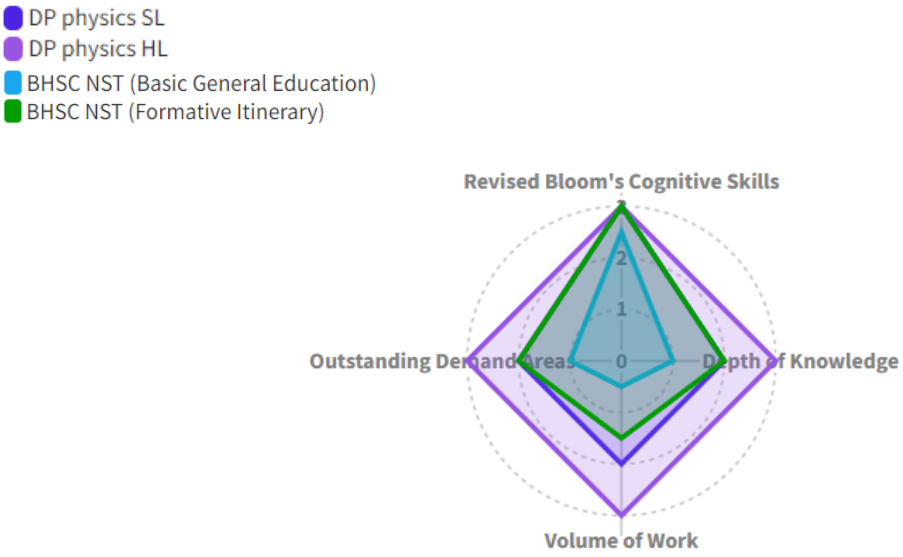
5.2.3 Demand – Physics

This section considers the alignment between DP physics and BHSC NST in terms of demand. Using the same demand tool for the analysis of each subject, a demand profile was created for DP physics (SL and HL), BHSC NST (BGE), and BHSC NST (FI).

BHSC NST (BGE) represents the demand of physics in basic general education. BHSC NST (FI) represents the cumulative demand of studying physics in basic general education and then specialising in an NST formative itinerary. It should be noted that the scores reflect the demand of the whole NST formative itinerary component, rather than its physics content specifically. These demand profiles are presented below in the form of radar diagrams, with a superimposed diagram featured to enable the immediate visual comparison of all profiles.

Figure 17: Visual representations of subject demand





The panel of experts carried out a detailed analysis of each course and reached a consensus on the scores shown in the profiles above. The following points were particularly important within the panel discussion:

- Regarding the scores for **Bloom's Cognitive Skills**:
  - DP physics has the same learning outcomes for both SL and HL, meaning that these scores are the same. These were judged to merit a score of 3 due to the high levels of critical thinking, critical awareness and elements of synthesis and creation present in the majority of Aims and Assessment Objective 3.
  - BHSC NST (BGE) was given a score of 2.5, as the learning outcomes include evaluation and creation/synthesis focused goals (for instance, proposing solutions to real-world problems, building prototypes of thermal systems). However, there was not enough evidence of a strong presence of evaluation and synthesis to warrant a judgement of 3. For BHSC NST (FI), a score of 3 was awarded, due to strong evidence of synthesis, creation and analysis. Additionally, the integrated nature of the formative itinerary component allows for the synthesis of knowledge across different science topics. Moreover, students use knowledge creatively to propose or innovate, as well as plan and carry out projects, all of which suggests higher order thinking.

- Regarding the score for **Depth of Knowledge**:
  - DP physics SL was deemed to merit a score of 2 for depth of knowledge due to the mathematical pre-requisite skills and competences required to access the course, as well as the moderate to high level of cognitive complexity of the knowledge that students are expected to acquire. As to the HL course, the greater depth and additional opportunities provided for extended thinking in the additional higher level option topics pushed the score to a 3.
  - BHSC NST (BGE) was awarded a score of 1 for depth of knowledge. Although the learning outcomes are generally indicative of higher order thinking (such as making predictions, performing calculations, and evaluating), the extent of depth to which physics topics are explored is unable to be confirmed from the broad references used in the documentation. As such, whilst there is potential for some topics to be

studied in-depth and require complex reasoning, there is insufficient evidence to warrant a judgment of 2. For BHSC NST (FI), depth of knowledge was judged to merit a score of 2. This was due to the open ended, project-based nature of the formative itinerary component and its contextualisation in the real world, both of which are suggestive of higher order processing. However, as there was limited evidence of complex science topics, a score of 2, rather than 3, was awarded.

- Regarding the scores for **Volume of Work**:
  - The DP physics SL was judged to comprise a moderate-heavy workload (a score of 2) as students are exposed to multiple physics topics, with each topic being allocated a standard to short amount of time. The volume demands of the HL course, on the other hand, were found to be sufficient to meet a score of 3 as, even though the number of topics per hour is smaller, these topics are covered in great depth and with a focus on application.
  - BHSC NST (BGE) was awarded a score of 0.5. While the complexity of the concepts being covered can be uncertain due to the limited detail provided, the majority of physics content can be assumed to be more basic than complex. Indeed, there is very limited evidence for a substantial number of complex subtopics and concepts. Considering the teaching hours allocated,[109] it was decided that there was a generous time allocation per theme, and thus it was determined that this overall represented a light volume of work. For BHSC NST (FI), a score of 1.5 was given. The course has scope for a significant proportion of the time to be spent on issues beyond basic conceptual depth, and the potential for in depth project-based work. Based upon the time allocated to the specialisation component of formative itineraries, the time allocation per theme was judged to be standard. However, the complexity of the content explored is unclear, and may be largely at teacher's discretion. Therefore, the judgement is limited to a 1.5.

- Regarding the scores for **Outstanding Areas of Subject Demand**:
  - For the DP physics SL course (awarded a score of 2), the IA scientific investigation research project that students need to undertake, the linking questions outlined in the syllabus and the collaborative sciences project were considered areas of stretch. In addition to the latter, the HL course features additional higher-level topics which were deemed to include additional areas of stretch, meriting a score of 3.
  - BHSC NST (BGE) was given a score of 1 for outstanding areas of demand as the inclusion of debates, real world applications and the investigative approaches were considered to potentially allow for 1 to 2 stretch areas. For BHSC NST (FI), a score of 2 was awarded. The emphasis on the following provided further stretch areas: real-life application, the project-based work, the cross curricular nature of the course, and the opportunities for discussion and debate.

[109] The teaching hours were taken from the Rio de Janeiro curriculum.

5.2.4 Content – Chemistry

This section compares and contrasts the chemistry content of DP chemistry and BHSC NST. For the content analysis of BHSC NST, several sources are used. For BHSC NST (BGE), the BNCC's specific competencies and specific skills for NST have been used, as well as the Rio de Janeiro Referential Curriculum (RJRC) for chemistry in basic general education. For the analysis of BHSC NST (FI), Rio de Janeiro's specialisation pathways for Natural Sciences and Technology formative itineraries have been used.

In order to support visual comparison at-a-glance, the chemistry content from DP, BNCC and the RJRC are presented in the following diagrams.

Figure 18: DP chemistry content visualiser[110]

Structure	**Structure 1. Models of the particulate nature of matter**	Structure 1.1 – Introduction to the particulate nature of matter	Structure 1.2 – The nuclear atom (SL + AHL)	Structure 1.3 – Electron Configurations (SL + AHL)	Structure 1.4 – Counting particles by mass: The mole	Structure 1.5 – Ideal gases
	Structure 2. Models of bonding and structure	Structure 2.1 – The ionic model	Structure 2.2 – The covalent model (SL + AHL)	Structure 2.3 – The metallic model (SL + AHL)	Structure 2.4 – From models to materials (SL + AHL)	
	Structure 3. Classification of matter	Structure 3.1 – The periodic table: Classification of elements (SL + AHL)	Structure 3.2 – Functional groups: Classification of organic Compounds (SL + AHL)			
Reactivity	**Reactivity 1. What drives chemical reactions?**	Reactivity 1.1 – Measuring enthalpy changes	Reactivity 1.2 – Energy cycles in reactions (SL + AHL)	Reactivity 1.3 – Energy from fuels	Reactivity 1.4 – Entropy and spontaneity (HL only)	
	Reactivity 2. How much, how fast and how far?	Reactivity 2.1 – How much? The amount of chemical change	Reactivity 2.2 – How fast? The rate of chemical change (SL + AHL)	Reactivity 2.3 – How far? The extent of chemical change (SL + AHL)		
	Reactivity 3. What are the mechanisms of chemical change?	Reactivity 3.1 – Proton transfer reactions (SL + AHL)	Reactivity 3.2 – Electron transfer reactions (SL + AHL)	Reactivity 3.3 – Electron sharing reactions	Reactivity 3.4 – Electron-pair sharing reactions (SL + AHL)	
Experimental programme	Practical work	Collaborative sciences project	Scientific investigation			

[110] '(HL only)' and '(SL + AHL)' are used to flag, respectively, topics only taught at HL and topics taught at both SL and HL, but which also feature additional higher level content.

Figure 19: Visualiser of BHSC Natural Sciences and Technology. (Source - BNCC).

Natural Sciences and Technology		
Specific Competencies		
1. Analyse natural phenomena and technological processes, based on the interactions and relationships between matter and energy, to propose individual actions and collective actions that improve production processes, minimize impacts on and improve living conditions at the local, regional and global level.	2. Analyse and use interpretations of the dynamics of Life, the Earth and the Cosmos to elaborate arguments, make predictions about the functioning and the evolution of living beings and the Universe, and to ground and defend ethical and responsible decisions.	3. Investigate problem situations and evaluate applications of scientific knowledge and its implications in the world, using procedures and languages of the Natural Sciences, in order to propose solutions that consider local, regional and/or global demands, and communicate their findings and conclusions to a variety of audiences, in a variety of contexts and through different media and digital information technologies and communication (TDIC).
Specific Skills*		
EM13CNT101 - EM13CNT107	EM13CNT201 - EM13CNT209	EM13CNT301 - EM13CNT310

* See Appendix D for the Natural Sciences and Technology Specific Skills in full detail.

Figure 20: Visualiser of BHSC Natural Sciences and Technology. (Source - RJRC).

Basic General Education	Formative Itinerary		
Chemistry (based on the BNCC and organised using the Specific Competencies and Skills)	**Integrated Core**	**Specialisation Pathways for Natural Sciences and Technology**	
	Life Project	**Energy Solutions**	**Natural Resources**
	Elective 1	Energy and its transformations	Consumption, multiple uses and management
	Elective 2	Energy, environmental impacts, and sustainability	Diversified sustainable practices
	Elective 3 (chosen from Catalogues, such as the Catalogue of Electives for Natural Sciences and Technology)	Energy: Problematisation and awareness raising	Natural resources and sustainable development

Structure

Science in the DP is structured such that physics, chemistry and biology are separate subjects, each with their own distinct content. In contrast, the BHSC combines physics, chemistry, and biology into Natural Sciences and Technology (NST). Where DP students choose one science subject to study at either SL or HL, high school students in Brazil study all sciences as part of NST in basic general education (BGE), and then can choose to specialise in NST in their formative itinerary (FI). As such, unlike the offering of DP chemistry HL, the BHSC does not offer an option to specialise in chemistry specifically. Moreover, DP science subjects are studied over the two-year programme, whereas science subjects may be taught in any or all years of high school in Brazil.

Within DP chemistry, content is arranged into two conceptual themes – Structure and Reactivity. Three topics are covered within each theme, each with two to five related subtopics.

In contrast, BHSC NST (BGE) content is not organised using chemistry topics. Indeed, the BNCC articulates specific competencies and skills for NST that are an integration of skills and physics, chemistry, and biology content. Each state in Brazil can decide how to organise their curriculum to ensure that the NST specific competencies and skills are taught in basic general education. For example, the Rio de Janeiro's Referential Curriculum (RJRC) organises basic general education into distinct subjects, with chemistry being one of these. The RJRC then organises its chemistry content using the NST specific competencies and specific skills and adds topics that should be linked with these.

Content for BHSC NST (FI) is developed by each Brazilian state and combines physics, chemistry, and biology content. As an example, the RJRC organises NST formative itinerary content into two specialisation pathways, namely 'Natural Resources' and 'Energy Solutions', each of which is made up of three curricular components (see figure 16).[111]

Content Alignment

This section will analyse the alignment of chemistry content in DP chemistry and BHSC NST. The following tables present a simplified summary of the extent of content alignment that BHSC NST (BGE) and BHSC NST (FI) have at the topic level with DP chemistry.

[111] Rio de Janeiro State Government, Department of Education. (2022). *Curricular Organisation of Formative Itineraries*.

Table 25: Summary of the content alignment BHSC NST has with the main topics in DP chemistry.

DP chemistry topics	BHSC NST (BGE)		BHSC NST (FI)*	
	SL presence	AHL presence	SL presence	AHL presence
Structure 1. Models of the particulate nature of matter				
Structure 1.1 – Introduction to the particulate nature of matter		N/A		N/A
Structure 1.2 – The nuclear atom				
Structure 1.3 – Electron configurations				
Structure 1.4 – Counting principles by mass: The mole		N/A	**	N/A
Structure 1.5 – Ideal gases		N/A		N/A
Structure 2. Models of bonding and structure				
Structure 2.1 – The ionic model		N/A		N/A
Structure 2.2 – The covalent model				
Structure 2.3 – The metallic model				
Structure 2.4 – From models to materials				
Structure 3. Classification of matter				
Structure 3.1 – The periodic table: Classification of elements				
Structure 3.2 – Functional groups: Classification of organic compounds				
Reactivity 1. What drives chemical reactions?				
Reactivity 1.1 – Measuring enthalpy changes		N/A	**	N/A
Reactivity 1.2 – Energy cycles in reactions			**	**
Reactivity 1.3 – Energy from fuels		N/A	**	N/A
Reactivity 1.4 – Entropy and spontaneity (AHL only)	N/A		N/A	
Reactivity 2. How much, how fast and how far?				
Reactivity 2.1 – How much? The amount of chemical change		N/A	**	N/A
Reactivity 2.2 – How fast? The rate of chemical change			**	
Reactivity 2.3 – How far? The extent of chemical change			**	
Reactivity 3. What are the mechanisms of chemical change?				
Reactivity 3.1 – Proton transfer reactions				
Reactivity 3.2 – Electron transfer reactions				
Reactivity 3.3 – Electron sharing reactions		N/A		N/A
Reactivity 3.4 – Electron-pair sharing reactions				
Experimental programme				

Key:

	Strong presence of this topic in BHSC NST		*Partial presence of this topic in BHSC NST , or the extent of presence is unclear*		*Little or no presence of this topic in BHSC NST*

***** Content alignments found for basic general education (BGE) are carried forwards and combined with, where applicable, new alignments identified in the formative itinerary (FI), to represent the cumulative content covered.
** The documentation indicates that the formative itinerary includes some similar content from this DP topic.

BHSC Natural Sciences and Technology (Basic General Education) - BHSC NST (BGE)

BHSC NST (BGE) covers some content from most DP chemistry SL subtopics. The only DP SL subtopics which do not appear to be covered in at least some part by BHSC NST (BGE) are from 'Reactivity 3. What are the mechanisms of chemical change?'. There is generally little to no presence of DP AHL content in BHSC NST (BGE). However, the documentation suggests that some content from Reactivity 1.2 – Energy cycles in reactions is present.

It should be noted that, where partial presence has been concluded, this is often based on an assumption that the broadly-described topics for BHSC NST (BGE) can be expected to contain similar content. Thus, the actual degree of alignment may differ to what a judgement of 'partial presence' suggests. The below discusses the presence of each DP topic in BHSC NST (BGE) in more detail.

Structure 1. Models of the particulate nature of matter

BHSC NST (BGE) includes atomic models and the structure of matter, which suggests that there may be some alignment with the SL content of 'Structure 1.1 Introduction to the particulate nature of matter', 'Structure 1.2 The nuclear atom', and 'Structure 1.3 Electron configurations'. Moreover, concepts such as Dalton's model of the atom, atomic mass, and atomic number, are mentioned, as is the Bohr model in physics, which supports the potential coverage of a number of DP SL subtopics in these areas.[112] Furthermore, references to stochiometric calculations suggest similar content to 'Structure 1.4 Counting principles by mass: The mole'.

There is limited evidence that BHSC NST (BGE) includes content relating to gases. However, concepts such as the work of a gas and kinetic energy of gases are included within physics.[113] As such, students may encounter related content from 'Structure 1.5 – Ideal gases' throughout their studies. Therefore, it is concluded that BHSC NST (BGE) has partial alignment with SL content in all topics of 'Structure 1. Models of the particulate nature of matter', though it should be noted that the presence of specific concepts has been largely inferred.

With regards to AHL content, spectroscopy could encompass elements of content from 'Structure 1.2 The nuclear atom' and 'Structure 1.3 Electron configuration'. Without more information, however, it is not reasonable to infer that these DP chemistry HL concepts are covered. Therefore, it is concluded that there is little to no presence of this topic in BHSC NST (BGE).

Structure 2: Models of bonding and structure

BHSC NST (BGE) includes the structure of matter, which is further specified to include chemical bonds and interparticle forces.[114] As ionic, covalent, and metallic are fundamental bond types, and are therefore likely to be included within these areas, it can be inferred that some similar content is covered to SL concepts within 'Structure 2.1 The ionic model', '2.2 The covalent model', and '2.3 The metallic model'. Furthermore, coverage of SL content from 'Structure 2.4 From models to materials' is possible as students are expected to analyse the properties of materials.[115] Knowledge of polymers is supported by the study of plastics

[112] These topics have been drawn from the RJRC.
[113] Ibid.
[114] Ibid.
[115] Specific skill EM13CNT307 from the BNCC.

(including polymers).[116] Notably, some specific DP chemistry concepts, such as bonding as a continuum or the concept of the bonding triangle, are less reasonably inferred from the detail in which content is described. Therefore, it is concluded that BHSC NST (BGE) has partial alignment with SL content in all topics of 'Structure 2. Models of bonding and structure', though it should be noted that the presence of some specific concepts has been inferred.

As is the case in other DP chemistry topics, the AHL content goes beyond what can be reasonably inferred from the detail provided regarding chemical bonds. Thus, it is concluded that there is little to no AHL content from 'Structure 2. Models of bonding and structure' in BHSC NST (BGE).

Structure 3. Classification of matter

The documentation includes the study of the periodic table, which is likely to encompass some of the SL content from 'Structure 3.1 The periodic table: Classification of elements'. However, it is unclear whether some elements of this DP chemistry topic, such as periodicity or trends across the periodic table, are present. BHSC NST (BGE) includes understanding the structure and properties of organic compounds, which indicates that some of the SL content from 'Structure 3.2 Functional groups: Classification of organic compounds' may be covered. Therefore, it is concluded that BHSC NST (BGE) has partial alignment with SL content in all topics of 'Structure 3. Classification of matter', though it should be noted that the presence of some specific concepts has been inferred.

AHL content within 'Structure 3.1 The periodic table: Classification of elements' and 'Structure 3.2 Functional groups: Classification of organic compounds', goes beyond what can be reasonably inferred without further references to specific concepts such as transition elements or electrolysis. Thus, it is concluded that there is little to no AHL content from 'Structure 3. Classification of matter' in BHSC NST (BGE).

Reactivity 1. What drives chemical reactions?

BHSC NST (BGE) includes the study of thermodynamics, as well as thermochemistry and other relevant content such as enthalpy of chemical reactions and related calculations.[117] This indicates that BHSC NST (BGE) may cover some SL content from 'Reactivity 1.1 Measuring enthalpy changes' and 'Reactivity 1.2 Energy cycles in reactions'. Although there are no direct references to bond formation/breaking or to Hess' law, both concepts may constitute pre-requisite knowledge for enthalpy calculation, and so are likely to be included.

Though there are limited references to fuel, BHSC NST (BGE) requires students to consider how best to meet demands for electricity and make suggestions for how it can be sustainably generated. A variety of renewable and non-renewable resources are further stated in the documentation such as oil and biofuels.[118] Therefore, while there are no references to the combustion of reactive metals or non-metals, it is likely that the remaining content within 'Reactivity 1.3 Energy from fuels' is included within BHSC NST (BGE). Overall, it can be concluded that BHSC NST (BGE) has partial alignment with SL content in all topics of

[116] This topic has been drawn from the RJRC.
[117] The latter topics are drawn from the RJRC.
[118] These topics have been drawn from the RJRC.

'Reactivity 1. What drives chemical reactions?', though it should be noted that the presence of some specific concepts has been inferred.

Presence of the AHL content from 'Reactivity 1.2 Energy cycles in reactions' is indicated in BHSC NST (BGE), as knowledge of the enthalpy of combustion for the purposes of energy efficiency are mentioned.[119] There are no references to AHL content within 'Reactivity 1.4 Entropy and spontaneity', such as Gibbs law, and thus the presence of these cannot be reasonably inferred.

Reactivity 2. How much, how fast and how far?

Some SL content from 'Reactivity 2.1 How much? The amount of chemical change' is present in BHSC NST (BGE), as students are expected to be aware of the conservation of matter and be able to conduct stochiometric calculations. This is further specified to include the proportions of reactants and products as well as solutions and concentrations.[120] Elements of SL content from 'Reactivity 2.2 How fast? The rate of chemical change' may also be represented in BHSC NST (BGE) within the topic of chemical kinetics. The speed of chemical transformation is also referred to – including variables that influence the speed.[121] Finally, some SL content from 'Reactivity 2.3 How far? The extent of chemical change' may be present, as BHSC NST (BGE) includes chemical kinetics and equilibrium. Therefore, it is concluded that BHSC NST (BGE) chemistry has partial alignment with SL content in all topics of 'Reactivity 2. How much, how fast and how far?', though it should be noted that the presence of some specific concepts has been inferred.

Much of the AHL content within 'Reactivity 2.2 How fast? The rate of chemical change' relates to multistep reactions, the presence of which cannot be reasonably inferred from the detail in BHSC NST (BGE) documentation. Likewise, AHL content relating to 'Reactivity 2.3 How far? The extent of chemical change' includes more advanced concepts not expressly referred to as present in BHSC NST (BGE). Thus, it is concluded that there is little to no AHL content from 'Reactivity 2. How much, how fast and how far?' in BHSC NST (BGE).

Reactivity 3. What are the mechanisms of chemical change?

There is little to no evidence of DP SL and AHL content relating to the mechanism of chemical change in BHSC NST (BGE).

Experimental programme

BHSC NST (BGE) includes students conducting investigations into real-world problems using scientific procedures. Further general competencies are suggestive of planning skills such as developing hypotheses or reaching conclusions; and mention laboratory skills such as employing tools. There are also references to examining models, simulations, and prototypes. There are, therefore, some similarities to the DP's experimental programme. However, BHSC NST (BGE) does not detail the specific experiments to be conducted, nor the specific practical skills to be developed. Furthermore, there is no inclusion of anything similar to the DP's collaborative sciences project. As such, it is concluded that BHSC NST (BGE) partially aligns with this component of the DP chemistry syllabus.

[119] This topic has been drawn from the RJRC.
[120] Ibid.
[121] Ibid.

Other BHSC NST (BGE) Content

BHSC NST (BGE) covers some chemistry content that is not in DP chemistry and is presented in the following table:

Table 26: BHSC NST (BGE) content which is not covered in the DP

Significant content which is not included in DP chemistry
• Risks associated with exposure to and improper disposal of materials • Water and sewage treatment

DP chemistry does not cover as much content relating to the impact of exposure to chemicals beyond safety considerations with regards to practical work. In contrast, BHSC NST (BGE) includes considerations of the benefits and risks to health of different materials considering different factors such as the level of exposure. Moreover, DP chemistry does not feature content relating to the proper disposal of materials, whereas BHSC NST (BGE) requires students to discuss how to properly dispose of substances and the impact of improper disposal. Notably, DP biology does include the effects of microplastics and biomagnification of pollutants.

Additionally, DP chemistry does not make explicit references to water or sewage treatment. In contrast, BHSC NST (BGE) includes considerations of infrastructure programmes, including sanitation, which is further specified to include water and sewage treatment specifically.

Summary

In summary, some SL content from most DP chemistry topics - with the exception of topics in Reactivity 3: What are the mechanisms of chemical change? – are included in BHSC NST (BGE). This suggests that chemistry in BHSC NST (BGE) has a slightly lower breadth of content than DP chemistry SL. Notably, the extent of depth to which topics are explored in BHSC NST (BGE) is inferred from broad references in the documentation. The absence of references to specific chemistry concepts within BHSC NST (BGE) might suggest that chemistry topics are not studied in the same depth as DP SL. There is little to no presence of chemistry AHL content in BHSC NST (BGE) except for some content from ‘Reactivity 1.2 Energy cycles in reactions’. Lastly, DP chemistry HL includes a greater number of complex areas than BHSC NST (BGE), thus the former has greater breadth and depth.

BHSC Natural Sciences and Technology (Formative Itinerary) - BHSC NST (FI)

The primary way high school students can further pursue science is by choosing to specialise in Natural Sciences and Technology (NST) in their formative itinerary (FI). The Rio de Janeiro specialisation pathways for NST formative itineraries were consulted to provide examples of the types of content covered in BHSC NST (FI).

A small amount of DP chemistry content is present within the specialisation pathways for Rio de Janeiro. More specifically, SL content from ‘Structure 1.4 Counting principles by mass: The mole’, and all topics within ‘Reactivity 1. What drives chemical reactions?’ and ‘Reactivity 2. How much, how fast and how far?’, is partially present in the specialisation pathways. With regards to AHL content, similar content to ‘Reactivity 1.2 Energy cycles in reactions’ may be included. No other SL or AHL content could be identified in the specialisation pathways, nor any other chemistry content. This can be attributed to the focus on a particular real-world issue

or context in NST formative itineraries, and the emphasis on application of knowledge as opposed to introducing additional chemistry content.

*Table 27: Chemistry content in BHSC NST (FI) which is not covered in the DP**

Significant content which is not included in DP chemistry
There is no significant chemistry content in the BHSC NST (FI) that is not included in the DP.

Summary

In conclusion, while formative itineraries are developed by each state, the examples from Rio de Janeiro provide useful insights into the content that these may cover and how this aligns with DP chemistry. Overall, the content of BHSC NST (FI) does not present a stronger alignment to DP chemistry content than BHSC NST (BGE), as very few further SL subtopics and AHL subtopics could be identified. Instead, BHSC NST (FI) provides an opportunity for students to extensively apply chemistry (and other science) concepts to a variety of contexts and issues, such as renewable energy sources and sustainable resource consumption. Therefore, the breadth and depth of chemistry content covered in BHSC NST (FI) is less than that of DP chemistry HL. The breadth in comparison to DP SL may be similar and, as mentioned previously, the depth cannot be confidently ascertained due to the lesser amount of detail in the documentation.

5.2.5 Demand – Chemistry

This section considers the alignment between DP chemistry and BHSC NST in terms of demand. Using the same demand tool for the analysis of each subject, a demand profile was created for DP chemistry (SL and HL), BHSC NST (BGE), and BHSC NST (FI).

BHSC NST (BGE) represents the demand of chemistry in basic general education. BHSC NST (FI) represents the cumulative demand of studying chemistry in basic general education and then specialising in an NST formative itinerary. It should be noted that the scores reflect the demand of the whole NST formative itinerary component, rather than its chemistry content specifically. These demand profiles are presented below in the form of radar diagrams, with a superimposed diagram featured to enable the immediate visual comparison of all profiles.

Figure 21: Visual representations of subject demand

The panel of experts carried out a detailed analysis of each course and reached a consensus on the scores shown in the profiles above. The following points were particularly important within the panel discussion:

- Regarding the scores for **Bloom's Cognitive Skills**:
  - DP chemistry has the same learning outcomes for both SL and HL, meaning that these scores are the same. These were judged to merit a score of 3 due to the

high levels of critical thinking, critical awareness and elements of synthesis and creation present in the majority of Aims and Assessment Objective 3.
    - BHSC NST (BGE) was awarded a score of 2.5, as the learning outcomes have a predominant focus on analysis, with some evidence of evaluation and creation/synthesis focused goals (for instance, creating and/or interpreting equations). However, there is insufficient evidence of a strong presence of evaluation and synthesis to warrant a judgement of 3. For BHSC NST (FI), a score of 3 was awarded due to a predominant focus on synthesis, creation and analysis in the skill for NST formative itineraries. Indeed, the formative itinerary component allows for the synthesis of knowledge across science topics, finding innovative approaches to real world issues and project-based work, all of which suggest higher order thinking, warranting a judgement of 3.

- Regarding the score for **Depth of Knowledge**:
    - DP chemistry SL was deemed to merit a score of 2 for depth of knowledge due to the mathematical pre-requisite skills and competences required to access the course, as well as the moderate to high level of cognitive complexity of the knowledge that students are expected to acquire. As to the HL course, the greater depth and additional opportunities provided for extended thinking in the additional higher level option topics pushed the score to a 3.
    - BHSC NST (BGE) was awarded a score of 1 for depth of knowledge. As is the case for other science subjects, the learning outcomes indicate higher order skills (such as making predictions, performing calculations and interpreting results). However, the extent of depth to which chemistry topics are explored is unable to be confirmed from the broad references used in the documentation. As such, whilst there is potential for some topics to be studied in-depth and require complex reasoning, there is insufficient evidence to warrant a judgment of 2. For BHSC NST (FI), depth of knowledge was judged to merit a score of 2. This was the case because the open ended, project-based nature of this course, as well as its contextualisation in the real world, are suggestive of higher order processing. However, as the BHSC NST (FI) does not appear to cover complex science topics, a score of 2, rather than 3, was awarded.

- Regarding the scores for **Volume of Work**:
    - The DP chemistry SL was judged to comprise a moderate-heavy workload (a score of 2) as students are exposed to multiple chemistry topics, with each topic being allocated a standard to short time amount of time. The volume demands of the HL course, on the other hand, were found to be sufficient to meet a score of 3 as, even though the number of topics per hour is smaller, these topics are covered in great depth and with a focus on application.
    - BHSC NST (BGE) was awarded a score of 0.5. As with other science subjects, the complexity of the concepts being covered can be uncertain due to the limited detail provided. However, the majority of chemistry content can be assumed to be more basic than complex. Indeed, there is very limited evidence for a substantial number of complex subtopics and concepts. Therefore, it was decided that there was a generous time allocation[122] per theme and that this overall represented a light

[122] Time allocations were drawn from the RJRC.

volume of work. For BHSC NST (FI), a score of 1.5 was given. The course has scope for a significant proportion of the time to be spent on issues beyond basic conceptual depth, and the potential for in depth project-based work. Based upon the time allocated to the specialisation component of formative itineraries, the time allocation per theme was judged to be standard. However, the complexity of the content explored is unclear, and may be largely at teacher's discretion. Therefore, the judgement is limited to a 1.5.

- Regarding the scores for **Outstanding Areas of Subject Demand**:
  - For the DP chemistry SL course (awarded a score of 2), the IA scientific investigation research project that students need to undertake, the linking questions outlined in the syllabus and the collaborative sciences project were considered to be areas of stretch. In addition to the latter, the HL course features additional higher-level topics which were deemed to include additional areas of stretch, meriting a score of 3.
  - BHSC NST (BGE) was given a score of 1 for outstanding areas of demand as the inclusion of debates, real world applications and the investigative approaches were considered to potentially allow for 1 to 2 stretch areas. For BHSC NST (FI), a score of 2 was awarded. The emphasis on the following provided further stretch areas: real-life application, the project-based work, the cross curricular nature of the course, and the opportunities for discussion and debate.

5.2.6 Content – Biology

This section compares and contrasts the biology content of DP biology and BHSC NST. For the content analysis of BHSC NST, several sources are used. For BHSC NST (BGE), the BNCC's specific competencies and specific skills for NST have been used, as well as the Rio de Janeiro Referential Curriculum (RJRC) for biology in basic general education. For the analysis of BHSC NST (FI), Rio de Janeiro's specialisation pathways for Natural Sciences and Technology formative itineraries have been used.

In order to support visual comparison at-a-glance, the biology content from DP, BNCC and the RJRC are presented in the following diagrams.

Figure 22: DP biology content visualiser[123]

A: Unity and diversity	**1. Molecules**	A1.1 Water*	A1.2 Nucleic acids*	
	2. Cells	A2.1 Origins of cells (HL only)	A2.2 Cell structure*	A2.3 Viruses (HL only)
	3. Organisms	A3.1 Diversity of organisms*	A3.2 Classification and cladistics (HL only)	
	4. Ecosystems	A4.1 Evolution and speciation*	A4.2 Conservation and biodiversity	
B: Form and function	**1. Molecules**	B1.1 Carbohydrates and lipids	B1.2 Proteins*	
	2. Cells	B2.1 Membranes and membrane transport*	B2.2 Organelles and compartmentalization*	B2.3 Cell specialization*
	3. Organisms	B3.1 Gas exchange*	B3.2 Transport*	B3.3 Muscle and motility (HL only)
	4. Ecosystems	B4.1 Adaptation to environment	B4.2 Ecological niches	
C: Interaction and interdependence	**1. Molecules**	C1.1 Enzymes and metabolism*	C1.2 Cell respiration*	C1.3 Photosynthesis*
	2. Cells	C2.1 Chemical signalling (HL only)	C2.2 Neural signalling*	
	3. Organisms	C3.1 Integration of body systems*	C3.2 Defence against disease	
	4. Ecosystems	C4.1 Populations and communities	C4.2 Transfers of energy and matter	
D: Continuity and change	**1. Molecules**	D1.1 DNA replication*	D1.2 Protein synthesis*	D1.3 Mutations and gene editing*
	2. Cells	D2.1 Cell and nuclear division*	D2.2 Gene expression (HL only)	D2.3 Water potential*
	3. Organisms	D3.1 Reproduction*	D3.2 Inheritance*	D3.3 Homeostasis*
	4. Ecosystems	D4.1 Natural selection*	D4.2 Sustainability and change*	D4.3 Climate change*
Experimental programme	Practical work	Collaborative sciences project	Scientific investigation	

*includes additional higher level (AHL) content

[123] Unless specified as HL only, all the above are studied in SL and HL, with the latter also including the AHL content

Figure 23: Visualiser of BHSC Natural Sciences and Technology. (Source - BNCC).

Natural Sciences and Technology		
Specific Competencies		
1. Analyse natural phenomena and technological processes, based on the interactions and relationships between matter and energy, to propose individual actions and collective actions that improve production processes, minimize impacts on and improve living conditions at the local, regional and global level.	2. Analyse and use interpretations of the dynamics of Life, the Earth and the Cosmos to elaborate arguments, make predictions about the functioning and the evolution of living beings and the Universe, and to ground and defend ethical and responsible decisions.	3. Investigate problem situations and evaluate applications of scientific knowledge and its implications in the world, using procedures and languages of the Natural Sciences, in order to propose solutions that consider local, regional and/or global demands, and communicate their findings and conclusions to a variety of audiences, in a variety of contexts and through different media and digital information technologies and communication (TDIC).
Specific Skills*		
EM13CNT101 - EM13CNT107	EM13CNT201 - EM13CNT209	EM13CNT301 - EM13CNT310

* See Appendix D for the Natural Sciences and Technology Specific Skills in full detail.

Figure 24: Visualiser of BHSC Natural Sciences and Technology. (Source - RJRC).

Basic General Education	**Formative Itinerary**		
Biology (based on the BNCC and organised using the Specific Competencies and Skills)	**Integrated Core**	**Specialisation Pathways for Natural Sciences and Technology**	
	Life Project	**Energy Solutions**	**Natural Resources**
	Elective 1	Energy and its transformations	Consumption, multiple uses and management
	Elective 2	Energy, environmental impacts, and sustainability	Diversified sustainable practices
	Elective 3 (chosen from Catalogues, such as the Catalogue of Electives for Natural Sciences and Technology)	Energy: Problematisation and awareness raising	Natural resources and sustainable development

Structure

Science in the DP is structured such that physics, chemistry and biology are separate subjects, each with their own distinct content. In contrast, the BHSC combines physics, chemistry, and biology into Natural Sciences and Technology (NST). Where DP students choose one science subject to study at either SL or HL, Brazilian high school students study all sciences as part of NST in basic general education (BGE), and then can choose to specialise in NST in their formative itinerary (FI). As such, unlike the offering of DP biology HL, the BHSC does not offer an option to specialise in biology specifically. Moreover, DP science subjects are studied over the two-year programme, whereas science subjects may be taught in any or all years of high school in Brazil.

DP biology content is arranged into four themes – A. Unity and diversity, B. Form and function, C. Interaction and interdependence, and D. Continuity and change. There are four levels within each theme, namely 1. Molecules, 2. Cells, 3. Organisms, and 4. Ecosystems. Each level consists of topics and subtopics.

In contrast, BHSC NST (BGE) content is not organised using themes, levels, or topics. Indeed, the BNCC articulates specific competencies and skills for NST that are an integration of skills and physics, chemistry, and biology content. Each state in Brazil can decide how to organise their curriculum to ensure that the NST specific competencies and skills are taught in basic general education. For example, the Rio de Janeiro's Referential Curriculum (RJRC) organises basic general education into distinct subjects, with biology being one of these. The RJRC then organises its biology content using the NST specific competencies and specific skills and adds topics that should be linked with these.

Content for BHSC NST (FI) is developed by each Brazilian state and combines physics, chemistry, and biology content. As an example, the RJRC organises NST formative itinerary content into two specialisation pathways, namely 'Natural Resources' and 'Energy Solutions', each of which is made up of three curricular components (see figure 16).[124]

Content Alignment

This section will analyse the alignment of biology content in DP biology and BHSC NST. The following tables present a simplified summary of the extent of content alignment that BHSC NST (BGE) and BHSC NST (FI) have with each theme and level of DP biology.

[124] Rio de Janeiro State Government, Department of Education. (2022). *Curricular Organisation of Formative Itineraries*.

Table 28: Summary of the content alignment BHSC NST has with the main themes and levels in DP biology.

DP biology themes and levels	BHSC NST (BGE)		BHSC NST (FI)*	
	SL presence	AHL presence	SL presence	AHL presence
A. Unity and diversity				
A1 Molecules				
A2 Cells				
A3 Organisms				
A4 Ecosystems			**	
B. Form and function				
B1 Molecules			**	
B2 Cells				
B3 Organisms				
B4 Ecosystems		N/A	**	N/A
C. Interaction and interdependence				
C1 Molecules			**	
C2 Cells				
C3 Organisms				
C4 Ecosystems		N/A	**	N/A
D. Continuity and change				
D1 Molecules				
D2 Cells				
D3 Organisms				
D4 Ecosystems			**	
Experimental programme				

Key:

	Strong presence of this level in BHSC NST		*Partial presence of this level in BHSC NST, or the extent of presence is unclear*		*Little or no presence of this level in BHSC NST*

***** Content alignments found for basic general education (BGE) are carried forwards and combined with, where applicable, new alignments identified in the formative itinerary (FI), to represent the cumulative content covered.
** The documentation indicates that the formative itinerary includes some similar content from this DP topic.

BHSC Natural Sciences and Technology (Basic General Education) - BHSC NST (BGE)

BHSC NST (BGE) covers some SL content from most levels in the DP biology themes. There is generally little to no presence of DP AHL content in BHSC NST (BGE).

It should be noted that, where partial presence has been concluded, this is often based on an assumption that the broadly-described topics for BHSC NST (BGE) can be expected to contain similar content. Thus, the actual degree of alignment may differ to what a judgement of 'partial presence' suggests. The following discusses the presence of each DP biology theme in BHSC NST (BGE) in more detail.

A: Unity and diversity

BHSC NST (BGE) has some alignment with SL content within A. University and diversity, with the exception of A3 Organisms. Indeed, it can be inferred that SL content from A1.1 Water may be covered within 'origin of life', but the properties of water and its relationship to organisms is not explicitly evident. Moreover, topics of biological inheritance and biomolecules reflect coverage of SL content from A1.2. Nucleic acids. More specifically, the structure of

amino acids, proteins, DNA and RNA are included within BHSC NST (BGE).[125] Furthermore, 'cellular organisation' in the BHSC NST (BGE) likely includes similar content to A2.2 Cell structure – though, notably, there are no references to microscopy. Additionally, SL content from A4.1 Evolution and speciation and A4.2 Conservation of biodiversity is likely present within BHSC NST (BGE) topics of 'evolution', 'origin and extinction of species', and 'biodiversity'. Finally, without references to specific concepts such as genomes, it is less reasonable to infer the presence of SL content relating to A3.1 Diversity of organisms in BHSC NST (BGE).

The topics of exobiology, phylogeny and phylogenetic trees reflect some AHL content from A1.1 Water and A3.2 Classification and cladistics could be covered.[126] Overall, however, there is little indication that AHL content from A: Unity and diversity is covered in BHSC NST (BGE) and its presence cannot be reasonably assumed from the broad references in BHSC NST (BGE) documentation.

B: Form and function

BHSC NST (BGE) has partial alignment with SL content from the theme B. Form and function at the level of B1 Molecules and B4 Ecosystems, but there is limited evidence of SL content from B2 Cells and B3 Organisms. Indeed, SL content from B1.1 Carbohydrates and lipids and B1.2 Proteins is evident within BHSC NST (BGE), based on the topics 'biomolecules' and 'the structure and properties of organic compounds'. There is also reference to carbohydrates, lipids and proteins (although notably this is part of chemistry content).[127] Moreover, the structure of amino acids, DNA and RNA are also present in BHSC NST (BGE).[128] SL content from B4.1 Adaptation to the environment and B4.2 Ecological niches is likely encompassed within BHSC NST (BGE) in the topic of 'ecosystems'. The topics of 'photosynthesis and photosynthetic organisms' and 'chemosynthesis' also indicate inclusion of content from the latter topic.[129] There is little evidence that SL content relating to B2 Cells and C3 Organisms is included, and their presence cannot be inferred from the broad references to 'cellular organisation' in BHSC NST (BGE).

There is little evidence that AHL content from B: Form and function is covered in BHSC NST (BGE), and its presence cannot be reasonably inferred from the general areas referenced in documentation.

C: Interaction and interdependence

BHSC NST (BGE) has some alignment with SL content in C. Interaction and interdependence. There is limited evidence that SL content from C1.1 Enzymes and metabolism is included, as there are no references to enzymes or to metabolism in BHSC NST (BGE). The presence of SL content in C1.2 Cell respiration and to C1.3 Photosynthesis is indicated by the references to cellular respiration and photosynthesis in BHSC NST (BGE). Moreover, it is indicated that SL content from C2.2 Neural signalling is included within BHSC NST (BGE) as it includes neuroscience and electrical impulses in neurones.[130] Some SL content from C3.1 Integration

[125] These topics are drawn from the RJRC.
[126] The topics have been drawn from the RJRC.
[127] Ibid.
[128] Ibid.
[129] Ibid.
[130] The latter topic has been drawn from the RJRC.

of body systems is likely to be included in BHSC NST (BGE) because the latter includes 'bodies' and 'organs and organ systems'. Likewise, some SL content from C3.2 Defence against disease is likely to be included in BHSC NST (BGE) as 'epidemiological processes' are referenced. Furthermore, BHSC NST (BGE) includes 'vaccination', 'individual and collective health' and 'sexually transmitted diseases'.[131] SL content in C4.1 Populations and communities is likely encompassed by BHSC NST (BGE), which includes references to 'populations' and 'ecosystems'. SL content from C4.2 Transfers of energy and matter is also indicated as BHSC NST (BGE) includes biogeochemical cycles and food webs, as well as autotrophic and heterotrophic energetic processes.[132]

There are few indications that AHL content from C: Interactions and interdependence is included in BHSC NST (BGE), and its presence cannot be reasonably inferred from the broad areas described in the documentation.

D: Continuity and change

There is limited evidence to suggest that SL content from D1.1 DNA replication and D1.2 Protein synthesis is included within BHSC NST (BGE) as there are no references to specific concepts such as transcription. Similarly, SL content from D2.1 Cell and nuclear division cannot be inferred without further reference to concepts such as mitosis, meiosis or cytokinesis. SL content in D4.1 Natural selection is likewise not evident in BHSC NST (BGE), as there are no references to concepts such as competition or selection pressures. Some coverage of D1.3 Mutations and gene editing in BHSC NST (BGE) is indicated through reference to 'mutations'. There are no references to water potential, homeostasis or feedback loops to indicate that SL content from D2.3 Water potential and D3.3 Homeostasis is present BHSC NST (BGE). SL content from D3.1 Reproduction and D3.2 Inheritance is likely present as BHSC NST (BGE) includes 'reproduction' and 'biological inheritance'. D4.2 Sustainability and change is indicated in BHSC NST (BGE) as sustainability, deforestation, bioaccumulation and ecosystem balance are referenced.[133] D4.3 Climate change can similarly be inferred, as BHSC NST (BGE) includes global warming and references climate change directly.[134]

Overall, however, there is little indication that AHL content from D. Continuity and change is covered in BHSC NST (BGE), particularly as much of the content goes beyond what can be reasonably inferred from the broad references in the documentation.

Experimental programme

BHSC NST (BGE) includes students conducting investigations into real-world problems using scientific procedures. Further general competencies are suggestive of planning skills such as developing hypotheses or reaching conclusions and mention laboratory skills such as employing tools. There are also references to examining models, simulations, and prototypes. There are, therefore, some similarities to the DP's experimental programme. However, BHSC NST (BGE) does not detail the specific experiments to be conducted, nor the specific practical skills to be developed. Furthermore, there is no inclusion of anything similar to the DP's collaborative sciences project. As such, it is concluded that BHSC NST (BGE) partially aligns with this component of the DP biology syllabus.

[131] These topics are drawn from the RJRC.
[132] The last two topics are drawn from the RJRC.
[133] Most of these topics are drawn from the RJRC.
[134] The latter topic is drawn from the RJRC.

Other BHSC NST (BGE) Content

There is some biology content in BHSC NST (BGE) that is not present in DP biology, see the following table:

*Table 29: Biology content in BHSC NST (BGE) which is not covered in the DP.**

Significant content which is not included in DP biology
• Environmental policies • Public health

Environmental policies and political considerations feature within BHSC NST (BGE). For instance, students are expected to evaluate the effects of environmental policies and consider political issues in relation to the world's energy needs. Political considerations such as these do not feature in DP biology.

BHSC NST (BGE) includes considerations of infrastructure and basic services such as health care as well as epidemiological processes (the study of the determinants of health and disease). Whilst this may feature in the DP biology topic of vaccination, the area is likely explored in less detail and with less focus on things such as public awareness and education.

Summary

Overall, BHSC NST (BGE) includes some SL content from each of the DP biology themes at most levels. However, SL content from various levels across three of the DP biology themes is not evident – namely A3 Organisms, B3 Organisms, B4 Ecosystems, D1 Molecules, and D2 Cells. The absence of these areas within BHSC NST (BGE) suggests that its biology content has a lower breadth of content in comparison to DP biology. As the coverage of specific biology concepts is often inferred from broad references in the documentation, it cannot be confidently concluded that the depth of biology content in BHSC NST (BGE) is similar to that of DP biology SL. Indeed, the absence of references to specific concepts in BHSC NST (BGE) may indicate that biology topics are not studied to the same degree of depth as DP SL. Lastly, there is very little presence of AHL biology content within BHSC NST (BGE), thus it has a lesser breadth and depth than DP biology HL.

BHSC Natural Sciences and Technology (Formative Itinerary) – BHSC NST (FI)

The primary way high school students can further pursue science is by choosing to specialise in Natural Sciences and Technology in their formative itinerary. The Rio de Janeiro specialisation pathways for NST formative itineraries were consulted to provide examples of the types of content covered in BHSC NST (FI).

The specialisation pathways indicate that some SL content from the following may be included in BHSC NST (FI): A4. Ecosystems, B2. Molecules, B4. Ecosystems, C1. Molecules, C4. Ecosystems, and D4. Climate change. No other SL or AHL content could be identified in the specialisation pathways. This can be attributed to the focus of the formative itinerary component on a particular real-world issue or context, and the emphasis on application of knowledge as opposed to introducing additional content.

Table 30: Biology content in BHSC NST (FI) which is not covered in the DP.

Significant content which is not included in DP biology
There is no additional significant biology content in BHSC NST (FI) that is not included in the DP.

Summary

In conclusion, while formative itineraries are developed by each state, the examples from Rio de Janeiro provide useful insights into the content that these may cover and how this aligns with DP biology. Overall, the content of BHSC NST (FI) does not appear to present a stronger alignment with DP biology content than BHSC NST (BGE), as very few further SL topics and AHL topics could be identified. Instead, BHSC NST (FI) provides an opportunity for students to extensively apply biology (and other science) concepts to a variety of contexts and issues, such as renewable energy sources and sustainable resource consumption. Therefore, the breadth and depth of biology content covered in BHSC NST (FI) is less than that of DP biology HL. The breadth in comparison to DP SL may be similar and, as mentioned previously, the depth cannot be confidently ascertained due to the lesser amount of detail in the documentation.

5.2.7 Demand – Biology

This section considers the alignment between DP biology and BHSC NST in terms of demand. Using the same demand tool for the analysis of each subject, a demand profile was created for DP biology (SL and HL), BHSC NST (BGE), and BHSC NST (FI).

BHSC NST (BGE) represents the demand of biology in basic general education. BHSC NST (FI) represents the cumulative demand of studying biology in basic general education and then specialising in an NST formative itinerary. It should be noted that the scores reflect the demand of the whole NST formative itinerary component, rather than its biology content specifically.

These demand profiles are presented in the form of radar diagrams, with a superimposed diagram featured to enable the immediate visual comparison of all profiles.

Figure 25: Visual representations of subject demand

The panel of experts carried out a detailed analysis of each course and reached a consensus on the scores shown in the profiles above. The following points were particularly important within the panel discussion:

- Regarding the scores for **Bloom's Cognitive Skills**:
  - DP biology has the same learning outcomes for both SL and HL, meaning that these scores are the same. These were judged to merit a score of 3 due to the high

levels of critical thinking, critical awareness and elements of synthesis and creation present in the majority of Aims and Assessment Objective 3.
    - BHSC NST (BGE) was awarded a score of 2.5, as the learning outcomes have a predominant focus on analysis, with some evidence of evaluation and creation/synthesis focused goals (for instance, creating and/or interpreting equations). However, there is insufficient evidence of a strong presence of evaluation and synthesis to warrant a judgement of 3. For BHSC NST (FI), a score of 3 was awarded due to a predominant focus on synthesis, creation and analysis in the skill for NST formative itineraries. Indeed, the formative itinerary component allows for the synthesis of knowledge across science topics, finding innovative approaches to real world issues and project-based work, all of which suggest higher order thinking, warranting a judgement of 3.

- Regarding the score for **Depth of Knowledge**:
    - DP biology SL was deemed to merit a score of 2 for depth of knowledge due to the pre-requisite skills and competences (e.g. interpretation of graphs data, mathematics skills, some chemistry and geography links) required to access the course, as well as the moderate to high level of cognitive complexity of the knowledge that students are expected to acquire. As to the HL course, the greater depth and additional opportunities provided for extended thinking in the additional HL topics pushed the score to a 3.
    - BHSC NST (BGE) was awarded a score of 1 for depth of knowledge. As is the case for other science subjects, the learning outcomes indicate higher order skills (such as making predictions, performing calculations and interpreting results). However, the extent of depth to which biology topics are explored is unable to be confirmed from the broad references used in the documentation. As such, whilst there is potential for some topics to be studied in-depth and require complex reasoning, there is insufficient evidence to warrant a judgment of 2. For BHSC NST (FI), depth of knowledge was judged to merit a score of 2. This was the case because the open ended, project-based nature of this course, as well as its contextualisation in the real world, are suggestive of higher order processing. However, as BHSC NST (FI) does not appear to cover complex science topics, a score of 2, rather than 3, was awarded.

- Regarding the scores for **Volume of Work**:
    - The DP biology SL was judged to comprise a moderate-heavy workload (a score of 2) as students are exposed to multiple biology topics, with each topic being allocated a standard to short amount of time. The volume demands of the HL course, on the other hand, were found to be sufficient to meet a score of 3 – even though the proportion of topics per allocated teaching hour is smaller, these topics are covered in great depth and with a focus on application.
    - BHSC NST (BGE) was awarded a score of 0.5. As with other science subjects, the complexity of the concepts being covered can be uncertain due to the limited detail provided. However, the majority of biology content can be assumed to be more basic than complex. Indeed, there is very limited evidence for a substantial number of complex subtopics and concepts. Therefore, it was decided that there was a

generous time allocation[135] per theme and that this overall represented a light volume of work. For BHSC NST (FI), a score of 1.5 was given. The course has scope for a significant proportion of the time to be spent on issues beyond basic conceptual depth, and the potential for in depth project-based work. Based upon the time allocated to the specialisation component of formative itineraries, the time allocation per theme was judged to be standard. However, the complexity of the content explored is unclear, and may be largely at teacher's discretion. Therefore, the judgement is limited to a 1.5.

- Regarding the scores for **Outstanding Areas of Subject Demand**:
  - For the DP biology SL course (awarded a score of 2), the IA scientific investigation research project that students need to undertake, the linking questions outlined in the syllabus and the collaborative sciences project were considered to be areas of stretch. In addition to the latter, the HL course features additional higher-level topics which were deemed to include additional areas of stretch, meriting a score of 3.
  - BHSC NST (BGE) was given a score of 1 for outstanding areas of demand as the inclusion of debates, real world applications and the investigative approaches were considered to potentially allow for 1 to 2 stretch areas. For BHSC NST (FI), a score of 2 was awarded. The emphasis on the following provided further stretch areas: real-life application, the project-based work, the cross curricular nature of the course, and the opportunities for discussion and debate.

[135] Time allocations were drawn from the RJRC.

5.3 Language and Literature

Below is the list of subjects used in the language and literature subject comparison analysis.

DP language A: language and literature (LA:LL)[136]
DP language A: language and literature (LA:LL) is a subject offered within the DP's language and literature subject group. This subject introduces the critical study and interpretation of written and spoken texts from a wide range of literary forms and non-literary text-types**.** The subject is available at SL and HL, with HL requiring the study of a greater number of literary works and non-literary texts, and a fourth assessment component in the form of an essay.

BHSC Language and Technology – Portuguese Language (Basic General Education)
BHSC LAT-PL (BGE)
In the BHSC, Language and Technology (LAT) is a compulsory area of knowledge for the basic general education (BGE) component of high school. LAT encompasses Portuguese Language, English Language, Art, and Physical Education. The key focus for analysis is the aspects of BHSC LAT relating to Portuguese Language specifically. At high school, Portuguese Language is situated in fields of social action, which is intended to help students make informed choices, take reflective positions, and be guided by the values of democratic society and the State. BHSC LAT-PL (BGE) is based upon the BNCC's specific skills for Portuguese Language,[137] which link to the specific competencies for the LAT area of knowledge.[138] To support the content analysis, the Rio de Janeiro Referential Curriculum (RJRC) has also been consulted to provide additional insight into the typical Portuguese Language content covered in BHSC LAT (BGE).

BHSC Language and Technology (Formative Itinerary)
BHSC LAT (FI)
In addition to Portuguese Language in basic general education, students may choose to specialise in LAT in their formative itinerary – which integrates Portuguese Language, English Language, the Arts, and Physical Education. Formative itineraries (FI) are curricular units which are designed for students to deepen their knowledge and prepare for further studies or careers. BHSC LAT (FI) is based upon the 'Curricular References for the Preparation of Formative Itineraries', which guide the development of this component by each state.[139] Again, the RJRC is consulted to provide further insights into the type of content covered in BHSC LAT (FI).[140]

[136] International Baccalaureate. (2015). *Language A: language and literature.*
[137] Brazil, Ministry of Education. (2018). *5.1.2.1. Portuguese Language in High School: fields of social action, specific competencies and skills.* BNCC*.* Available from: National Common Curricular Base - Education is the Base (mec.gov.br)
[138]Brazil, Ministry of Education. (2018). *5.1. The area of Language and Technology*. BNCC. Available from: National Common Curriculum Base - Education is the Base (mec.gov.br)
[139] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. Available from: Referenciais-Curriculares-para-Elaboracao-de-Itinerarios-Formativos-1-1.pdf (sedu.es.gov.br)
[140] Rio de Janeiro State Government, Department of Education. (2022). *Curricular Organisation of Formative Itineraries*. Available from: Trails (educacao.rj.gov.br).

5.3.1 Learning Outcomes – Language and Literature

This section compares and contrasts the learning outcomes of curricula falling within the category of language and literature. For DP LA:LL, the learning outcome themes were extracted from the language and literature group aims and assessment objectives. BHSC Language and Technology (LAT) learning outcomes are drawn from the specific competencies for LAT and the specific skills for Portuguese Language. For LAT formative itineraries specifically, additional skills are given, which are based on the formative itinerary structuring axes. Moreover, the BHSC also articulates general competencies for high school education which have also been considered when relevant.

The following summary table demonstrates the learning outcome themes that were extracted from DP LA:LL outcomes and indicates if and where they were judged to have presence within the learning outcomes of BHSC LAT (particularly for Portuguese Language).

Table 31: Presence of the DP LA:LL learning outcome themes in BHSC Language and Technology (LAT).

Themes extracted from DP LA:LL learning outcomes	Presence in BHSC Language and Technology (LAT)	
1. Develop knowledge of a wide range of diverse texts and forms		Present in BHSC LAT, as the Portuguese Language skills include a range of literary and non-literary text types.
2. Understand the relationship between context and text		Present in BHSC LAT, as the Portuguese Language skills include considerations of historical, social, geographical, and cultural contexts.
3. Extract meaning and interpret texts		Present in BHSC LAT, as the Portuguese Language skills in include analysing, evaluating, and interpreting meaning.
4. Understand the writer's craft		Present in BHSC LAT, as the Portuguese Language skills include understanding and analysing the choices made by the author/creator and how to use techniques appropriately when producing texts.
5. Formulate and express ideas in a variety of ways		Somewhat present in BHSC LAT, as the Portuguese Language skills expect students to produce a range of texts (both verbal and non-verbal). However, being able to communicate well (in a clear and logical manner) is not explicit.
6. Develop an appreciation of intertextuality and interdisciplinarity		Present in BHSC LAT, as the Portuguese Language skills include establishing and analysing relations of intertextuality and engaging with texts related to other areas of knowledge.
7. Develop an identity through the study of language and literature.		Present in BHSC LAT, as the Portuguese Language skills intend to prepare students to effectively contribute in society, as well as to share with, and relate to, other people.

Key:

	This theme is well-evidenced in the learning outcomes of BHSC LAT		*This theme is partially evidenced in the learning outcomes of BHSC LAT*		*This theme is not evident in the learning outcomes of BHSC LAT*

Presence of the DP's Learning Outcome Themes

There is a high level of alignment between DP LA:LL and BHSC LAT learning outcomes, with most of the DP's themes being well-evidenced in the specific skills for Portuguese Language.

However, it can be noted that the presence of these themes is less clear in the additional LAT formative itinerary (FI) skills. The presence of each DP theme in the BHSC LAT specific competencies and skills is discussed in more detail, followed by a small section regarding the presence in the FI skills.

1. *Develop knowledge of a wide range of diverse texts and forms*

Both the DP LA:LL and BHSC LAT learning outcomes require students to engage with a wide range of texts and forms. Indeed, as with DP LA:LL, BHSC LAT requires students to engage with both literary and non-literary texts. Literary texts in BHSC LAT include significant works of Brazilian literature, as well as other countries and peoples, including Portuguese, indigenous, and African and Latin American authors. Non-literary texts in BHSC LAT include scientific research texts, legal documents, multi-semiotic, journalistic, social media, performances, and others. The texts span a range of media such as digital, video, audio, images, and written. Like DP LA:LL, BHSC LAT requires students to engage with works from different authors, genres and periods of time, so that they enhance their critical and cultural perspectives.

2. *Understand the relationship between context and text*

Similarly to DP LA:LL, BHSC LAT learning outcomes expect students to know and understand the different contexts within which texts are written and received. The specific competencies require students to use their knowledge of different languages and cultural practices with regards to the reception and production of speech, understand how conflicts and power relations impact the social practices of language, and to appreciate different cultural productions, considering their local, regional, and global characteristics. Moreover, several of the skills require students to consider the context of the production. Indeed, the skills include that students should consider multiple perspectives of human and social life of novels and the political and social dimension of texts, as well how contexts may influence the motivations and purposes of legal texts. Finally, the competencies and skills consistently promote awareness and respect of the diversity of perspectives that exist.

3. *Extract meaning and interpret texts*

The DP LA:LL learning outcome theme of extracting meaning and interpreting texts is evidenced in BHSC LAT. Indeed, BHSC LAT involves analysing and evaluating the ways that language can be used to create meaning. For example, the Portuguese Language skills in BHSC LAT involve analysis of how sense effects, speech-related elements, choice of images, use of linguistic-discursive elements, and author-choices generally create meaning. Furthermore, students are expected to show knowledge of meaning in literary texts, perceiving that they can be apprehended differently by individuals and groups. However, it can be noted that the BHSC LAT skills emphasise students' own ability to produce meaning themselves, indicating that these skills are more explicit for this purpose.

4. *Understand the writer's craft*

The learning outcomes of BHSC LAT indicate that, similarly to the DP LA:LL, students are expected to know and understand the elements and techniques that can be used in writing and performance and to analyse their effects. For example, the Portuguese Language skills expect students to know and analyse the effects of speech-related elements, personalisation strategies, Portuguese syntax, elements of performance, sound elements, linguistic variation,

and stylistic devices. However, it can be noted that evaluating the effects of these devices is not as strongly present in BHSC LAT as it is in DP LA:LL.

5. *Formulate and express ideas in a variety of ways*

The DP LA:LL learning outcome theme of formulating and expressing ideas in a variety of ways is somewhat evidenced in BHSC LAT. Indeed, the Portuguese Language specific skills indicate that students are expected to produce texts appropriate to different situations and purposes, and to communicate in various forms, such as written, verbal, and multisemiotic. There is also an expectation that students communicate confidently and collaboratively, such as in debating contexts. However, the ability to communicate in a clear, logical, and persuasive way, in a range of styles and registers, is not highlighted as a key skill to the same degree as it is in DP LA:LL's learning outcomes.

6. Develop an appreciation of intertextuality and interdisciplinarity

The DP LA:LL learning outcome theme of developing an appreciation of intertextuality and interdisciplinarity is well-evidenced in BHSC LAT. Indeed, several of the specific skills for Portuguese Language explicitly expect the establishing and analysing of intertextual and interdiscursive relations, as well as making links with other areas of knowledge through engaging with oral, written, and multisemiotic scientific dissemination texts.

7. *Develop identity through the study of language and literature*

The DP LA:LL learning outcome theme of developing an identity through the study of language and literature is well-evidenced in BHSC LAT. Indeed, at high school, the specific skills for Portuguese Language are designed to enable students' contribution to social transformation. As such, they include an expectation that studies in Portuguese Language will equip students to act autonomously, exercise critical thinking, ownership, conflict resolution, and to think flexibly, with respect for others' diverse opinions. Moreover, some skills are organised under 'Field of personal life', which will serve as support for "the processes of identity construction".[141] Also, similarly to DP LA:LL learning outcomes, BHSC LAT places importance on developing an enjoyment of language and literature.

Presence of the DP's Learning Outcome Themes in the FI Skills

While it is concluded that there is a strong presence of DP LA:LL learning outcomes themes in BHSC LAT generally, it can be noted that the skills for LAT formative itineraries have less evidence of the learning outcome themes. Indeed, there is a less explicit focus on studying texts in the FI skills, which may reflect the integrated nature of LAT formative itineraries – which encompass the study of English Language, Art, and Physical Education, as well as Portuguese Language. That said, it can be noted that the FI skills include investigation and research, problem-solving, consideration of global and local issues, engagement with different media, and reference the investigation and analysis of organisation and the effects of meaning.

Other Themes in BHSC LAT Learning Outcomes

While many of the BHSC LAT competencies and skills relate to the DP LA:LL learning outcomes themes, the strong emphasis on social action in Portuguese Language skills in high

[141] Brazil, Ministry of Education. (2018). *5.1.2.1. Portuguese Language in High School: fields of social action, specific competencies and skills.* BNCC.

school can be noted. Indeed, the skills are organised into fields of social action (and are often related to promoting human rights, advocacy, equality, and diversity). While similar themes are present in the DP generally, the BHSC's approach of studying language through the lens of social action is unique.

Furthermore, while both include the development of writing skills, there seems to be a more explicit requirement in BHSC LAT for students to produce a range of different texts, such as stories, scripts, scientific reports, and news reports. In contrast, the writing skills in DP LA:LL are more explicitly focused on producing analysis and essays regarding the texts being studied.

Summary

Overall, there is strong alignment between the learning outcomes of DP LA:LL and those of BHSC LAT (focusing on Portuguese Language). Indeed, BHSC LAT learning outcomes also require the development of reading, writing, speaking and listening skills, and expect students to study a broad range of texts, consider wider contexts and their influence, understand and analyse authors' choices, develop an appreciation of intertextuality and interdisciplinarity, and to develop their identity through the study of language and literature. However, it can be noted that communicating in a clear and logical manner is less explicitly emphasised in BHSC LAT than it is in the DP. Furthermore, the Portuguese Language skills in BHSC LAT differ to in DP LA:LL learning outcomes by considering different 'fields of social action' and also by having a stronger requirement for students to produce, as well as study, a range of different text types.

Finally, it can be noted that the evidence for BHSC LAT's alignment with DP LA:LL learning outcomes primarily comes from the specific skills for Portuguese Language, rather than the FI skills. This is likely due to the integrated nature of a LAT formative itinerary, which results in a lesser focus on the study of texts.

5.3.2 Content – Language and Literature

This section compares the content of DP LA:LL with BHSC LAT – focusing on Portuguese Language in the latter. For the content analysis of BHSC LAT, several sources have been used. For BHSC LAT-PL (BGE), the BNCC's specific competencies for LAT and specific skills for Portuguese Language have been used, as well as the Rio de Janeiro Referential Curriculum (RJRC) for Portuguese Language in basic general education. For the analysis of BHSC LAT (FI), Rio de Janeiro's specialisation pathways for LAT formative itineraries have been used. To support the visual comparison at-a-glance, content from the DP, BNCC, and RJRC are presented in the following diagrams.

Figure 26: DP language A: language and literature content visualiser

Areas of exploration	**Readers, Writers and Texts**	Why and how do we study language and literature?	How are we affected by texts in various ways?	In what ways is meaning constructed, negotiated, expressed and interpreted?	How does language use vary amongst text types and amongst literary forms?	How does the structure or style of a text affect meaning?	How do texts offer insights and challenges?
	Time and Space	How important is the cultural or historical context to the production and reception of a text?	How do we approach texts from different times and cultures to our own?	To what extent do texts offer insight into another culture?	How does the meaning and impact of a text change over time?	How do texts reflect, represent or form a part of cultural practices?	How does language represent social distinctions and identities?
	Intertextuality: Connecting Texts	How do texts adhere to and deviate from conventions associated with literary forms or text types?	How do conventions and systems of reference evolve over time?	In what ways can diverse texts share points of similarity?	How valid is the notion of a classic text?	How can texts offer multiple perspectives of a single issue, topic or theme?	In what ways can comparison and interpretation be transformative?
Literary works (four for SL and six for HL)	Literary texts should take into account the following considerations:	Authors	Literary forms	Period	Place		
Non-literary texts	Non-literary texts should:	Be extended, full-length major non-literary texts or groups of shorter non-literary texts that share the same text type and authorship.		Have time allocated to them such that there is a balance with the time spent on literary works within each area or in the course as a whole.			

Figure 27: Visualiser of BHSC Language and Technology. (Source -BNCC).

Language and Technology			
Specific Competencies			
1. Understand how different languages and practices work culturally (artistic, bodily and verbal) and mobilize this knowledge in the reception and production of speeches in the different fields of social activity and in the various media, to expand the forms of social participation, the understanding and possibilities of explanation and critical interpretation of the reality and to keep learning.	2. Understand the identity processes, conflicts and power relations that permeate the social practices of language, respecting the diversity and plurality of ideas and positions, and to act socially on the basis of principles and values based on democracy, equality and Human Rights, exercising self-knowledge, empathy, dialogue, conflict resolution and cooperation, and combating prejudices of any nature.	3. Use different languages (artistic, bodily and verbal) to exercise, with autonomy and collaboration, protagonism and authorship in personal life and critically, creatively, and ethically, defending points of respect for others and promote human rights, human conscience and responsible consumption, at the local, regional and global levels.	4. Understand languages as a (geo)political, historical, cultural, social, variable, heterogeneous and sensitive to the contexts of use, recognizing varieties and experiencing them as forms of identity expressions, personal and collective actions, as well as acting in the face of prejudice of any nature.
Specific Skills*			
EM13LGG101 - EM13LGG105	EM13LGG201 - EM13LGG204	EM13LGG301 - EM13LGG305	EM13LGG401 - EM13LGG403
Specific Competencies (continued)			
5. Understand the processes of production and negotiation of meanings in the bodily practices, recognizing and experiencing them as forms of expression of values and identities, with a democratic perspective and respect for diversity.	6. Aesthetically appreciate the most diverse artistic and cultural productions, considering their local, regional and global characteristics, and mobilize their knowledge of artistic languages to give meaning and (re)construct individual and collective authorial productions, exercising protagonism in a critical and creative way, with respect for diversity of knowledge, identities and cultures.	7. Mobilise language practices in the digital universe, considering the technical, critical, creative, ethical, and aesthetic dimensions, to expand the ways of producing meanings, of engaging in authorial practices and to learn how to learn in the fields of science, culture, work, information and personal and collective life.	
Specific Skills*			
EM13LGG501 - EM13LGG503	EM13LGG601 - EM13LGG604	EM13LGG701 - EM13LGG704	

*The BNCC describes skills for Portuguese Language specifically, hence the Specific Skills for the whole Language and Technology area of knowledge are not a key focus for comparison to DP LA:LL. The following figure visualises the organisation of Portuguese Language specific skills in the BNCC.

Figure 28: Visualiser of Portuguese Language specific skills in the BNCC

Fields of Social Action					
All Fields	Field of Personal Life	Field of Action in Public Life	Field of Study and Research Practices	Journalistic-media Field	Artistic-literary Field
Specific Skills*					
EM13LP01-EM13LP18	EM13LP19-EM13LP22	EM13LP23-EM13LP27	EM13LP28-EM13LP35	EM13LP36- EM13LP45	EM13LP46- EM13LP54

*See Appendix D for the Specific Skills in full detail.

Figure 259: Visualiser of Portuguese Language/Language and Technology content in the Rio de Janeiro high school curriculum (RJRC)

Basic General Education	Formative Itinerary		
Portuguese Language (based on the BNCC and organised using the Specific Competencies and Skills for Language and Technology and Portuguese Language)	**Integrated Core**	**Specialisation Pathways for Language and Technology**	
	Life Project	**Media: Language in Action** Curricular components:	**Language in Movement** Curricular components:
	Elective 1	What's going on out there?	Always on the Move!
	Elective 2	Keeping an Eye on the Digital Network	In the Activity!
	Elective 3 (from the Catalogue of Electives, such as for Language and Technology)	Action! It's in Your Hands!	Language Beyond Words: Practices for Existing

Structure

The BHSC contains a compulsory area of Language and Technology (LAT), which encompasses Portuguese Language, English Language, physical education, and art. Portuguese Language specifically must be studied in all years of Brazilian high school.

DP LA:LL is offered at SL and HL, with the latter involving the study of more texts. In contrast, the BHSC does not offer an option to specialise in language and literature specifically. Indeed, in addition to Portuguese Language as part of basic general education (BHSC LAT-PL (BGE)), the BHSC offers the options to specialise in a LAT formative itinerary (BHSC LAT (FI)) which integrates the subjects mentioned above.

Subject content in DP LA:LL is primarily guided by three overlapping, conceptual areas of exploration: the nature of interactions between readers, writers and texts; the way texts interact with time and space; and intertextuality, meaning how texts interact with one another. Each area of exploration includes a list of guiding conceptual questions for consideration. For example, in the 'readers, writers and texts' area of exploration, it is suggested that students understand 'Why and how […] we study language and literature.'

In comparison, BHSC LAT-PL (BGE) content is organised into five fields of social action – namely personal life, public life, study and research practices, journalistic-media, and artistic-literacy. Content is presented as skills, which are categorised into one of these fields, or identified as applicable to all of them. Each skill relates to one, or several, BHSC LAT specific competencies. Thus, content is defined on a more granular level for BHSC LAT (BGE), compared to the broader and conceptual approach the DP takes through the use of guiding conceptual questions.

Moreover, BHSC LAT (FI) also differs to the organisation of DP LA:LL by organising content into curricular components. As an example, Rio de Janeiro offers two specialisation pathways for LAT formative itineraries – namely Media: Language in Action and Language in Movement – with each pathway being broken down into three curricular components (see figure 29).

In addition, DP LA:LL requires teachers to select either four (for SL) or six (for HL) literary texts from a range of criteria including author, literary form, period, and place. In contrast, BHSC LAT does not prescribe the number of literary texts which should be studied, or further quantitative criteria, though the content (particularly for BHSC LAT-PL (BGE)) indicates that texts should span different authors, literary forms, periods, and places.

With regards to non-literary texts, for DP LA:LL students must study extended, full-length major non-literary texts or groups of shorter, non-literary texts; and these must be balanced equally against literary texts, and may include forms such as infographics, screenplays, and works of art. BHSC LAT requires students to also study a range of non-literary texts, however, it is not specified what proportion of time should be allocated to literary and non-literary texts.

Content Alignment

To complement the analysis, the following table represents a simplified summary of the content alignment that BHSC LAT-PL (BGE) and BHSC LAT (FI) have with DP LA:LL. While the guiding conceptual questions in DP LA:LL are not prescribed or explicitly assessed,

considering whether these are indicated to be present in the BHSC helps assess the extent to which each area of exploration may be considered generally.

Table 32: Summary of the content alignment that BHSC LAT has with the guiding conceptual questions in DP LA:LL.

DP language A: language and literature – areas of exploration and guiding questions	Presence in BHSC LAT-PL (BGE)	Presence in BHSC LAT (FI)*
Areas of exploration – readers, writers and texts		
Why and how do we study language and literature?		
How are we affected by texts in various ways?		**
In what ways is meaning constructed, negotiated, expressed, and interpreted?		
How does language use vary amongst text types and amongst literary forms?		
How does the structure or style of a text affect meaning?		
How do texts offer insights and challenges?		
Areas of exploration – time and space		
How important is the cultural or historical context to the production and reception of a text?		
How do we approach texts from different times and cultures to our own?		
To what extent do texts offer insight into another culture?		
How does the meaning and impact of a text change over time?		
How do texts reflect, represent or form a part of cultural practices?		**
How does language represent social distinctions and identities?		
Areas of exploration – intertextuality: connecting texts		
How do texts adhere to and deviate from conventions associated with literary forms or text types?		
How do conventions and systems of reference evolve over time?		
In what ways can diverse texts share points of similarity?		
How valid is the notion of a classic text?		
How can texts offer multiple perspectives of a single issue, topic or theme?		
In what ways can comparison and interpretation be transformative?		

Key:

	Strong presence of this guiding question in BHSC LAT.		*Partial presence of this guiding question in BHSC LAT.*		*Little or no presence of this guiding question in BHSC LAT.*

* Content alignments found for basic general education (BGE) are carried forwards and combined with, where applicable, new alignments found in the formative itinerary (FI), to represent the cumulative content covered.
** Represents where the documentation indicates that the formative itinerary specifically includes some similar content from this DP topic.

BHSC Language and Technology – Portuguese Language (Basic General Education)

The conceptual nature of the DP LA: LL subject content encourages students to think metacognitively about the discipline to a greater extent than what is explicitly articulated in BHSC LAT-PL (BGE). However, the skills indicate that some of the guiding questions are likely to be considered across all areas of exploration in DP LA:LL. The following discusses in more detail the alignment that BHSC LAT-PL (BGE) has with each area of exploration within DP LA:LL.

Area of exploration – readers, writers, and texts

Content in BHSC LAT-PL (BGE) reflects some strong similarities with the DP LA:LL's readers, writers, and texts area of exploration. Indeed, BHSC LAT-PL (BGE) involves the analysis of a broad range of texts and literary forms, to include poems, novels, short-stories, articles, essays, infographics, scientific reports, speeches, news reports, documentaries, podcasts, scripts, advertising and political campaigns, and legal and normative texts, as well as multi-modal texts. Students must read, and sometimes produce, these text types, therefore it is clear that students will be addressing the conceptual question 'How does language use vary amongst text types and amongst literary forms?'. Moreover, BHSC LAT-PL (BGE) includes that students will consider how choices made by the creator, such as sound elements, use of images, personalisation strategies, grammatical devices, expressive language, linguistic variation, and the style and structure, will construct and affect the meaning of these works, thus aligning with the guiding questions 'In what ways is meaning constructed, negotiated, expressed and interpreted?' and 'How does the structure or style of a text affect meaning?'.

Area of exploration – time and space

The content of BHSC LAT-PL (BGE) reflects some similarities with the DP LA:LL's time and space area of exploration. Indeed, BHSC LAT-PL (BGE) requires students to study texts from a range of historical periods and cultures, including Brazilian, Portuguese literature, indigenous peoples, Latin American and African. However, it can be noted that this range is only explicitly described within the artistic-literary field, which may mean that this specific range only applies to literary texts, rather than other literary and non-literary texts, as in DP LA:LL. Regardless, the skills in BHSC LAT-PL (BGE) clarify that students are expected to consider the socio-historical context of the production and reception of all texts. Overall, the skills imply, at least implicitly, that students will become aware of the importance of historical and cultural context.

Moreover, the skills in BHSC LAT-PL (BGE) involve the consideration of contextual and cultural references through analysing authors' choices, exploring environmental, social, political issues through texts, and exploring how literature and art are developed over time, which aligns with the DP's guiding question 'How do texts reflect, represent or form part of cultural practices?'.

Moreover, the parameters for curricular organisation/progression for the artistic-literary field of action state that works from different historical periods should be "apprehended in synchronic and diachronic dimensions",[142] which implies there is some alignment with the DP LA:LL guiding question 'How does the meaning and impact of text change over time?'. Furthermore,

[142] Brazil, Ministry of Education. (2018). *5.1.2.1. Portuguese Language in High School: fields of social action, specific competencies and skills.* BNCC.

the texts from different cultures in the artistic-literary fields means that students may consider the guiding questions 'How do we approach texts from different times and cultures to our own?' and 'To what extent do texts offer insight into another culture?'.

Area of exploration – intertextuality: connecting texts

The skills in BHSC LAT-PL (BGE) explicitly require students to analyse relationships of intertextuality and interdiscursivity which will allow for "explanations of dialogical relationships, the identification of positions or perspectives..."[143], thus there is some alignment with this area of exploration in the DP. Indeed, this indicates alignment with the guiding questions 'How do texts adhere to and deviate from conventions associated with literary forms or text types?' and 'How can texts offer multiple perspectives of a single issue, topic or theme?'. Furthermore, students are likely to consider intertextuality in the journalistic-media and artistic-literary fields of BHSC LAT-PL (BGE), as these involve comparing multiple perspectives of events and issues, as well as relations between works by different authors and literary genres.

There is an indication of partial alignment with some of the other conceptual guiding questions in this DP LA:LL area of exploration. Indeed, there is partial alignment with 'How do conventions and systems of reference evolve over time?', as a skill in the artistic-literary field of BHSC LAT-PL (BGE) states "Analyse intertextual and interdiscursive relations between works… of the same historical moment and different historical moments, exploring the ways in which literature and the arts in general are constituted… and feed back into each other".[144] Furthermore, the skills in BHSC LAT-PL (BGE) indicate that some of the ways in which comparison and interpretation is transformative could be considered, such as how they impact the readers' interpretation and position. Moreover, there is some evidence in the skills that students will consider and draw out points of similarity from different texts.

Other BHSC LAT-PL (BGE) Content

There are a few areas of content which have more presence in BHSC LAT-PL (BGE) than in DP LA:LL, see table below.

Table 33: Language and literature content in BHSC LAT-PL (BGE) which is not covered in DP LA:LL.

Significant content which is not included in DP LA: LL
• Concept of curation and how information is curated online • There is a more explicit requirement for students to produce a range of different text-types E.g. scripts, articles, reports, videos, infographics, book and film reviews, oral texts and multisemiotic texts • More explicit requirement for students to participate in activities such as debates, social events, clubs, meetings at school, and campaigns • More content regarding students' personal life e.g. preparing for careers, introducing self on various platforms, and sharing interests with others • A higher emphasis on students using software and technological tools • Engaging in potential solutions for problems affecting the community • Phenomenon of post-truth

[143] Ibid.
[144] Ibid.

Summary

Altogether, DP LA:LL promotes greater depth in content, particularly through encouraging students to think metacognitively about the subject. However, BHSC LAT-PL (BGE) content may allow depth of thought in aspects of language and literature which align with the areas of exploration in DP LA:LL. Indeed, BHSC LAT-PL (BGE) includes content which will allow students to analyse a broad range of text-types and consider how language varies between these, how meaning is constructed, the choices made by the author, historical and cultural contexts, different perspectives, and intertextual and interdiscursive relationships. Regarding text choice, DP LA:LL is more prescriptive in what reading is allowed, though BHSC LAT-PL (BGE) indicates that a similarly broad range of text-types will be considered, to also include different authors, genres, cultures, periods, and places.

BHSC Language and Technology (Formative Itinerary) – BHSC LAT (FI)

In addition to basic general education, students may continue to engage with Portuguese Language content as part of a formative itinerary specialising in LAT. Along with the BHSC, the Rio de Janeiro curriculum (RJRC) is consulted to provide examples of the type of content covered in BHSC LAT (FI).

Rio de Janeiro offers two specialised pathways for LAT formative itineraries, namely ‘Media: Language in Action’ and ‘Language in Movement’. Generally, most of the content in these specialised pathways does not align with DP LA:LL. Indeed, as LAT formative itineraries also encompass art, physical education, and English language, a significant amount of content does not involve the study of language through the analysis of literary and non-literary texts. Instead, students may learn how technology can be used for art, the elements of dance, how language and expression is communicated through the body, body art, theatrical dramatization, physical activities, and so on.

That said, some of the content in ‘Media: Language in Action’ does align with a few of the DP’s guiding questions. For example, students are required to consider how media has influenced eating disorders and self-image, which draws some similarity with the DP LA:LL guiding question ‘How do texts affect us in various ways?’. Moreover, there is evidence that students may consider ‘How do texts reflect, represent or form a part of cultural practices?’ as the curricular components include consideration of how the internet has affected writing, analysing works of literature from peoples of different cultures, and how literature and culture interact in the present.

Finally, it can be noted that the specialisation pathways do not appear to cover any significantly different language and literature content to DP LA:LL.

Table 34: Language and literature content in BHSC LAT (FI) that is not covered in DP LA:LL.

Significant content which is not included in DP LA:LL
Whilst BHSC LAT (FI) covers content from subjects such as art and physical education, no significantly different language and literature content to DP LA:LL is covered.

Summary

The specialisation pathways from Rio de Janeiro indicate that BHSC LAT (FI) content does not increase alignment with DP LA:LL compared to what is observed for BHSC LAT-PL (BGE).

Indeed, LAT formative itineraries are broader than the focus of DP LA:LL, encompassing Portuguese Language, physical education, art, and English language, thus there is a lesser emphasis on continuing to analyse literary and non-literary texts. However, it can be noted that some of the curricular components in BHSC LAT (FI) may provide some opportunity to analyse texts, but to a significantly lesser extent and depth than DP LA:LL HL.

5.3.3 Demand – Language and Literature

This section considers the alignment between DP LA:LL and BHSC LAT in terms of demand. Using the same demand tool for the analysis of each subject, a demand profile was created for DP LA:LL SL, DP LA:LL HL, BHSC LAT-PL (BGE), and BHSC LAT (FI).

The demand profile for BHSC LAT-PL (BGE) represents the demand of Portuguese Language in basic general education. The BHSC LAT (FI) demand profile represents the cumulative demand of Portuguese Language in basic general education and LAT formative itineraries.

These demand profiles are presented in the form of radar diagrams, with a superimposed diagram featured to enable the immediate visual comparison of all profiles.

Figure 30: Visual representations of subject demand.

The panel of experts carried out a detailed analysis of each course and reached a consensus on the scores shown in the profiles above. The following points were particularly important within the panel discussion:

- Regarding the scores for **Bloom's Cognitive Skills:**
  - DP LA:LL has the same learning outcomes for both SL and HL, meaning that these scores are the same. The DP subjects were judged to show a elements of sophisticated metacognition, and also indicated that some evaluation and

synthesis was present. However, these elements were often found to be implicit (rather than explicit) in both cases, with the majority of learning outcomes focusing explicitly on analysis, application, knowledge and understanding. A score of 2 was provided to both.

- For BHSC LAT-PL (BGE), the learning outcomes focused primarily on analysis, with examples such as analysing texts, relationships, and arguments. There was also some evidence of evaluation, synthesis, and creation, such as through evaluating the reliability of sources and producing different types of texts, sometimes drawing from multiple sources to do so. Overall, this resulted in a score of 2. For BHSC LAT (FI), a score of 2.5 was deemed appropriate, as the skills indicated further requirements to synthesise and create, such as through supporting hypotheses and conclusions using multiple sources and proposing solutions to problems.

- Regarding the scores for **Depth of Knowledge:**
  - The DP LA:LL SL was judged to merit a score of 2, as it was found to provide many opportunities for strategic thinking. Moreover, the subject content encourages conceptual thinking of language as a subject, and there is also evidence of some extended thinking. For DP LA:LL HL, the long-term reflective nature of the HL essay – which is based on the exploration carried out throughout the course in the learner portfolio – was found to feature a significant component of extended thinking, pushing the score to a 3.
  - BHSC LAT-PL (BGE) was awarded a 2, as it was found to provide sufficient opportunities for learners to engage in thinking beyond recall and application. Indeed, the requirements to analyse, participate in debates, take critical positions, produce texts to disseminate research, and to make well-rounded decisions all indicated that strategic thinking was embedded in learning. There was not enough evidence that extended strategic thinking was consistently used, therefore a 2, rather than 3 was awarded. For BHSC LAT (FI), a score of 2 was also awarded, on the same basis that it presented mostly opportunities for short-term strategic thinking, with some opportunities for extended strategic thinking, such as problem-solving and research projects.

- Regarding the scores for **Volume of Work:**
  - DP LA:LL SL was judged to comprise a moderate-heavy workload, warranting a score of 2, as students are expected to engage with a high number of themes and spend a significant proportion of their time on issues beyond basic conceptual depth, including complex multidisciplinary concepts. For the DP LA:LL HL, the panel agreed on a volume of work demand score of 2.5 due to the higher number of texts studied (compared to the SL) and the addition of the HL essay. The proportion of time spent on complex reasoning was judged to push the volume of work score into a 2.5.
  - For BHSC LAT-PL (BGE), a score of 1 was deemed appropriate, which recognised that there was a considerable amount of time to cover the themes, but that these often had an element of conceptual complexity.[145] The amount of time allocated to a LAT formative itinerary was deemed very generous, thus bringing the score down

[145] Time allocations were drawn from the RJRC.

to 0.5 for BHSC LAT (FI) (a score of 0 was not deemed suitable due to the level of cognitive complexity required by the tasks).

- Regarding the scores for **Outstanding Areas of Subject Demand:**
  - A score of 2 (3-4 stretch areas) was awarded to the DP LA:LL SL due to the significant presence of challenging guiding questions in the subject guide – providing frequent opportunities for higher order thinking – the expansive and exploratory nature of the syllabus, and because students may explore different schools of thought and interrogate the development of texts over time. For the DP LA: LL HL, it was found that the HL essay and the requirement to explore an additional translated text pushed it to a score of 3.
  - A score of 0 was given to both BHSC LAT-PL (BGE) and For BHSC LAT (FI). While the panel discussed that there was scope in the curriculum for teachers to create challenge for high-achieving students, it was decided that there was no *required* area or aspect that had demand beyond the typical scope of an upper-secondary language and literature course.

5.4 History

Below is the list of subjects used in the history subject comparison analysis.

DP history[146]
History is a subject option within the Individuals and societies subject group in the DP. History is available at SL and HL, with HL also requiring an in-depth study of three sections from one of the HL regional options and an additional exam based on this content. This subject aims to look at various perspectives and types of history (political, economic, social and cultural) in order to develop students' understanding about the past, which in turn will deepen their understanding about society and the world today.

BHSC Applied Human and Social Sciences (Basic General Education) – BHSC AHSS (BGE)
In the BHSC, Applied Human and Social Sciences (AHSS) is a compulsory area of knowledge for the basic general education (BGE) component of high school. AHSS encompasses history, geography, philosophy, and sociology. At high school, AHSS is intended to develop students' ability to establish dialogues between different individuals and social groups, so that they will be accepting of others and conduct themselves ethically in society. BHSC AHSS (BGE) is based upon the specific competencies and skills prescribed by the BNCC.[147] To support the content analysis, the Rio de Janeiro Referential Curriculum (RJRC) has also been consulted to provide additional insight into the typical history topics and subtopics covered in BHSC AHSS (BGE).[148]

BHSC Applied Human and Social Sciences (Formative Itinerary) – BHSC AHSS (FI)
In the BHSC, Applied Human and Social Sciences (AHSS) is an area of knowledge that students may choose to specialise in for their formative itinerary component of high school. Formative itineraries (FI) are curricular units which are designed for students to deepen their knowledge and prepare for further studies or careers. BHSC AHSS (FI) is based upon the 'Curricular References for the Preparation of Formative Itineraries', which guide the development of this component by each state.[149] Again, the RJRC is consulted to provide further insights into the type of content covered in BHSC AHSS (FI).[150]

5.4.1 Learning Outcomes – History

This section compares and contrasts the learning outcomes of curricula falling within the category of history.

[146] International Baccalaureate. (2015). *History guide*.
[147] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills*. BNCC. Available from: National Common Curricular Base - Education is the Base (mec.gov.br)
[148] Rio de Janeiro State Government, Department of Education. (2022). *History*. High School Referential Curriculum for the State of Rio de Janeiro. p. 106-109. Available from: https://novoensinomedio.educacao.rj.gov.br/pdfs/curriculo.pdf
[149] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. Available from: Referenciais-Curriculares-para-Elaboracao-de-Itinerarios-Formativos-1-1.pdf (sedu.es.gov.br)
[150] Rio de Janeiro State Government, Department of Education. (2022). *Curricular Organisation of Formative Itineraries*. Available from: Trails (educacao.rj.gov.br).

For DP history, the learning outcome themes were extracted from the Individuals and societies group aims, and the history aims and assessment objectives. BHSC Applied Human and Social Sciences (AHSS) learning outcomes are presented as specific competencies and specific skills. For AHSS formative itineraries specifically, additional skills are given, which are based on the formative itinerary structuring axes. Moreover, the BHSC also articulates general competencies for high school education which have also been considered when relevant.

The following summary table demonstrates the learning outcome themes that were extracted from DP history and indicates if and where they were judged to have presence within the learning outcomes of BHSC Applied Human and Social Sciences (AHSS).

Table 35: Presence of DP history learning outcome themes in BHSC Applied Human and Social Sciences (AHSS)

Themes extracted from DP history learning outcomes	Presence in BHSC Applied Human and Social Sciences (AHSS)	
1. Develop knowledge and understanding of wide-ranging historical contexts		Present in BHSC AHSS, particularly specific competencies 2 and 4
2. Critical study or evaluation of diverse sources		Present in BHSC AHSS, particularly Competencies 1,3, and 6 and the FI skills
3. Engage with multiple perspectives and interpretations		Present in BHSC AHSS, particularly specific competencies 1,3, and 4
4. Metacognition and understanding of the self and the present day		Not directly present in BHSC AHSS, however, there is reference to developing an understanding of processes through different times and positioning oneself in relation to them.
5. Formulate arguments through synthesis, analysis, and application		Present in BHSC AHSS, particularly specific competencies 2 and 3 and the FI skills
6. Reflect on the nature of history, including methods and theories		No evidence found of similar reflection within BHSC AHSS.

Key:

	This theme is well-evidenced in the learning outcomes of BHSC AHSS		*This theme is partially evidenced in the learning outcomes of BHSC AHSS*		*This theme is not evident in the learning outcomes of BHSC AHSS*

Presence of the DP's Learning Outcome Themes

There is a good alignment between DP history and BHSC AHSS learning outcomes, with most of the DP's themes being well-evidenced in the specific competencies and specific skills of AHSS, and sometimes further demonstrated in the additional skills for the formative itinerary (FI). The presence of each DP theme is discussed by the following in more detail.

1. Develop knowledge and understanding of wide-ranging historical contexts

The DP's theme of developing knowledge and understanding of wide-ranging historical contexts is strongly evidenced in BHSC AHSS learning outcomes, with the latter referring to understanding of "the formation of territories and borders in different times and spaces" and "the relations of production, capital and work in different territories, contexts and cultures."[151]

[151] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills.* BNCC.

Even if not always directly referenced in the specific competencies for BHSC AHSS, the presence of knowledge and understanding of a wide range of historical contexts is strongly implied through the requirement for students to use higher-order thinking skills that require this knowledge as a foundation. As for FI skills, evidence of this theme can be seen in examples such as "Identify and explain situations involving conflicts, imbalances and threats".[152]

2. Critical study or evaluation of diverse sources

This DP history theme of critical study and evaluation of diverse sources is evidenced within BHSC AHSS and can be seen in multiple specific competencies. For example, specific competency 1 requires students to "Analyse political, economic, social, environmental and cultural processes",[153] which necessitates engagement with sources that cover a wide range of content. Similarly, specific competency 3 asks students to "Analyse and critically evaluate the relationships of different groups, peoples and societies",[154] thus students are expected to critically engage with different perspectives.

Furthermore, when looking at the FI skills, further evidence of this theme can be found in skills which state, "considering data and information available in different media" and "Select and systematize, based on studies and/or research in reliable sources".[155] Critical study, analysis and evaluation is, thus, an area of focus within BHSCC AHSS, demonstrating strong alignment with this DP theme.

3. Engage with multiple perspectives and interpretations

The DP theme of engaging with multiple perspectives and interpretations is also well referenced in BHSC AHSS. Indeed, specific competencies 1 and 3 requiring students to consider different points of view and to make decisions based on arguments and sources, as well as to "Analyse and critically evaluate the relationships of different groups, peoples and societies".[156]

Further reference to this theme in the FI skills is limited but can be observed in examples that state students should be "considering data and information available in different media" and "identifying the different points of view".[157]

4. Metacognition and understanding of the self and the present day

Evidence to support that this DP history theme is present within BHSC AHSS is relatively limited and, although the ethos of the theme may be implicitly present in the specific competencies and specific skills, there is only one reference which directly relates to this theme. Indeed, specific competency 1 refers to understanding "political, economic, social, environmental and cultural processes at the local, regional, national and global levels at

[152] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. p.13.
[153] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills.* BNCC.
[154] Ibid.
[155] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries.* p.11.
[156] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: specific competencies and skills*. BNCC.
[157] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries.* p. 11.

different times."[158] Although not directly referencing oneself, this competency does require the student to show an understanding of a number of different contexts across different times and how they interact with one another.

Moreover, within the FI skills, there is further evidence that could be indicative of this theme, without showing direct reference to it. This can be seen in references such as "contextualising knowledge in its local reality" or "based on respect for differences, listening, empathy and socio-environmental responsibility".[159] Therefore, there is at least partial presence of this theme in BHSC AHSS, with similar types of skills being demanded of students.

5. Formulate arguments through synthesis, analysis, and application

This DP history theme is well evidenced within BHSC AHSS learning outcomes. Indeed, specific competency 3 requires students to "Analyse and critically evaluate the relationships of different groups, peoples and societies with nature and their economic and socio-environmental impacts, with a view to proposing alternatives".[160] By asking the student to propose alternatives, this competency requires them to build an argument around why their proposed alternative would be appropriate. Analysis and evaluation are also required throughout many of the specific skills for BHSC AHSS.

Moreover, this theme is further referenced in FI skills, with direct reference to arguments. Indeed skill EMIFCHSA03 states "positioning oneself through argumentation, taking care to cite the sources of resources used in the research and seeking to present conclusions."[161] Therefore, there is a clear link to the DP history theme.

6. Reflect on the nature of history, including methods and theories

The DP history theme of reflection on the nature of history is not explicitly found within BHSC AHSS. Indeed, there is no direct reference to reflection in the specific competencies and skills or the additional skills for formative itineraries.

Other Themes in BHSC AHSS Learning Outcomes

As BHSC AHSS applies to a broader area of knowledge than DP history, there are several wider themes that are not found in DP history to the same extent. As an example, specific competency 5 states, "Identify and combat various forms of injustice, prejudice and violence, adopting ethical, democratic, inclusive and supportive principles, and respecting Human Rights".[162] This may be covered within the content of the DP, but it is not a skill or knowledge area that is explicitly shown in the history themes extracted from the DP. Furthermore, the FI skills have a specific focus placed on offering solutions and mediation of problems – a component that is not explicitly outlined in the DP history learning outcomes.

[158] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: specific competencies and skills*. BNCC.
[159] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries* p. 13.
[160] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: specific competencies and skills*. BNCC.
[161] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. p. 11.
[162] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: specific competencies and skills*. BNCC.

Summary

Overall, there is a high level of alignment between DP history and BHSC AHSS with regards to learning outcomes. Both seek to develop similar skills, including analysis, critical evaluation, and an understanding of various historical contexts and times. Though broadly they share very similar learning outcome themes, it can be noted that the FI skills have a greater focus on proposing mediation and intervention strategies than DP history.

5.4.2 Content – History

This section compares the history content of DP history and BHSC AHSS. For the content analysis of BHSC AHSS, several sources have been used. For BHSC AHSS (BGE), the BNCC's specific competencies and specific skills for AHSS have been used, as well as the Rio de Janeiro Referential Curriculum (RJRC) for history in basic general education. For the analysis of BHSC AHSS (FI), Rio de Janeiro's specialisation pathways for AHSS formative itineraries have been used. To support the visual comparison at-a-glance, content from the DP, BNCC, and RJRC are presented in the following diagrams.

Figure 31: DP history content visualiser

Prescribed subjects		World history topics		HL options: Depth studies		Investigation
1. Military leaders	Genghis Khan (c1200-1227) Richard I of England (1173-1199) Leadership Campaigns Impact	**1. Society and economy (750-1400) - Content and Context**	Society and economy Cultural and intellectual developments Religion and society	**1. History of Africa and the Middle East**	18 topics ranging from 750-2005 across a range of concepts and themes	**A historical investigation into a topic of their choice**
		2. Causes and effects of wars (750-1500) - content and context	Types and causes of conflicts Course, practices and outcomes Effects			
2. Conquest and its impact	The final stages of Muslim rule in Spain The conquest of Mexico and Peru (1519-1551) Conflict and motives Key events and actors Impact	**3. Dynasties and rulers (750–1500) - content and context**	Dynasties and rulers Law, governing institutions and administration Challenges	**2. History of the Americas**	18 topics ranging from 750-2005 across a range of concepts and themes	
		4. Societies in transition (1400–1700) - content and context	Social and economic change Cultural and intellectual change Religious change			
3. The move to global war	Japanese expansion in East Asia (1931-1941) German and Italian expansion (1933-1940) Causes of expansion Events Responses	**5. Early Modern states (1450–1789) - content and context**	Nature of power and rule Expansion Conflicts and challenges	**3. History of Asia and Oceania**	18 topics ranging from 750-2005 across a range of concepts and themes	
		6. Causes and effects of Early Modern wars (1500–1750) – content and context	Causes of conflicts Practices and impact on outcome effects			
4.Rights and protest	Civil rights movement in the United States (1954-1965) Apartheid South Africa (1948-1964) Nature and characteristics of discrimination Protests and action The role and significance of key actors/groups	**7. Origins, development and impact of industrialization (1750–2005) - content and context**	The origins of industrialization The impact and significance of key developments The social and political impact of industrialization	**4. History of Europe**	18 topics ranging from 1066-2000 across a range of concepts and themes	
		8. Independence movements (1800–2000) - content and context	Origins and rise of independence movements, up to the point of independence Methods used and reasons for success Challenges faced in the first 10 years, and responses to the challenges			
5. Conflict and intervention	Rwanda (1990-1998) Kosovo (1989-2002) Causes of the conflict Course and interventions Impact	**9. Emergence and development of democratic states (1848–2000) - content and context**	Emergence of democratic states The development of democratic states Aims and results of policies			
		10. Authoritarian states (20th century) - content and context	Emergence of authoritarian states Consolidation and maintenance of power Aims and results of policies			
		11. Causes and effects of 20th-century wars - content and context	Causes of war Practices of war and their impact on the outcome Effects of war			
		12. The Cold War: Superpower tensions and rivalries (20th century) - content and context	Rivalry, mistrust, and accord Leaders and nations Cold War crises			

Figure 32: Visualiser of BHSC Applied Human and Social Sciences. (Source – BNCC).

Applied Human and Social Sciences		
Specific Competencies		
1. Analyse political, economic, social, environmental and cultural processes at the local, regional, national and global levels at different times, based on the plurality of epistemological, scientific and technological procedures, in order to understand and critically position oneself in relation to them, considering different points of view and making decisions based on arguments and sources of a scientific nature.	2. Analyse the formation of territories and borders in different times and spaces, by understanding the power relations that determine territorialities and the geopolitical role of nation-states.	3. Analyse and critically evaluate the relationships of different groups, peoples and societies with nature (production, distribution and consumption) and their economic and socio-environmental impacts, with a view to proposing alternatives that respect and promote awareness, socio-environmental ethics and responsible consumption at local, regional, national and global levels.
Specific Skills*		
EM13CHS101 - EM13CHS106	EM13CHS201 - EM13CHS206	EM13CHS301 - EM13CHS306
Specific Competencies		
4. Analyze the relations of production, capital and work in different territories, contexts and cultures, discussing the role of these relations in the construction, consolidation and transformation of societies.	5. Identify and combat various forms of injustice, prejudice and violence, adopting ethical, democratic, inclusive and supportive principles, and respecting Human Rights.	6. Participate in the public debate in a critical way, respecting different positions and making choices aligned with the exercise of citizenship and your life project, with freedom, autonomy, critical awareness and responsibility
Specific Skills*		
EM13CHS401 - EM13CHS404	EM13CHS501 - EM13CHS504	EM13CHS601 - EM13CHS606

*See Appendix D for the Specific Skills for Applied Human and Social Sciences in full detail.

Figure 33: Visualiser of BHSC Applied Human and Social Sciences (Source - RJRC)

Basic General Education	Formative Itinerary		
History (based on the BNCC and organised using the Specific Competencies and Skills)	Integrated Core	Specialisation Pathways for Applied Human and Social Sciences	
	Life Project	Opportunity	Political-Social Education
	Elective 1	Aging of the Brazilian Population	Political-Administrative Organisation of Brazil
	Elective 2	From Law to the City	Public Policy Cycle
	Elective 3 (from Catalogues of Electives, such as for Applied Human and Social Sciences)	Heritage Reliquary	Social Participation in the Brazilian State

Structure

DP history SL is structured around prescribed subjects, world history topics, and the internal investigation. Teachers select what options to offer to students. SL students take one prescribed subject, two world history topics, and then choose any historical topic for their internal investigation. DP history HL is identical in structure to SL except students are required to also take one of the regional options from the HL depth studies, within which they study three of the 18 possible sections.

In contrast, BHSC AHSS (BGE) is not organised using history topics. Instead, the BNCC articulates specific competencies and skills for AHSS that are an integration of skills and history, geography, sociology, and philosophy content. Each state in Brazil can decide how to organise their curriculum to ensure that the AHSS specific competencies and skills are taught in basic general education. For example, the Rio de Janeiro's Referential Curriculum (RFRC) organises basic general education into distinct subjects, with history being one of these. The RJRC organises its history content using the AHSS specific competencies and specific skills and then adds topics that should be linked with these.

Whereas the DP offers the option to study HL history, the BHSC does not offer an option to specialise in history specifically. Instead, students can specialise in an Applied Human and Social Sciences formative itinerary, BHSC AHSS (FI), which represents a broader area of knowledge. As an example, Rio de Janeiro offers two specialisation pathways for AHSS formative itineraries, namely 'Opportunity' and 'Political-Administrative Organisation of Brazil', which are each broken into three curricular components.

Content Alignment

It can be complex to compare the history curricula of two different programmes, as the levels of optionality available mean that what may appear as significant divergence on paper could be considerably less divergent in practice, depending on the options selected by students/teachers. As a result, Ecctis' analysis of subject alignment considered both the specific historical content of subtopics, such as time and place, and the conceptual aspect of topics – what are the themes that emerge and what historical approaches are deployed? This dual perspective gives a more accurate overall picture of subject content alignment.

To complement the analysis, the following tables present a simplified summary of the extent of content alignment which BHSC AHSS (BGE) and BHSC AHSS (FI) have at the topic level with DP history.

Table 36: Summary of the content alignment that BHSC AHSS has with the main topics in DP history.

DP history topics	Presence in BHSC AHSS (BGE)	Presence in BHSC AHSS (FI)*
Prescribed subjects		
Military leaders		
Conquest and its impact		**
The move to global war		**
Rights and protests		**
Conflict and intervention		**
World history topics		
Society and economy (750-1400)		
Causes and effects of wars (750-1500)		**
Dynasties and rulers (750-1500)		
Societies in transition (1400-1700)		
Early Modern states (1450-1789)		
Causes and effects of Early Modern wars (1500-1750)		**
Origins, development and impact of industrialization (1750-2005)		
Independence movements (1800-2000)		
Emergence and development of democratic states (1848-2000)		
Authoritarian states (20th century)		
Causes and effects of 20th-century wars		**
The Cold War: Superpower tensions and rivalries (20th century)		**
HL depth studies		
History of Africa and the Middle East		
History of the Americas		**
History of Asia and Oceania		
History of Europe		
Internal investigation		**

Key:

	Strong presence of this topic in BHSC AHSS.		*Partial presence of this topic in BHSC AHSS, or the extent of presence is unclear.*		*Little or no presence of this topic in BHSC AHSS.*

* Content alignments found for basic general education (BGE) are carried forwards and combined with, where applicable, new alignments found in the formative itinerary (FI), to represent the cumulative content covered.
** Represents where the documentation indicates that the formative itinerary specifically includes some similar content from this DP topic.

BHSC Applied Human and Social Sciences (Basic General Education) – BHSC AHSS (BGE)

The presence of DP history prescribed subjects, world history topics and HL depth studies in BHSC AHSS (BGE) is discussed below.

Prescribed subjects

BHSC AHSS (BGE) has some alignment with each of the five DP history prescribed subjects, although comparisons are not always direct. The topic of 'rights and protests' is the most strongly evidenced in BHSC AHSS (BGE), as specific competency 5 states students should

"Identify and combat various forms of injustice, prejudice and violence".[163] Moreover, one specific skill requires students to "Identify and analyse the relationships between subjects, groups, social classes and societies within different cultures".[164] Furthermore, BHSC AHSS (BGE) also covers topics such as the impact of social movements, diversity of individuals and social groups, and historical heritage and national identities.[165]

With regards to the DP's 'Military leader' prescribed subject, there are some topics in BHSC AHSS (BGE) that contain scope for leadership, campaigns and impact to be explored. Indeed, the Brazilian documentation indicates that government systems (theocracy, monarchies, republics, and dictatorial and totalitarian regimes) are covered.[166] However, there is no explicit indication that Genghis Khan or Richard I, which are the two key case studies for Military leaders in the DP, are studied as part of BHSC AHSS (BGE).

With regards to 'Conquest and its impact', the documentation indicates that BHSC AHSS (BGE) includes consideration of the consequences of conquests on the economy in Brazil and globally.[167] This indicates some alignment with the 'impact' element of this DP topic, and potential scope for consideration of key events/actors and motives. However, the DP focuses on the Spanish Inquisition in this topic, which is not explicitly covered in BHSC AHSS (BGE).

Furthermore, the documentation indicates that the two world wars are covered in BHSC AHSS (BGE), which could align with 'The move to global wars' topic in the DP.[168] However, there is no explicit indication that the causes of expansion or the responses are considered. Moreover, there is no direct reference to Japanese, German, or Italian expansion – which is the DP's focus in this area.

Lastly, a specific skill for BHSC AHSS (BGE) involves the consideration of internal and external population conflicts in the context of space occupation and the formation of territories, which indicates some alignment with 'Conflict and intervention' in DP history.[169] While there is scope within this for students to explore the causes, interventions, and impact of conflict, there is no explicit requirement for this. Moreover, there are no direct references to Rwanda or Kosovo, which are the two focuses for this prescribed subject in DP history.

World history topics

With regards to world history topics, the documentation indicates that BHSC AHSS (BGE) contains some scope for similar content to be covered to that included in these. Indeed, specific competencies 2 and 3 are concerned with analysing the formation of territories and borders and the relationships of different groups, which can encompass aspects of various world history topics in the DP. For example, specific competency 2 requires an understanding of "power relations that determine territorialities and the geopolitical role of nation states",[170]

[163] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills*. BNCC.
[164] Ibid.
[165] These topics have been drawn from the RJRC.
[166] Ibid.
[167] Ibid.
[168] Ibid.
[169] Specific skill EM13CHS204, BNCC.
[170] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills*. BNCC.

which, although has no specific time period stated, has similarities with the themes in the DP history's 'Early Modern states' topic.

Moreover, the documentation indicates that BHSC AHSS (BGE) includes some topics with clear similarities to DP world history topics.[171] One example is the Industrial Revolution, which indicates that similar content to 'Origins, development and impact of industrialization (1750-2005)' in DP history may be covered. Another example is a topic on the impact of social movements, which could cover similar content to the DP's 'Independence movements (1800-2000)' topic. One last example is a topic on the construction of democracy in the Americas, Africa and Asia, which has strong similarity with the 'Emergence and development of democratic states (1848–2000)' topic in DP history.

HL depth studies

While broad comparisons to the DP's prescribed subjects and world history topics can be made from the documentation for BHSC AHSS (BGE), there is no indication that a particular region would be studied to the extent that is observed in the DP's HL depth studies.

Investigation

There is no direct reference in BHSC AHSS (BGE) to a historical investigation like those conducted in DP history.

Other BHSC AHSS (BGE) Content

As there is limited detail regarding the history topics covered in BHSC AHSS (BGE), it is challenging to identify topics covered by the latter which are not covered in DP history. However, it can be noted that, as would be expected, the BHSC NST (BGE) documentation indicates a more specific focus on Brazilian history. Moreover, there is coverage of population studies and heritage which could not be directly linked with DP history content.

*Table 37: History content in BHSC AHSS (BGE) which is not covered in DP history**

Significant content which is not included in DP history
• Population studies • Heritage • Brazilian focus

*These topics have been taken from the RJRC and may not apply to the curriculum in every state and region in Brazil.

Summary

Overall, there is a degree of history content alignment between DP history and BHSC AHSS (BGE). Content shared by both curricula includes globally relevant topics such as world wars, rights and protests, social movements, and industrialisation. The lesser detail regarding history topics for BHSC AHSS (BGE) makes it challenging to confidently determine levels of alignment with DP history. However, the RJRC does provide some insights on topics covered in BHSC AHSS (BGE), steering the overall judgement to a low-moderate level of alignment. Whilst it is challenging to draw comparisons regarding breadth and depth, the documentation suggests that BGE AHSS (BGE) features less breadth and depth than DP history HL.

[171] The BHSC AHSS (BGE) topics referred to in this paragraph have been drawn from the RJRC.

BHSC Applied Human and Social Sciences (Formative Itinerary) – BHSC AHSS (FI)

In addition to basic general education, students may continue to engage with history content as part of a formative itinerary specialising in AHSS. Along with the BHSC, the Rio de Janeiro curriculum (RJRC) was consulted to provide examples of the type of content covered in BHSC AHSS (FI).

The skills for BHSC AHSS (FI) offer scope for some similar content to DP history to be covered. Indeed, the formative itinerary skills[172] involve students engaging with real-world problems and conflicts across different historical contexts at local, national and global levels – which could allow for similar content to the DP prescribed subjects of 'Conflict and intervention' and 'Rights and protests' to be covered. Moreover, these same skills also link with cause and effect themes covered in DP world history topics such as 'Causes and effects of Early Modern Wars (700-1500)'.

Moreover, skills for BHSC AHSS (FI) reference research-based tasks and larger projects. However, it is not possible to determine whether the depth of these investigation-type tasks meets the depth of the DP's historical investigation, thus a partial alignment is concluded.

The specialisation pathways in the Rio de Janeiro curriculum indicate that there is a specific study of the history of Latin America in BHSC AHSS (FI). Thus, this could have some alignment with the DP HL depth study 'History of the Americas'. However, the inclusion of this area may just be a reflection of the national context, and there are no further details to clarify whether this topic is covered in as much detail as DP HL depth studies. Indeed, rather than extending history knowledge specifically, the specialisation pathways focus on exploring broad areas, such as social participation in the Brazilian State, using an integration of philosophical, geographical, sociological, political, and historical considerations. Finally, no additional history content appears to be covered in BHSC AHSS (FI) which is not also covered by DP history.

Table 38: History content in BHSC AHSS (FI) which is not covered in DP history

Significant content which is not included in DP history
There is no significant history content in BHSC AHSS (FI) that is not included in the DP.

Summary

As with BHSC AHSS (BGE), it can be noted that specific historical events and periods are generally not identified in the documentation reviewed for BHSC AHSS (FI), which makes comparison challenging. It can be noted that BHSC AHSS (FI) integrates content from multiple subjects, hence the focus is not on significantly extending historical knowledge specifically. Indeed, the level of content alignment of BHSC AHSS (FI) with DP history is mostly the same as that of BHSC AHSS (BGE). Though the significantly more limited level of detail in the BHSC poses a challenge, the documentation reviewed suggests that BHSC AHSS (FI) has some similarity with the breadth and depth of DP history SL, and lesser breadth and depth than DP history HL.

[172] EMIFCHSA01, EMIFCHSA05, EMIFCHSA07, and EMIFCHSA09 from the Curricular References for the Preparation of Formative Itineraries.

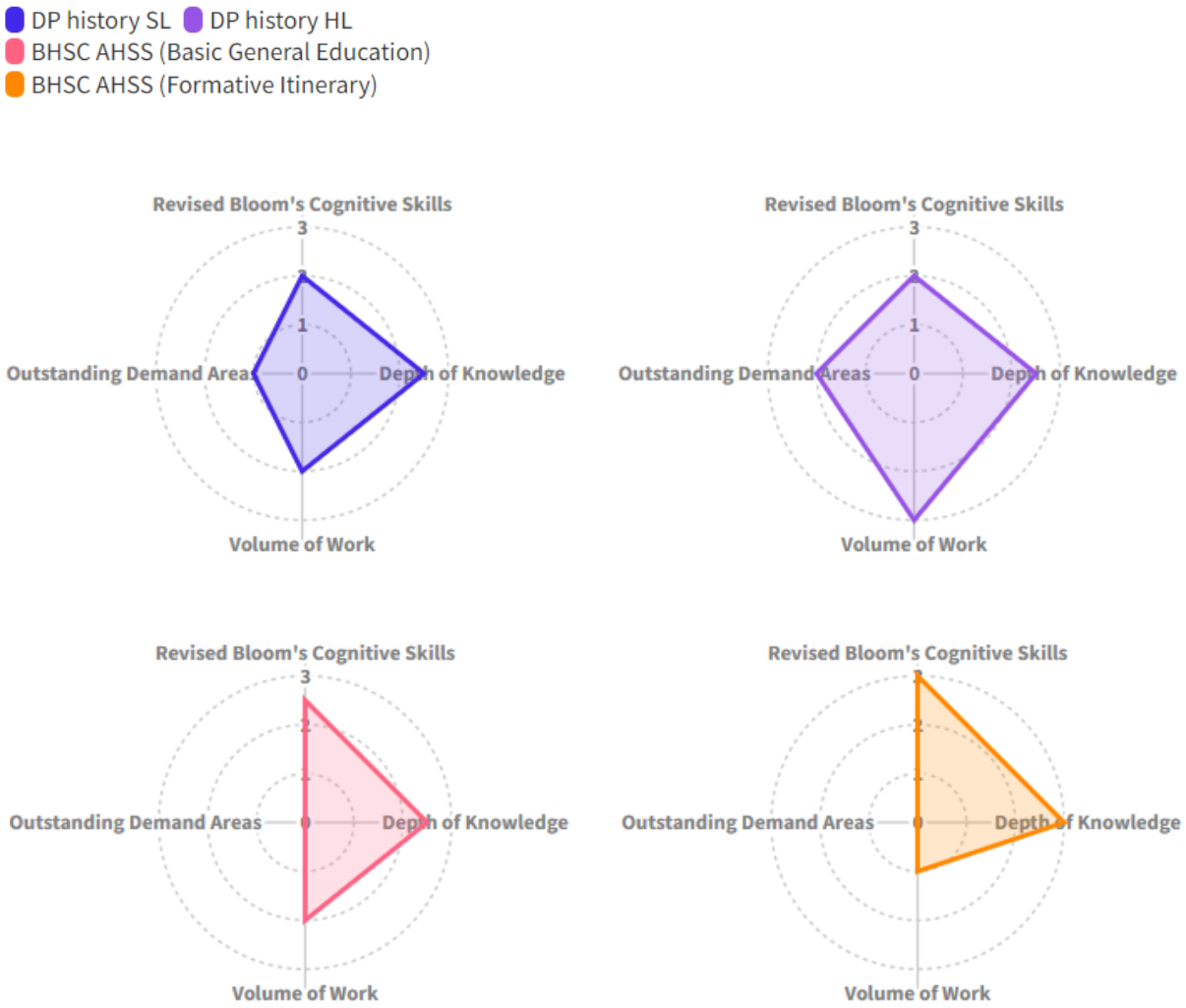
5.7.3 Demand – History

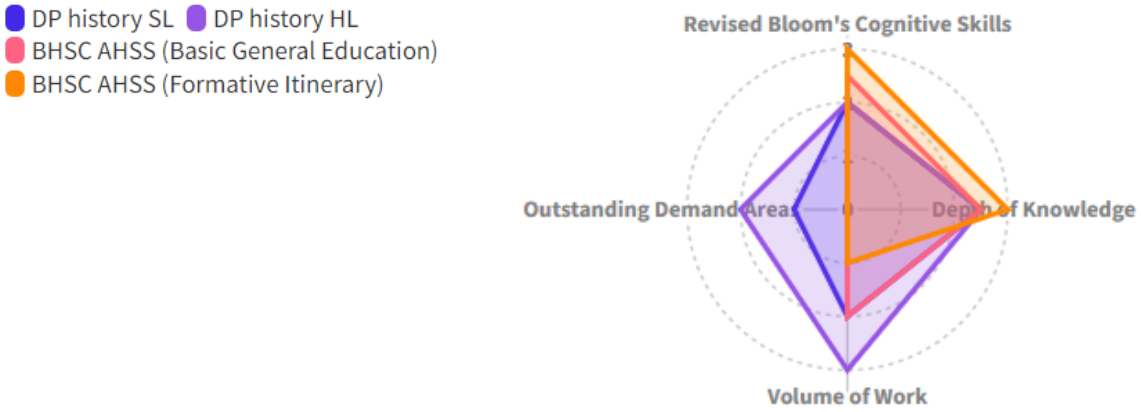
This section considers the alignment between DP history and BHSC AHSS in terms of demand. Using the same demand tool for the analysis of each subject, a demand profile was created for DP history SL, DP history HL, BHSC AHSS (BGE), and BHSC AHSS (FI).

BHSC AHSS (BGE) represents the demand of history within AHSS in basic general education. BHSC AHSS (FI) represents the cumulative demand of studying history in basic general education and then specialising in AHSS in the formative itinerary. It should be noted that the scores reflect the demand of the whole AHSS formative itinerary component, rather than its history content specifically.

These demand profiles are presented below in the form of radar diagrams, with a superimposed diagram featured to enable the immediate visual comparison of all profiles.

Figure 34: Visual representations of subject demand





The panel of experts carried out a detailed analysis of each course and reached a consensus on the scores shown in the profiles above. The following points were particularly important within the panel discussion:

- Regarding the scores for **Bloom's Cognitive Skills**:
  - DP history has the same learning outcomes for both SL and HL, meaning that these scores are the same. The DP history subjects were judged to show some presence of evaluation and synthesis, but with the majority of learning outcomes focused on a combination of analysis, application, knowledge and understanding, a score of 2 was provided to both.
  - For BHSC AHSS (BGE), the panel decided that a score of 2.5 was the most appropriate. Indeed, there was a clear theme of analysis found throughout the competencies and skills and there was several instances of evaluation and synthesis, though reference to these latter skills was not found to be sufficient to warrant a score of 3. For BHSC AHSS (FI) the demand panel decided that a score of 3 was most suitable. Indeed, there was a continued focus on analysis in the formative itinerary, with extended focus on the synthesis and evaluation of a number of complex themes. As a progression from basic general education, this built upon the existing skills and pushed the score to the top level of 3.

- Regarding the scores for **Depth of Knowledge**:
  - Both the DP history SL and HL were judged to merit a score of 2.5. Assessment Objectives 3 and 4, and history Aims 8, 10 and 12 were judged to show evidence that students would be required to develop joined-up and strategic thinking around methods, sources and theories in many contexts. In terms of assessment, the Internal Investigation was judged to be the most important piece of evidence that students would carry out in augmentation, particularly through the requirement to design their own questions and reflect on their work.
  - For BHSC AHSS (BGE) it was judged that students were mostly engaged in tasks that involved some complex reasoning. Indeed, the specific competencies and skills go beyond a score of 1 and comfortably into a 2, with students being required to show an understanding of the analysis of complex national and international issues alongside social, economic, geographical, economic issues. While there is evidence of approaching complex situations, gaining comprehension of the situation, and then deriving and proposing solutions to problems, there was not

enough evidence of extended thinking to warrant a score of 3, thus a score of 2.5 was given. For BHSC AHSS (FI), a score of 3 for depth of knowledge was deemed suitable. Although BHSC AHSS (FI) does not extend knowledge in history specifically, its interdisciplinary nature and requirement to synthesise knowledge from different areas to address topics and problems was deemed to pose further opportunity for extended thinking.

- Regarding the scores for **Volume of Work**:
  - DP history SL was judged to comprise moderate-heavy workload (a score of 2) as students will be exposed to multiple types of history, across multiple regions, often going beyond basic conceptual depth in each topic, and carrying out an internal investigation. DP history HL was considered to have a heavy volume of work, resulting in a score of 3.
  - For BHSC AHSS (BGE), it is difficult to determine the exact number of topics covered and there is also limited information on the extent to which each of the identified topics will be studied. However, by taking into account the nature of the concepts studied and the time allocated,[173] it was deemed that the volume of work was moderate-heavy, resulting in a score of 2. For BHSC AHSS (FI), a score of 1 for volume of work was deemed suitable. Although there are some complex tasks involved, the time allocated to the specialisation components of the formative itinerary is very generous. As this would allow enough time for the student to build knowledge and refine the necessary skills, it was deemed that the volume of work was moderate.

- Regarding the scores for **Outstanding Areas of Subject Demand**:
  - The internal investigation and the fact that students are exposed to so many forms of history were judged to comprise stretch components of DP history SL – resulting in a score of 1 – while the regional expertise developed through the HL regional options caused the HL score to exceed the SL on this measure – reaching a score of 2.
  - As BHSC AHSS (BGE) and BHSC AHSS (FI) have no definitive list of history topics to be studied, it is hard to make a clear judgement on the number of stretch areas. However, the types of tasks associated with the skills and competencies of BHSC AHSS appear to be standard for upper-secondary level, and therefore, no stretch areas were identified and a score of 0 was awarded to both profiles. That said, it should be noted that this does not mean there are no stretch areas in the BHSC for history; rather that stretch areas have not been evidenced in the documentation reviewed.

[173] Time allocations were drawn from the RJRC.

5.5 Philosophy

Below is the list of subjects used in the philosophy subject comparison analysis.

DP philosophy[174]
The overarching emphasis of the DP philosophy course is to actively engage students in philosophical activity. A key focus of the course is on encouraging students to explore complex philosophical concepts and questions in a curious and critical way. The course develops transferrable skills such as how to formulate clear arguments, make reasoned judgements and evaluate highly complex issues. Students can study philosophy at SL or HL and the course consists of the core theme, one optional theme and one prescribed text. HL students must study one additional optional theme and the extension topic "Philosophy and contemporary issues".

BHSC Applied Human and Social Sciences (Basic General Education) – BHSC AHSS (BGE)
In the BHSC, Applied Human and Social Sciences (AHSS) is a compulsory area of knowledge for the basic general education (BGE) component of high school. AHSS encompasses history, geography, philosophy, and sociology. At high school, AHSS is intended to develop students' ability to establish dialogues between different individuals and social groups, so that they will be accepting of others and conduct themselves ethically in society. BHSC AHSS (BGE) is based upon the specific competencies and skills prescribed by the BNCC.[175] To support the content analysis, the Rio de Janeiro Referential Curriculum (RJRC) has also been consulted to provide additional insight into the typical philosophy content covered in BHSC AHSS (BGE).[176]

BHSC Applied Human and Social Sciences (Formative Itinerary) – BHSC AHSS (FI)
In the BHSC, Applied Human and Social Sciences is an area of knowledge that students may choose to specialise in for their formative itinerary component of high school. Formative itineraries are curricular units which are designed for students to deepen their knowledge and prepare for further studies or careers. BHSC AHSS (FI) is based upon the 'Curricular References for the Preparation of Formative Itineraries', which guide the development of this subject by each state.[177] Again, the RJRC is consulted to provide further insights into the type of content covered in BHSC AHSS (FI).[178]

[174] International Baccalaureate. (2023). *Philosophy guide*.
[175] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills*. BNCC. Available from: National Common Curricular Base - Education is the Base (mec.gov.br)
[176] Rio de Janeiro State Government, Department of Education. (2022). *Philosophy*. High School Referential Curriculum for the State of Rio de Janeiro. p.100-103. Available from: https://novoensinomedio.educacao.rj.gov.br/pdfs/curriculo.pdf
[177] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. Available from: Referenciais-Curriculares-para-Elaboracao-de-Itinerarios-Formativos-1-1.pdf (sedu.es.gov.br)
[178] Rio de Janeiro State Government, Department of Education. (2022). *Curricular Organisation of Formative Itineraries*. Available from: Trails (educacao.rj.gov.br).

5.5.1 Learning Outcomes – Philosophy

This section compares and contrasts the learning outcomes of curricula falling within the category of philosophy.

For DP philosophy, the learning outcome themes were extracted from the individuals and societies group aims, and the philosophy aims and assessment objectives. BHSC Applied Human and Social Sciences (AHSS) learning outcomes are presented as specific competencies and specific skills. For AHSS formative itineraries specifically, additional skills are given, which are based on the formative itinerary structuring axes. Moreover, the BHSC also articulates General Competencies for high school education which have also been considered when relevant.

The following summary table demonstrates the learning outcome themes that were extracted from DP philosophy and indicates if and where they were judged to have presence within the learning outcomes of BHSC Applied Human and Social Sciences (AHSS).

Table 39: Presence of DP philosophy learning outcome themes in BHSC Applied Human and Social Sciences (AHSS)

Themes extracted from DP philosophy learning outcomes	Presence in BHSC Applied Human and Social Sciences (AHSS)	
1. Develop knowledge and understanding of philosophical concepts and arguments.		Present in BHSC AHSS, particularly specific competencies 1,3,4 and 5 and the FI skills
2. Apply knowledge of philosophical concepts and arguments to individuals and society.		There is limited evidence or direct reference to this theme in BHSC AHSS, although the theme is implied in some specific competencies such as 1 and 5.
3. Analyse and evaluate philosophical concepts, arguments and philosophical activity.		Present in BHSC AHSS, particularly specific competencies 1, 2, 3 and 6 and the FI skills
4. Develop an understanding of ethics and diversity and apply this knowledge in real-life situations.		Present in BHSC AHSS, particularly in specific competencies 3 and 5.
5. Understand the similarities and differences between forms of reasoning used in different philosophical content areas		There is no explicit reference to this theme in BHSC AHSS. However, the presence of this theme can be somewhat be inferred from specific competency 1.
6. Generate responses using appropriate philosophical formats, to a range of philosophical questions.		There is limited reference to this theme in BHSC AHSS, although the presence of this theme can be inferred from specific competency 6.
7. Select, apply and evaluate material to generate views and ideas.		Present in BHSC AHSS, as the use of materials to form arguments is required.

Key:

	This theme is well-evidenced in the learning outcomes of BHSC AHSS		*This theme is partially evidenced in the learning outcomes of BHSC AHSS*		*This theme is not evidenced in the learning outcomes of BHSC AHSS*

Presence of the DP's Learning Outcome Themes

There is a good alignment between DP philosophy and BHSC AHSS learning outcomes, with most of the DP's themes being well-evidenced in the specific competencies and specific skills,

and often further demonstrated in the additional skills for the formative itinerary (FI). The presence of each DP theme is discussed by the following in more detail.

1. Develop knowledge and understanding of philosophical concepts and arguments

This DP theme of developing knowledge and understanding of philosophical concepts and arguments is in BHSC AHSS. Indeed, several specific competencies reflect this theme – for example, specific competency 5 requires students to "Identify and combat various forms of injustice, prejudice and violence", and specific competency 4 involves "discussing the role of these relations in the construction, consolidation and transformation of societies".[179] As the specific competencies for BHSC AHSS are for a wide range of subject areas, there is no direct mention of philosophical concepts and arguments. However, as philosophy is embedded into BHSC AHSS, it can be assumed that knowledge of philosophical concepts will be developed within the broad themes described, such as "ethical, democratic, inclusive and supportive principles".[180] Moreover, specific skill EM13CHS101 reinforces that philosophical concepts will be covered as it states**,** "Identify, analyse, and compare different sources and narratives expressed in different languages, with a view to understanding philosophical ideas and processes…".[181]

Further presence of this DP theme can be found in the FI skills. Indeed, EMIFCHSA07 states "Identify and explain situations in which conflicts, imbalances and threats to social groups, the diversity of ways of life, different cultural identities and the environment occur".[182] As philosophy is part of BHSC AHSS, it can be inferred that this skill will require understanding of philosophical concepts to facilitate the identification and explanation of these topics.

2. Apply knowledge of philosophical concepts and arguments to individuals and society

This DP theme of applying philosophical concepts to individuals and society is difficult to identify within BHSC AHSS, as there are limited references to philosophy specifically. However, as mentioned previously, philosophy is encompassed in BHSC AHSS and therefore the skills and themes will involve the consideration of philosophical concepts. Therefore, it can be inferred that philosophical concepts and arguments will be applied when identifying various forms of justice, prejudice, and violence (specific competency 5) and when analysing political, economic, social, environmental and cultural processes in the local, regional, national and global levels (specific competency 1).

The FI skills indicate further scope for philosophical concepts and arguments to be applied when debating. This can be seen in EMIFCHSA03 which involves "identifying the different points of view and positioning oneself through argumentation".[183] Overall, explicit reference to this DP theme is limited, but it can be reasonably assumed that philosophical arguments and concepts will be applied in BHSC AHSS.

[179] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills*. BNCC.
[180] Ibid.
[181] Ibid.
[182] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. p. 13.
[183] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. p. 11.

3. Analyse and evaluate philosophical concepts, arguments and philosophical activity

The DP theme of analysis and evaluation are evident across a number of learning outcomes in the BHSC AHSS. For example, specific skill EM13CHS103 states "Develop hypotheses, select evidence, and compose arguments related to political, economic, social, environmental, cultural and epistemological processes, based on the systematization of data and information of various natures (artistic expressions, philosophical and sociological texts, …, among others)".[184]

The FI skills also offer further examples of this DP theme in BHSC AHSS, as EMIFCHSA01 requires students to investigate and analyse problems involving themes of a philosophical nature. Therefore, like the DP, the BHSC AHSS requires students to develop arguments and to make use of relevant information to support these.

4. Develop an understanding of ethics and diversity and apply this knowledge in real-life situations

Similar to DP philosophy, both ethics and diversity are explicitly covered in BHSC AHSS learning outcomes. Some examples of this include specific competency 3, which asks students to propose "alternatives that respect and promote awareness, socio-environmental ethics and responsible consumption" and specific skill EM13CHS502 which requires students to "Analyse everyday life situations, lifestyles, values, behaviours etc., denaturalizing and problematizing forms of inequality, prejudice, intolerance and discrimination".[185]

Again, the theme is further evidenced within the FI skills, with ethics being mentioned in EMIFCHSA06, which states that students should "Propose and test ethical, aesthetic, creative and innovative solutions to real problems."[186]

5. Understand the similarities and differences between forms of reasoning used in different philosophical content areas

As for the individual and societies group of the DP, understanding and engaging with multiple perspectives is intended for BHSC AHSS. Indeed, this theme is seen through specific competency 6, which requires students to respect others' positions when engaging in the public debate, and specific competency 1, which requires students to consider different points of view in order to make informed decisions. As mentioned before, explicit references to philosophical thinking specifically are limited in the specific competencies – though the reference to the pluralism of epistemological procedures in specific competency 1 indicates that different approaches in philosophical thinking will be considered.

Similarly, the FI skills also include that each student should be "identifying the different points of view and positioning oneself through argumentation", asking them to select and mobilize their knowledge and resources "based on respect for differences, listening, empathy and socio-environmental responsibility".[187]

[184] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills*. BNCC.
[185] Ibid.
[186] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. p. 12.
[187] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. p. 11.

6. Generate responses using appropriate philosophical formats, to a range of philosophical questions.

This DP theme is only partially evidenced within BHSC AHSS. Indeed, while it is clear that students are required to articulate ideas and form arguments in AHSS BHSC, it is not explicit that students are required to produce clear and well-structured written responses or demonstrate appropriate and precise use of philosophical vocabulary.

Likewise, in the FI skills students are required to "Raise and test hypotheses on themes and processes" and "Propose and test mediation and intervention strategies"[188], which, in the context of philosophical study, requires students to create and generate responses in relation to philosophical themes. However, again, there is no explicit requirement for clear, well-structured written responses or use of philosophical vocabulary.

7. Select, apply and evaluate material to generate views and ideas.

The DP theme of using and critically engaging with material is evidenced in BHSC AHSS. Indeed, it's clear from specific skill EM13CHS103 that students will be required to select evidence and will use material such as philosophical and sociological texts, historical and geographical documents, and others, to form arguments.

Further evidence of this theme is found within the FI skills, where the use of materials and sources is required to generate ideas. Indeed, this can be seen in the requirements for students to "select and systematize, based on studies and/or research in reliable sources…information on themes and processes of a historical, social, economic, philosophical, political and/or cultural nature"[189] and to consider data and information when analysing problems involving philosophical themes and processes.

Other Themes in BHSC AHSS Learning Outcomes

As BHSC AHSS applies to a broader area of knowledge than DP philosophy, there are several wider themes that are not found in DP philosophy to the same extent. That said, it can be noted that the FI skills perhaps have a higher emphasis on solving real world problems involving themes and processes of a philosophical nature – though it can be noted that the DP philosophy intends for students to apply their skills and knowledge to the world around them.

Summary

Overall, there is a good level of alignment between DP philosophy and BHSC AHSS with regards to learning outcomes. Some of the DP philosophy learning outcome themes are clearly present within BHSC AHSS, such as the development of knowledge and understanding of philosophical concepts and the analysis and evaluation of concepts relating to the subject. In contrast, other themes – such as those relating to the articulation of ideas in written formats and understanding the diversity of thinking and approaches in philosophy – are not explicitly covered by the BHSC AHSS, although they can be inferred from some of the learning outcomes.

[188] Ibid.
[189] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. p. 11-12.

5.5.2 Content – Philosophy

This section compares the philosophy content of DP philosophy and BHSC AHSS. For the content analysis of BHSC AHSS, several sources have been used. For BHSC AHSS (BGE), the BNCC's specific competencies and specific skills for have been used, as well as the Rio de Janeiro Referential Curriculum (RJRC) for philosophy in basic general education. For the analysis of BHSC AHSS (FI), Rio de Janeiro's specialisation pathways for AHSS formative itineraries have been used. To support the visual comparison at-a-glance, content from the DP, BNCC, and RJRC are presented in the following diagrams.

Figure 35: DP philosophy content visualiser[190]

	Key concepts	Suggested topics of study		
Core Theme – Being Human	**Identity**	Personal identity	Identity over time	Cultural identity
	The self and the other	Self and non-self	Solipsism and intersubjectivity	Relations to others
	Consciousness	Consciousness, the self and the world	The mind–body problem	The problem of other minds
	Personhood	Self-consciousness	Agency	Moral responsibility
	Human nature	Individuality and universality	The nature versus nurture debate	Emotion and reason
	Freedom	Freedom and determinism	Social conditioning	Existential angst and authenticity
	Themes	**Required content**		
Optional Themes	**Aesthetics**	The nature of art	The artist and the artistic process	Aesthetic experience and judgement
	Epistemology	Nature of knowledge	Problems of knowledge	Application of knowledge
	Ethics	Normative ethics	Meta-ethics	Applied ethics
	Philosophy of religion	Nature and existence of God	Religious language	Religious experience and behaviour
	Philosophy of science	Nature and methodologies of science	Science and the self	Science and society
	Political philosophy	The state	Justice	Liberty and rights
	Social philosophy	Social structures and institutions	Equality and discrimination	Gender
	Topics	**Required content**		
HL extension: Philosophy and contemporary issues	**Philosophy and technology**	Nature and role of technology; relationship between technology and nature	Impact of technology on individuals and societies	Philosophical challenges arising from developments in biotechnology, robotics, and information and communication technology
	Philosophy and the environment	Environmental challenges and degradation	Environmental conservation and activism	Intrinsic and extrinsic value; deep ecology, social ecology and anthropocentrism
	The nature, function, meaning and methodology of philosophy	Nature of philosophy	Function and meaning of philosophy	Philosophical methodology

[190] Content for the core and optional themes of the DP SL and HL is identical, however SL students study one optional theme, by contrast HL students study two optional themes. It should also be noted that the subtopics for the core themes are suggested areas of study and not designed to be prescriptive.

Figure 36: Visualiser of Applied Human and Social Sciences. (Source – BNCC).

Applied Human and Social Sciences		
Specific Competencies		
1. Analyse political, economic, social, environmental and cultural processes at the local, regional, national and global levels at different times, based on the plurality of epistemological, scientific and technological procedures, in order to understand and critically position oneself in relation to them, considering different points of view and making decisions based on arguments and sources of a scientific nature.	2. Analyse the formation of territories and borders in different times and spaces, by understanding the power relations that determine territorialities and the geopolitical role of nation-states.	3. Analyse and critically evaluate the relationships of different groups, peoples and societies with nature (production, distribution and consumption) and their economic and socio-environmental impacts, with a view to proposing alternatives that respect and promote awareness, socio-environmental ethics and responsible consumption at local, regional, national and global levels.
Specific Skills*		
EM13CHS101 - EM13CHS106	EM13CHS201 - EM13CHS206	EM13CHS301 - EM13CHS306
Specific Competencies		
4. Analyze the relations of production, capital and work in different territories, contexts and cultures, discussing the role of these relations in the construction, consolidation and transformation of societies.	5. Identify and combat various forms of injustice, prejudice and violence, adopting ethical, democratic, inclusive and supportive principles, and respecting Human Rights.	6. Participate in the public debate in a critical way, respecting different positions and making choices aligned with the exercise of citizenship and your life project, with freedom, autonomy, critical awareness and responsibility.
Specific Skills*		
EM13CHS401 - EM13CHS404	EM13CHS501 - EM13CHS504	EM13CHS601 - EM13CHS606

*See Appendix D for the Specific Skills for Applied Human and Social Sciences in full detail.

Figure 37: Visualiser of BHSC Applied Human and Social Sciences (Source - RJRC)

Basic General Education	Formative Itinerary		
Philosophy (based on the BNCC and organised using the Specific Competencies and Skills)	**Integrated Core**	**Specialisation Pathways for Applied Human and Social Sciences**	
	Life Project	**Opportunity**	**Political-Social Education**
	Elective 1	Aging of the Brazilian Population	Political-Administrative Organisation of Brazil
	Elective 2	From Law to the City	Public Policy Cycle
	Elective 3 (from Catalogues of Electives, such as for Applied Human and Social Sciences)	Heritage Reliquary	Social Participation in the Brazilian State

Structure

DP philosophy has two levels, SL and HL, with the main difference between these levels being the requirement to study an additional theme from the seven options available. The content of the DP philosophy curriculum includes a core theme (Being human) which is studied by all DP students and seven optional themes covering a wide range of topics. SL students will study one optional theme, while HL students will study two. All students will also study one of the DP "Prescribed texts" and will complete the philosophical analysis internal assessment. In addition to this, the HL students will complete one HL extension topic in "Philosophy and contemporary issues".

In contrast, BHSC AHSS (BGE) is not organised using philosophy themes and content. Instead, the BNCC articulates specific competencies and skills for AHSS that are an integration of skills and history, geography, sociology, and philosophy content. Each state in Brazil can decide how to organise their curriculum to ensure that the AHSS specific competencies and skills are taught. For example, Rio de Janeiro's Referential Curriculum (RJRC) organises basic general education into distinct subjects, with philosophy being one of these. The RJRC organises its philosophy content using the AHSS specific competencies and specific skills and then adds philosophy themes that should be linked to these.

Where the DP has the option to study HL philosophy, the BHSC does not offer an option to specialise in philosophy specifically. Instead, students can specialise in an Applied Human and Social Sciences formative itinerary, BHSC AHSS (FI), which represents a broader area of knowledge. As an example, Rio de Janeiro offers specialisation two pathways for AHSS formative itineraries, namely 'Opportunity' and 'Political-Administrative Organisation of Brazil', each of which are broken into three curricular components.

Content Alignment

To complement the analysis, the following tables present a simplified summary of the extent of content alignment that BHSC AHSS (BGE) and BHSC AHSS (FI) have at the topic level with DP philosophy.

Table 40: Summary of the content alignment that BHSC AHSS has with the main topics in DP philosophy.

DP philosophy topics		Presence in BHSC AHSS (BGE)	Presence in BHSC AHSS (FI)*
Core theme: Being human (SL and HL)	1. Identity		
	2. The Self and the other		**
	3. Consciousness		
	4. Personhood		
	5. Human nature		
	6. Freedom		
Prescribed text	Choice of one from list of IB prescribed texts		
Optional themes (SL one theme, HL two themes)	1. Aesthetics		
	2. Epistemology		
	3. Ethics		**
	4. Philosophy of religion		
	5. Philosophy of science		
	6. Political philosophy		**
	7. Social philosophy		**
HL extension	Philosophy and contemporary issues		

Key:

	Strong presence of this topic in BHSC AHSS.		*Partial presence of this topic in BHSC AHSS, or the extent of presence is unclear.*		*Little or no presence of this topic in BHSC AHSS.*

* Content alignments found for basic general education (BGE) are carried forwards and combined with, where applicable, new alignments found in the formative itinerary (FI), to represent the cumulative content covered.
** Represents where the documentation indicates that the formative itinerary specifically includes some similar content from this DP topic.

BHSC Applied Human and Social Sciences (Basic General Education) – BHSC AHSS (BGE)

The presence of the DP philosophy's core theme, optional themes, prescribed text, and HL extension in BHSC AHSS (BGE) is discussed below.

Core Theme: Being Human

The DP philosophy's core theme of 'Being Human' covers six topics. The first topic covers 'Identity' and features content that is also found within both the specific competencies and skills of BHSC AHSS (BGE). For example, specific competency 6 concerns "citizenship, the life project, freedom, autonomy, critical awareness and responsibility", which, alongside the skills concerned with humanity and evolutionary typologies, imply at least a partial presence of the content covered in this DP topic. It can be noted that 'human experience' is referenced in the documentation for BHSC AHSS (BGE).[191]

Another 'Being Human' topic is 'The self and other', of which BHSC AHSS (BGE) has partial alignment with. Indeed, specific competency involves critical awareness and skill

[191] This topic was drawn from the RJRC.

EM13CHS105 asks students to criticise evolutionary typologies. Again, the topic of 'human experience' in BHSC AHSS (BGE) also indicates content relating to this DP topic.

'Personhood' is another topic within DP philosophy's core theme and covers moral responsibilities and self-consciousness. Again, some links to this topic are present in BHSC AHSS (BGE) from skills that concern the life project and topics such as 'Ethics' and 'Human Rights'. However, the alignment level is deemed to be partial, as there is not clear indication of the depth to which this area is considered in BHSC AHSS (BGE).

There is evidence of similar content to the DP's 'Freedom' topic in BHSC AHSS (BGE). Indeed, there is explicit reference to this concept in the skills that cover topics such as 'freedom, cooperation, autonomy, entrepreneurship, democratic coexistence and solidarity'. This is supported within competencies that cover 'autonomy and critical awareness'.

From the BHSC AHSS (BGE) documentation reviewed, no alignment was found with the DP's 'Consciousness' topic. This is not to say that this is not covered in practice as part of philosophy subjects in Brazil; however, no direct or implied mention of this topic was found within the documentation. There is also limited content which indicates that similar concepts are covered to the DP's 'Human nature' topic, though it is possible that there is some coverage of this area through the specific skill EM13CHS104 which relates to 'beliefs, practices that characterise the identity and cultural diversity of different societies'.

Optional Themes

The first DP optional theme is Aesthetics. This theme covers 'the nature of art', 'artistic processes' and 'aesthetic experience'. This is not an area that was found to be present in BHSC AHSS (BGE).

Epistemology is another optional theme in the DP and includes a number of topics surrounding 'knowledge' and its nature. Epistemology is likewise included within BHSC AHSS (BGE), with specific competency 1 asking students to "analyse processes at a number of different levels based on the plurality of epistemological procedure" and some skills involving philosophical ideas, conceptual matrices and "knowledge, values, beliefs and practices that characterize the identity and cultural diversity of different societies".[192] Moreover, the documentation suggests that content regarding the first philosophers and forms of knowledge is included in BHSC AHSS (BGE).[193]

Ethics is another theme which is present in both DP philosophy and BHSC AHSS (BGE). Indeed, for BHSC AHSS (BGE), ethics is directly referenced in specific competency 5, which covers ethics and inclusivity. Moreover, the specific skills state students should "Analyse the foundations of ethics in different cultures, times and spaces, identifying processes that contribute to the formation of ethical subjects who value freedom, cooperation, autonomy, entrepreneurship, democratic coexistence and solidarity".[194]

[192] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills.* BNCC.
[193] This content was drawn from the RJRC.
[194] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills.* BNCC.

Philosophy of religion is also covered in DP philosophy, and there is a partial presence of this theme in BHSC AHSS (BGE) – namely within specific competency 3 that concerns different groups and societies and specific skills such as EM13CHS401 and EM13CHS104 that discuss 'different groups and societies'[195] and 'beliefs and social groups'.[196] Moreover, topics such as 'The secularism of the state and religious groups in Brazil' are referenced.[197]

Philosophy of science is also covered in DP philosophy. BHSC AHSS (BGE) shows partial alignment with this DP optional theme, as specific competency 1 covers "different processes at a number of levels with regard to decisions based on sources of a scientific nature"[198] and there is reference to 'Science and postmodern society'.[199]

Another DP optional theme, 'Political philosophy', covers a number of concepts, such as 'Liberty and rights', 'Justice' and 'The State'. Similar content can be found within BHSC AHSS (BGE). Indeed, specific competencies 1 and 5 cover areas such as 'the formation of borders' and injustice and prejudice. Moreover, specific skills such as EM13CHS504, cover ethics and ethical treatment of societies and individuals – both of which share some similarity with the DP theme. Furthermore, there is reference in the documentation to 'Forms of legitimizing power, political thought and current politics in Brazil and the world'.[200]

'Social Philosophy' is the final optional theme in DP philosophy and covers areas such as gender, equality and discrimination, and social structures and institutions. Whilst gender is not referenced in the BHSC AHSS (BGE), explicit reference to equality and discrimination can be found within the topics of injustice and prejudice in specific competency 5 and skill EM13CHS502. Moreover, social structures and institutions are also present in BHSC AHSS (BGE), as specific competency 5 covers 'relations of different groups and societies' – this is supported further by reference to 'Human existence and the thought of capitalist society'.[201]

Prescribed Text

It is indicated that philosophical texts are to be read in BHSC AHSS (BGE), but specific texts are not identified – thus partial alignment with DP philosophy is concluded for this syllabus component.

HL Extension

The DP HL extension covers three additional topic areas – 'Philosophy and Technology', 'Philosophy and the Environment', and 'The Nature, Function, Meaning and Methodology of Philosophy'. Only one of these – 'Philosophy and Technology' – is found to have any clear presence within BHSC AHSS (BGE). Indeed, a specific skill for AHSS involves "Characteris[ing] and analys[ing] the impacts of technological transformations on contemporary social and work relations, promoting actions aimed at overcoming social

[195] Ibid.
[196] Ibid.
[197] This topics was drawn from the RJRC.
[198] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills. BNCC*.
[199] This topic is drawn from the RJRC.
[200] Ibid.
[201] Ibid.

inequalities, oppression and violations of Human Rights".[202] Presence of this area is further supported by the topic of 'Benefits of technological advances in the areas of health and communication'.[203]

Other BHSC AHSS (BGE) Content

As there is limited detail regarding the philosophy topics to be covered in BHSC AHSS (BGE), it is challenging to identity topics that are not in DP philosophy. However, it can be noted that there are two areas of content in BHSC AHSS (BGE) that are not clearly present within the DP – namely corruption and models of work.[204] Whilst it is possible that the concept of corruption may be covered in the DP's Social Philosophy optional theme, and that models of work may be covered in the HL extension of 'Philosophy and Technology', it is not explicit these are considered in DP philosophy.

*Table 41: Philosophy content in BHSC AHSS (BGE) which is not covered in DP philosophy.**

Significant content which is not included in DP philosophy
• Corruption • Models of Work/Production

*These topics have been taken from the RJRC and may not apply to the curriculum in every state and region in Brazil.

Summary

Overall, there is some philosophy content alignment between BHSC AHSS (BGE) and DP SL philosophy. While it does not appear that BHSC AHSS (BGE) covers content which relates to all six concepts in the DP philosophy's core theme, 'Being human', there is some content that relates to multiple of the DP's optional themes – particularly ethics and political philosophy. Thus, it can be concluded that the breadth of philosophy content maybe more than that of DP philosophy SL. It is difficult to determine the degree of depth that these themes are studied in from the detail provided in the documentation for BHSC AHSS (BGE). However, it can be noted that the Rio de Janeiro curriculum allocates 80 hours for philosophy.[205] Hence, while a broader range of themes may be considered in BHSC AHSS (BGE), the depth that they are studied in is likely less than what is the case for DP philosophy SL.

BHSC AHSS (BGE) aligns with one area of the DP philosophy HL extension, namely Philosophy and Technology. However, there is no strong alignment with the other areas in the HL extension. As BHSC AHSS (BGE) does not appear to cover all concepts from the DP core theme but indicates a strong presence of two DP optional themes, as well as some evidence of others, the breadth of themes covered BHSC AHSS (BGE) may be similar to DP philosophy HL. As commented previously, it is challenging to determine the depth that themes are considered in, though the teaching allocation for BHSC AHSS (BGE) indicates that considerably less time is spent on themes compared to DP history HL.

[202] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills.* BNCC.
[203] This topic is drawn from the RJRC.
[204] These topics have been drawn from the RJRC.
[205] Secretary of state Rio De Janeiro. (2022). *Guidelines for the implementation of the Curricular Matrices for Basic Education in the School Units of the Public Network*. *SEEDUC Resolution No. 6035.*

BHSC Applied Human and Social Sciences (Formative Itinerary) – BHSC AHSS (FI)

In addition to basic general education, students may continue to engage with philosophy content as part of a formative itinerary specialising in AHSS. Along with the BHSC, the Rio de Janeiro curriculum (RJRC) is consulted to provide examples of the type of content covered in BHSC AHSS (FI).

The skills for BHSC AHSS (FI) offer scope for some broadly similar content to DP philosophy to be covered. Indeed, one skill involves students focusing on personal development and the life project, which has similarities to the 'The Self and other' concept in the DP's core theme.[206] Moreover, the skills require students to investigate, analyse, and propose ethical solutions to problems related to themes and processes of a philosophical and political nature, which has broad similarity with the Ethics and Political philosophy optional themes in the DP. Finally, the skills covered involve consideration of social groups and cultural identities, which could offer scope for content broadly aligning with the DP Social philosophy theme.

Content in the Rio de Janeiro specialisation pathways ('Opportunity' and 'Political-Social Education') appear to suggest BHSC AHSS (FI) is more focused on history and geography. However, references to the State, social structures, liberty, ethics, and rights also implies the presence of the DP philosophy themes mentioned above. Though again, the extent and depth to which these are considered is not clear.

No additional philosophy concepts are covered within BHSC AHSS (FI) beyond what is mentioned for BHSC AHSS (BGE). As such, no further significant content is included within the BHSC AHSS (FI) that is not included in DP philosophy.

Table 42: Philosophy content in BHSC AHSS (FI) which is not covered in DP philosophy

Significant content which is not included in DP philosophy
There is no significant philosophy content in BHSC AHSS (FI) that is not included in the DP.

Summary

Overall, BHSC AHSS (FI) does not focus on extending philosophy learning specifically, but instead integrates history, geography, philosophy and sociology to consider themes/topics (such as Opportunity as in the RJRC). Therefore, the content of BHSC AHSS (FI) does not have increased alignment with DP philosophy compared to BHSC AHSS (BGE). Hence, in the case where an AHSS formative itinerary is also studied, it remains that a broad range of philosophy themes are included but are likely considered in lesser depth compared to DP philosophy SL and HL.

5.5.3 Demand – Philosophy

This section considers the alignment between DP philosophy and BHSC AHSS in terms of demand. Using the same demand tool for the analysis of each subject, a demand profile was created for DP philosophy SL, DP philosophy HL, BHSC AHSS (BGE), and BHSC AHSS (FI).

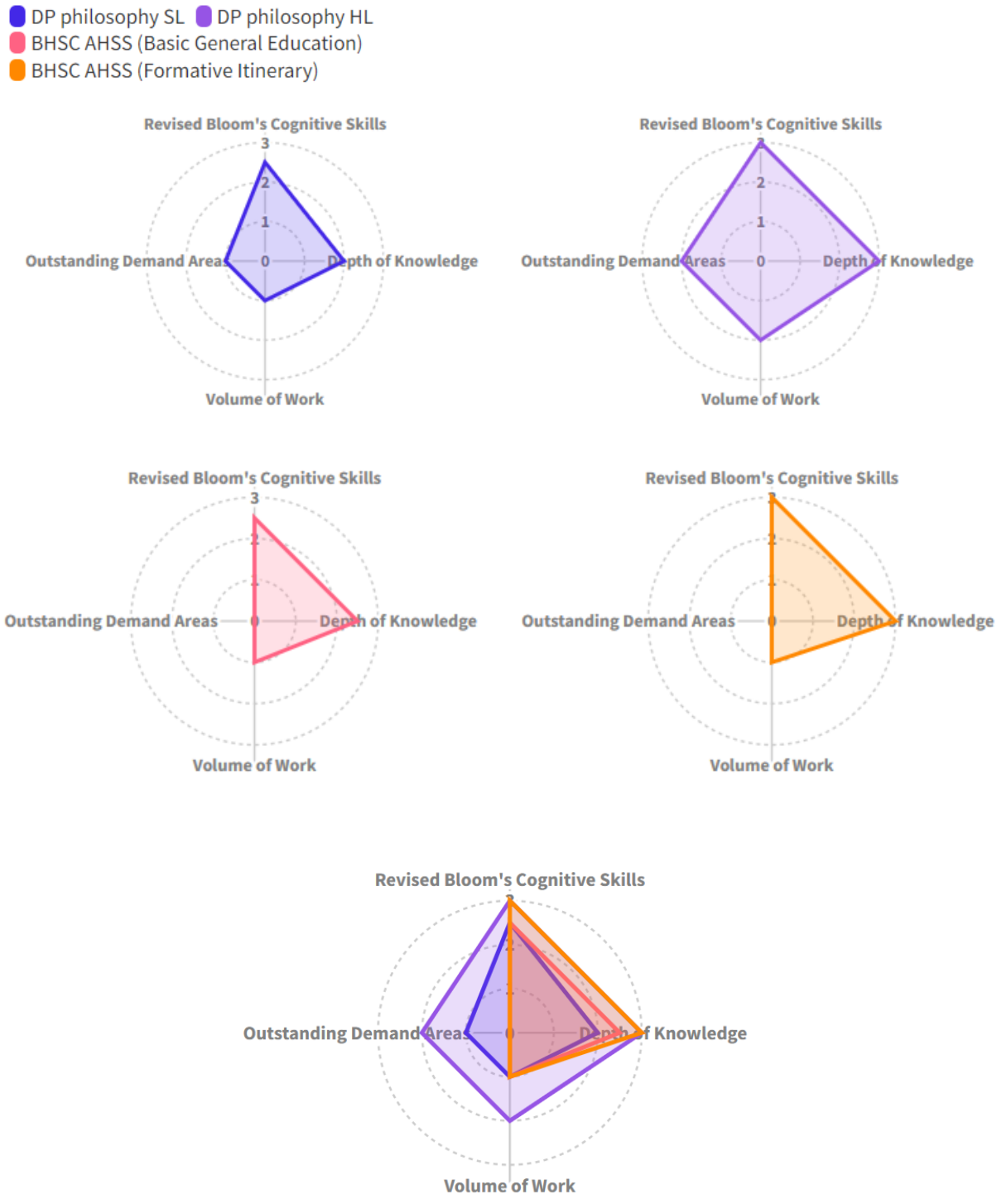
BHSC AHSS (BGE) represents the demand of philosophy within AHSS in basic general education. BHSC AHSS (FI) represents the cumulative demand of studying philosophy in

[206] Skill EMIFCHSA12 from the Curricular References for the Preparation of Formative Itineraries.

basic general education and then specialising in AHSS in the formative itinerary. It should be noted that the scores reflect the demand of the whole AHSS formative itinerary component, rather than its philosophy content specifically.

These demand profiles are presented below in the form of radar diagrams, with a superimposed diagram featured to enable the immediate visual comparison of all profiles.

Figure 38: Visual representations of subject demand



The panel of experts carried out a detailed analysis of each course and reached a consensus on the scores shown in the profiles above. The following points were particularly important within the panel discussion:

- Regarding the scores for **Bloom's Cognitive Skills**:
  - Evidence from the assessment objectives of the DP SL demonstrated that a score of 2.5 best reflects the demand level in this area. For example, there is an emphasis on Level 2 skills, as reflected in assessment objectives such as explain and analyse philosophical concepts, construct and develop balanced and focused arguments, make use of relevant supporting evidence, and discuss different points of view. Whilst there was some reference to evaluation of philosophical concepts, issues and arguments, there was not a broad enough focus on skills around creating and/or synthesising to rank this at Level 3. Therefore, a score of 2.5 was given.
  - With regards to the DP HL, the main difference in the cognitive skills between SL and HL is the addition of assessment objectives which refer to understanding, analysing and evaluating the nature, function, meaning and methodology of philosophical activity. This indicates that the cognitive skills required of the HL are, in general, more advanced than the SL with a broader range of analysis and evaluation skills required. This greater focus on analysis and evaluation led to a score of 3 being awarded.
  - For BHSC AHSS (BGE), the panel decided that a score of 2.5 was the best fit. Indeed, there was a clear theme of analysis found throughout the competencies and skills, with some evidence of evaluation and deeper synthesis – though reference to these skills was not found to be sufficient to warrant a score of 3. For BHSC AHSS (FI), the demand panel decided that a score of 3 was most suitable. Indeed, there was a continued focus on analysis in the skills specifically for formative itineraries, with extended focus on the synthesis and evaluation of a number of complex themes. As a progression from basic general education, this built upon the existing skills and pushed the score to a 3.

- Regarding the scores for **Depth of Knowledge**:
  - The DP SL assessment objectives suggest students are required to undertake strategic thinking, evidenced in AOs such as explain and analyse philosophical concepts, issues and arguments, construct and develop balanced and focused arguments, discuss different points of view and come to reasoned conclusions. These are all cognitive skills related to Level 2, and there is insufficient evidence to demonstrate that the reasoning/planning/synthesis of philosophical issues/ideas is complex enough for Level 3. Strategic thinking, some complex reasoning, and the use of evidence is required as part of the assessments, but it is not clear to what extent extended thinking (augmentation), synthesis of information and problem solving are present. Therefore, a score of 2 was awarded.
  - As with the DP SL, the HL assessment objectives suggest there is an overarching requirement for strategic thinking, as shown in a number of assessment objectives and the HL-specific assessment objectives, such as demonstrate, analyse and evaluate the nature, function, meaning and methodology of philosophical activity. This indicates there is a greater emphasis in the HL on higher order thinking skills such as analysis and evaluation. This, combined with the HL's coverage of an additional theme, led to the conclusion that a greater depth of knowledge will be

required at HL through further engagement with critical thinking skills. Therefore, a score of 3 was given.
    - For BHSC AHSS (BGE), a score of 2.5 was deemed suitable. Indeed, the multiple lenses with which students were required to analyse concepts through was deemed to present considerable complexity and encourage a deep philosophical outlook. For BHSC AHSS (FI), a score of 3 for depth of knowledge was deemed suitable. Although BHSC AHSS (FI) does not extend knowledge in philosophy specifically, the interdisciplinary nature of the AHSS formative itinerary and its requirement to synthesise knowledge from different areas to address topics and problems was deemed to pose further opportunity for extended thinking.

- Regarding the scores for **Volume of Work**:
    - For DP SL, six themes are present within the 'Being Human' concept. Within the six themes are a range of suggested subtopics. The six themes are typical of philosophy subjects at this level and signify a moderate portion of time is spent going beyond basic concepts. The total teaching hours are 150 and the assessment comprises two examination papers and a philosophical analysis of non-philosophical stimulus. This demonstrates that the assessment demand is moderate and programme hours are typical (again moderate) of a programme at this level and therefore a score of 1 was given.
    - The DP HL also comprises six themes and a broad range of sub-themes. However, at HL level there is a requirement for students to study a further optional theme and an 'extension topic', which demonstrates a larger range of themes is covered at HL than at SL. Furthermore, there is greater assessment demand in the HL, with an additional exam paper on an unseen text. The increased assessment scope, together with a broader range of concepts covered suggests the overall volume of work, is greater than at SL and is at a moderate-heavy level. Therefore, a score of 2 was given.
    - For BHSC AHSS (BGE), it is difficult to determine the exact number of topics covered, given the flexibility of the curriculum. There is also limited information on the extent to which each of the identified topics will be studied. However, by taking into account the nature of the concepts studied and the time allocated for philosophy, it was deemed that the volume of work was moderate, resulting in a score of 1.[207] For BHSC AHSS (FI), a score of 1 for volume of work was deemed suitable. Although there are some complex tasks involved, the time allocated to the specialisation components of the formative itinerary was very generous. As this would allow enough time for the student to build knowledge and refine the necessary skills, it was deemed that the volume of work was moderate.

- Regarding the scores for **Outstanding Areas of Subject Demand**:
    - For the DP SL, some optional themes – such as political philosophy or aesthetics – were judged to provide an opportunity for stretch. Students are required to choose one optional theme, which suggests that there may be a stretch area in the subject. Therefore, a score of 1 was deemed appropriate.
    - In the DP HL, students are required to choose two optional themes, suggesting that there is the potential for two stretch areas to be present at HL level in the optional

[207] Time allocations have been drawn from the RJRC.

themes. Additionally, students may be stretched further by the HL extension topic, which requires them to “engage with some of the most urgent issues facing humanity in the 21st century and to consider how philosophy can help us to engage with and navigate them”. As such, there is potential for three stretch areas, and a score of 2 was deemed appropriate.

- As BHSC AHSS (BGE) and BHSC AHSS (FI) have no definitive list of philosophy topics to be studied, it is hard to make a clear judgement on the number of stretch areas. However, it was deemed that more metaphysical thinking would need to be evidenced in philosophy content to warrant a higher score than 0.

5.6 Brazilian Social Studies

Below is the list of subjects used in the subject comparison analysis.

DP Brazilian social studies[208]

Brazilian social studies (BSS) is a subject option within the DP Individuals and societies subject group. As a school-based syllabus, Brazilian social studies is only offered at SL and only available to selected schools. This subject aims to provide a comprehensive overview of Brazil's development and its status as a regional power in the global economy – exploring physical, political, social, economic, religious, technological and cultural aspects of Brazil. The subject is divided into several areas of study on the history and geography of Brazil.

BHSC Applied Human and Social Sciences (Basic General Education) – BHSC AHSS (BGE)

In the BHSC, Applied Human and Social Sciences (AHSS) is a compulsory area of knowledge for the basic general education (BGE) component of high school. AHSS encompasses history, geography, philosophy, and sociology. At high school, AHSS is intended to develop students' ability to establish dialogues between different individuals and social groups, so that they will be accepting of others and conduct themselves ethically in society. BHSC AHSS (BGE) is based upon the specific competencies and skills prescribed by the BNCC.[209] To support the content analysis, the Rio de Janeiro Referential Curriculum (RJRC) has also been consulted to provide additional insight into the typical content covered in BHSC AHSS (BGE). [210] As DP BSS covers Brazilian history and geography, these are the main areas considered in BHSC AHSS (BGE).

BHSC Applied Human and Social Sciences (Formative Itinerary) – BHSC AHSS (FI)

In the BHSC, Applied Human and Social Sciences is an area of knowledge that students may choose to specialise in for their formative itinerary component of high school. Formative itineraries are curricular units which are designed for students to deepen their knowledge and prepare for further studies or careers. BHSC AHSS (FI) is based upon the 'Curricular References for the Preparation of Formative Itineraries', which guide the development of this subject by each state.[211] Again, the RJRC is consulted to provide further insights into the type of content covered in BHSC AHSS (FI). [212] As with BHSC AHSS (BGE), the analysis focuses on the areas of Brazilian history and geography within BHSC AHSS (FI).

[208] International Baccalaureate. (2020). *Brazilian social studies guide.*
[209] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills*. BNCC. Available from: National Common Curricular Base - Education is the Base (mec.gov.br)
[210] Rio de Janeiro State Government, Department of Education. (2022). *High School Referential Curriculum for the State of Rio de Janeiro.* p. 104-109. Available from: https://novoensinomedio.educacao.rj.gov.br/pdfs/curriculo.pdf
[211] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. Available from: Referenciais-Curriculares-para-Elaboracao-de-Itinerarios-Formativos-1-1.pdf (sedu.es.gov.br)
[212] Rio de Janeiro State Government, Department of Education. (2022). *Curricular Organisation of Formative Itineraries*.

5.6.1 Learning Outcomes – Brazilian Social Studies

This section compares and contrasts the learning outcomes of curricula falling within the category of Brazilian social studies.

For DP BSS, the learning outcome themes were extracted from the Individuals and societies group aims, and the BSS aims and assessment objectives. BHSC Applied Human and Social Sciences (AHSS) learning outcomes are presented as specific competencies and specific skills. For AHSS formative itineraries specifically, additional skills are given, which are based on the formative itinerary structuring axes. Moreover, the BHSC also articulates General Competencies for high school education which have also been considered when relevant.

The following summary table demonstrates the learning outcome themes that were extracted from DP BSS and indicates if and where they were judged to have presence within the learning outcomes of BHSC Applied Human and Social Sciences (AHSS).

Table 43: Presence of DP BSS learning outcome themes in BHSC Applied Human and Social Sciences (AHSS).

Themes extracted from DP Brazilian social studies learning outcomes	Presence in BHSC Applied Human and Social Sciences (AHSS)	
1. Develop knowledge and understanding of Brazil's culture and society through historical and geographical studies.		This theme is present BHSC AHSS, particularly in specific competencies 1,2 and 5 for AHSS and the FI skills.
2. Appreciate, and critically engage with, different perspectives of events and issues.		This theme is present in BHSC AHSS, particularly in specific competencies 1, 3, 4 and 6.
3. Use appropriate skills to carry out investigations related to Brazil's history/geography.		This theme is partially evidence in BHSC AHSS. Some specific skills indicate this theme, although there are clearer links in the FI skills.
4. Construct clear arguments using knowledge, evidence, and analysis.		This theme is present in BHSC AHSS, particularly specific competencies 5 and 6
5. Interpret, analyse, and evaluate a range of source materials.		This theme is present in BHSC AHSS, particularly specific competencies 1, 2, 3 and 4 as well as the FI skills EMIFCHSA01, EMIFCHSA03 and EMIFCHSA05.
6. Use understanding and awareness of the global context to reflect on identity and make informed and principled decisions.		This theme is present in BHSC AHSS, particularly in specific competencies 1, 3 and 6.

Key:

	This theme is well-evidenced in the learning outcomes of BHSC AHSS.		*This theme is partially evidenced in the learning outcomes of BHSC AHSS.*		*This theme is not evident in the learning outcomes of BHSC AHSS.*

Presence of the DP's Learning Outcome Themes

There is a high level of alignment between DP BSS and BHSC AHSS learning outcomes, with most of the DP's themes being well-evidenced in the specific competencies and specific skills

of AHSS, and often further demonstrated in the additional skills for the formative itinerary (FI). The presence of each DP theme is discussed by the following in more detail.

1. Develop knowledge and understanding of Brazil's culture and society through historical and geographical studies.

This DP theme is clearly evidenced in BHSC AHSS through the specific competencies which focus on "understanding the power relations that determine territorialities and the geopolitical role of nation-states" and "Identify[ing] and combat[ing] various forms of injustice, prejudice…".[213] This theme is also present throughout several specific skills that require considerations of culture and society in Brazil.

This is also true of the FI skills, with direct and indirect references to this theme being made across the skills. Examples of this can be seen in EMIFCHSA07 and EMIFCHSA08, which ask students to 'Identify and explain situations in which conflicts, imbalances and threats to social groups, the diversity of ways of life, different cultural identities and the environment occur' and 'Intentionally select and mobilize knowledge and resources from Applied Human and Social Sciences'[214].

2. Appreciate, and critically engage with, different perspectives of events and issues.

The DP's theme of critically engaging with different perspectives of events and issues is well evidenced in BHSC AHSS learning outcomes. Indeed, the specific competencies and skills require students to consider "different points of view", make "decisions based on arguments and sources of a scientific nature" and "Analyse and critically evaluate the relationships of different groups, peoples and societies".[215] These are all examples of alignment with the DP theme, as students are encouraged to review several sources to inform their understanding and reasoning when tackling different topics.

The DP theme is also present in the FI skills, with students being asked to "identify the different points of view" and display their understanding of a number of different contexts such as "historical, social, economic, philosophical, political and/or cultural".[216]

3. Use appropriate skills to carry out investigations related to Brazil's history/geography.

There is some presence of this DP theme in BHSC AHSS learning outcomes. Indeed, one specific skill requires students to develop hypotheses and select evidence, which are relevant to investigation. However, unlike DP BSS, there is no direct requirement for students to apply these skills to carry out investigations related to Brazil's history or geography.

There are clearer links with this DP theme in the FI skills, namely where students are asked to "Propose and test ethical, aesthetic, creative and innovative solutions to real problems" and "Investigate and analyse problem situations involving themes and processes of a historical […] nature".[217] Based on this, it is concluded that this theme is partially evidenced in BHSC AHSS.

[213] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills.* BNCC.
[214] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. p. 13-14.
[215] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills.* BNCC.
[216] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. p. 11.
[217] Ibid.

4. Construct clear arguments using knowledge, evidence, and analysis

This DP theme is clearly present within BHSC AHSS learning outcomes. Indeed, specific competency 6 expects students to participate critically in the public debate and specific skill EM13CHS103 requires students to develop hypotheses, select evidence and compose arguments. Moreover, FI skills require students to display their skills and knowledge by "positioning oneself through argumentation, taking care to cite the sources of resources used"[218]. Also, references to proposing actions and solutions also demonstrate that students will have to show skills in argumentation.[219] Therefore, it is apparent from these examples that BHSC AHSS seeks to develop students' ability to construct arguments in a critical way, showing strong alignment with this DP theme.

5. Interpret, analyse, and evaluate a range of source materials

This DP theme is well-evidenced in BHSC AHSS, which has a clear focus on analysis as a key skill that students should use across various topics and contexts. For example, specific competency 1 requires students to "Analyze political, economic, social, environmental and cultural processes" and specific competency 2 requires students to "Analyze the formation of territories and borders in different times and spaces".[220] Moreover, there are numerous references in the specific skills to evaluation and taking a critical approach. Additionally, the requirement to engage with a range of source materials is present in BHSC AHSS, as can be seen in the specific competency that states students should be "considering different points of view and making decisions based on arguments and sources of a scientific nature".[221]

Moreover, the FI skills require students to "Intentionally select and mobilize creative resources" and "consider[ing] data and information available in different media".[222]

6. Use understandings and awareness of the global context to reflect on identity and make informed and principled decisions

This DP theme is well-evidenced in BHSC AHSS learning outcomes, which make clear reference to students developing an understanding of multiple contexts. Examples of this can be seen within specific competency 1 and specific competency 3 which reference an understanding of "cultural processes at the local, regional, national and global levels at different times" and "socio-environmental ethics and responsible consumption at local, regional, national and global levels".[223]

Furthermore, the FI skills frequently involve considerations of the 'local, regional, national and/or global level', thus consistently promoting consideration of these various contexts.

Other Themes in BHSC AHSS Learning Outcomes

As BHSC AHSS learning outcomes apply to a broader area of knowledge than DP BSS, there are several wider themes that are not found in DP BSS to the same extent. An example of this

[218] Ibid.
[219] Ibid.
[220] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills.* BNCC.
[221] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills*. BNCC.
[222] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*. p. 12.
[223] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills*. BNCC.

is the consideration of forms of injustice, prejudice, and violence, which is not a focus in DP BSS. Moreover, there is a higher emphasis on offering solutions to, and the mediation of, real world problems in the FI skills of BHSC AHSS, compared to DP BSS.

Summary

Overall, there is a high level of alignment between DP BSS and BHSC AHSS with regards to learning outcomes. Both seek to develop similar skills, such as critically engaging with multiple perspectives and source materials, understanding the culture in Brazil through its history and geography, understanding global contexts, and forming arguments based on evidence. However, it can be noted that there is less emphasis on applying skills to historical/geographical investigations in BHSC AHSS compared to DP BSS. Conversely, there is a greater focus on proposing and testing mediation and intervention strategies in the FI skills of BHSC AHSS compared to DP BSS.

5.6.2 Content – Brazilian Social Studies

This section compares the content of DP BSS with Brazilian history and geography content in BHSC AHSS. For the content analysis of BHSC AHSS, several sources have been used. For BHSC AHSS (BGE), the BNCC's specific competencies and specific skills for AHSS have been used, as well as the Rio de Janeiro Referential Curriculum (RJRC) for history and geography in basic general education. For the analysis of BHSC AHSS (FI), Rio de Janeiro's specialisation pathways for AHSS formative itineraries have been used. To support the visual comparison at-a-glance, content from the DP, BNCC, and RJRC are presented in the following diagrams.

Figure 39: DP BSS content visualiser

Geography: Topics 1-4	Topic 1—Agricultural and industrial developments and territorial dynamics in Brazil	1.1 Spatial dimension of the colonial economy	1.2 The industrialization process and Importation Substitution Policy	1.3 Industries' location	1.4 The military dictatorship and industrialization
	Topic 2—Demographic dynamics and urbanization in Brazil	2.1 Demographic transition	2.2 The role of women from the 1960s	2.3 Changes in demographic structure	2.4 Socio-economic indices
		2.5 The formation of the population	2.6 Emigration and immigration	2.7 Internal migration	2.8 Urbanization
	Topic 3—Brazil's perspectives on the New World Order (Core Topic)	3.1 Constitution of the New World Order	3.2 New phase of capitalism	3.3 Neoliberalism	3.4 Economic opening
		3.5 Latifundia	3.6 Green Revolution	3.7 Agrarian Reform	3.8 Working relationships in rural areas
		3.9 Current agricultural production	3.10 Reprimarization	3.11 The tertiary sector and gross domestic product (GDP)	
	Topic 4—Environment and society	4.1 Regionalization proposals	4.2 Morphoclimatic domains and biodiversity formation	4.3 Hydrology	4.4 Energy and mineral matrix
		4.5 Urban environmental problems	4.6 Rural environmental problems	4.7 Sustainability and conservation	
History: Topics 4–8	Topic 5—Assembly, dynamics and crisis of Portuguese colonization in America (1500–1822)	5.1. Colonization (1500–1750)	5.2. Crisis and collapse of Portuguese colonization (1750–1822)		
	Topic 6—Citizenship and formation of the Brazilian state (1822–1930)	6.1 Formation of the Brazilian national state and the construction of citizenship (1822–1848)	6.2 Apogee and crisis of the Brazilian monarchist regime (1848–1889)	6.3 Implementation of the republican regime (1889–1930)	
	Topic 7—The modernization of Brazil (1930–1964) (Core Topic)	7.1. Relations between state, society, economy and labour and their cultural expressions in Brazil in the process of modernization	7.2. Brazil in the international political–ideological web	7.3. Contradictions and ambiguities of modernization	
	Topic 8—Civil–military dictatorship and democratic construction in Brazil (1964–2006)	8.1. The civil–military dictatorship (1964–1985)	8.2. Crisis of the dictatorship and construction of democracy (1985–2006)	8.3. Civil society (1964–2006)	
Internal assessment	Historical or geographical investigation				

Figure 40: Visualiser of Applied Human and Social Sciences. (Source – BNCC).

Applied Human and Social Sciences		
Specific Competencies		
1. Analyse political, economic, social, environmental and cultural processes at the local, regional, national and global levels at different times, based on the plurality of epistemological, scientific and technological procedures, in order to understand and critically position oneself in relation to them, considering different points of view and making decisions based on arguments and sources of a scientific nature.	2. Analyse the formation of territories and borders in different times and spaces, by understanding the power relations that determine territorialities and the geopolitical role of nation-states.	3. Analyse and critically evaluate the relationships of different groups, peoples and societies with nature (production, distribution and consumption) and their economic and socio-environmental impacts, with a view to proposing alternatives that respect and promote awareness, socio-environmental ethics and responsible consumption at local, regional, national and global levels.
Specific Skills*		
EM13CHS101 - EM13CHS106	EM13CHS201 - EM13CHS206	EM13CHS301 - EM13CHS306
Specific Competencies		
4. Analyze the relations of production, capital and work in different territories, contexts and cultures, discussing the role of these relations in the construction, consolidation and transformation of societies.	5. Identify and combat various forms of injustice, prejudice and violence, adopting ethical, democratic, inclusive and supportive principles, and respecting Human Rights.	6. Participate in the public debate in a critical way, respecting different positions and making choices aligned with the exercise of citizenship and your life project, with freedom, autonomy, critical awareness and responsibility
Specific Skills*		
EM13CHS401 - EM13CHS404	EM13CHS501 - EM13CHS504	EM13CHS601 - EM13CHS606

*See Appendix D for the Specific Skills for Applied Human and Social Sciences in full detail.

Figure 41: Visualiser of BHSC Applied Human and Social Sciences (Source - RJRC)

Basic General Education		Formative Itinerary		
History	Geography	Integrated Core	Specialisation Pathways for Applied Human and Social Sciences	
Based on the BNCC and organised using the Specific Competencies and Skills		Life Project	Opportunity	Political-Social Education
		Elective 1	Aging of the Brazilian Population	Political-Administrative Organisation of Brazil
		Elective 2	From Law to the City	Public Policy Cycle
		Elective 3 (from Catalogues of Electives, such as for Applied Human and Social Sciences)	Heritage Reliquary	Social Participation in the Brazilian State

Structure

The content of the DP Brazilian social studies (BSS) curriculum is split into two main sections and a historical or geographical investigation. The two main sections of the DP cover four geography-based topics and four history-based topics. As for all the DP's school-based syllabuses, the BSS subject is only offered at SL.

In contrast, BHSC AHSS (BGE) is not organised using history and geography topics. Instead, the BNCC articulates specific competencies and skills for AHSS that are an integration of skills and history, geography, sociology, and philosophy content. Each state in Brazil can decide how to organise their curriculum to ensure that the AHSS specific competencies and skills are taught in basic general education. For example, Rio de Janeiro's Referential Curriculum (RJRC) organises basic general education into distinct subjects, with history and geography being two of these. The RJRC organises history and geography content using the AHSS specific competencies and specific skills and then adds topics that should be linked to these.

Furthermore, students can specialise in an Applied Human and Social Sciences formative itinerary, BHSC AHSS (FI), which represents a broader area of knowledge than DP BSS. As an example, Rio de Janeiro offers specialisation two pathways for AHSS formative itineraries, namely 'Opportunity' and 'Political-Administrative Organisation of Brazil', each of which are broken into three curricular components.

Content Alignment

To complement the analysis, the following table represents a simplified summary of the content alignment that BHSC AHSS (BGE) and BHSC AHSS (FI) have at the topic level, with DP BSS.

Table 44: Summary of the content alignment that BHSC AHSS has with the main topics in DP BSS.

DP BSS topics	Presence in BHSC AHSS (BGE)	Presence in BHSC AHSS (FI)*
Geography topics		
Topic 1 - Agricultural and industrial developments and territorial dynamics in Brazil		
Topic 2 - Demographic dynamics and urbanization in Brazil		**
Topic 3 - Brazil's perspective on the New World Order		
Topic 4 - Environment and Society		**
History topics		
Topic 5 - Assembly, dynamic and crisis of Portuguese colonization in America (1500-1822)		**
Topic 6 - Citizenship and formation of the Brazilian state (1822-1930)		
Topic 7 - The modernization of Brazil 1930-1964		
Topic 8 - Civil-Military dictatorship and democratic construction in Brazil 1964-2006		**
Historical or geographical investigation		**

Key:

	Strong presence of this topic in BHSC AHSS		*Partial presence of this topic in BHSC AHSS, or the extent of presence is unclear*		*Little or no presence of this topic in BHSC AHSS*

* Content alignments found for basic general education (BGE) are carried forwards and combined with, where applicable, new alignments found in the formative itinerary (FI), to represent the cumulative content covered.
** Represents where the documentation indicates that the formative itinerary specifically includes some similar content from this DP topic.

BHSC Applied Human and Social Sciences (Basic General Education) – BHSC AHSS (BGE)

The presence of the DP BSS geography and history topics in BHSC AHSS (BGE) is discussed below.

Geography Topics

The documentation indicates that BHSC AHSS (BGE) has partial alignment with all DP BSS geography topics. Indeed, while similar content to a few subtopics from each of the DP BSS topic's is present in BHSC AHSS (BGE), a significant number of areas within the prescribed content of each DP BSS topic is not.

Indeed, the industrialisation process and its consequences are covered in BHSC AHSS (BGE)[224], which indicates some alignment with DP BSS Topic 1, specifically with 1.2 The industrialization process and Importation Substitution Policy. However, there is no indication of similar content to other DP BSS Topic 1 areas, such as 1.4 The military dictatorship and industrialisation.

Similarly, BHSC AHSS (BGE) content has various levels of alignment with different subtopics within DP BSS Topic 2 - Demographic dynamics and urbanization in Brazil. Indeed, there is good alignment with 2.7 Internal migration and 2.8 Urbanization, as recent migration

[224] This topic was drawn from the RJRC for geography.

processes, socio-environmental issues, social stratification – urban and rural space, and conflicts over land and their consequences are all covered.[225] However, other Topic 2 subtopics, such as 2.2 The role of women in the 1960s, cannot be identified in BHSC AHSS (BGE).

With regards to DP BSS Topic 3 – Brazil's perspective on the New World Order, content from some subtopics, such as 3.1 Constitution of the New World Order, 3.3 Neoliberalism and 3.10 Reprimarization is not directly referred within the BHSC AHSS (BGE) documentation available. However, the inclusion of exploring natural resources indicates good alignment with 3.9 Current agricultural processes.[226] Moreover, other content references in BHSC AHSS (BGE) indicate partial alignment with Topic 3 subtopics. For example, the inclusion of the transition from feudalism to capitalism indicates some alignment with 3.5 Latifundia.[227]
Similarly, BHSC AHSS (BGE) has varying levels of alignment with the subtopics within DP BSS Topic 4 – Environment and Society. Subtopics that there is a strong alignment with are 4.5 Urban environmental problems and 4.6 Rural environmental problems, as the documentation indicates similar content through including socio-environmental issues and social stratification.[228] BHSC AHSS (BGE) also indicates that some similar content to the DP BSS subtopic 4.7 Sustainability and conservation could be covered. However, there are several DP BSS subtopics that have no clear presence within BHSC AHSS (BGE), including 4.1 Regionalisation proposals, 4.3 Hydrology and 4.4 Energy and mineral matrix.

History Topics
BHSC AHSS (BGE) content indicates good alignment with DP BSS Topic 5 – Assembly, dynamic and crisis of Portuguese colonization in America (1500-1822). Indeed, the colonisation process and its consequences are included.[229] Moreover, DP BSS Topic 6 – Citizenship and formation of the Brazilian state (1822-1930) is also well covered within BHSC AHSS (BGE), which covers content on the formation of the Brazilian state, the Brazilian monarchist regime and the republic regimes.[230]

BHSC AHSS (BGE) shows partial alignment with Topic 7 – The modernisation of Brazil 1930-1964. Indeed, BHSC AHSS (BGE) covers tradition and modernity[231], which somewhat aligns with 7.1 The contradictions and ambiguities of modernization. Moreover, BHSC AHSS (BGE)'s inclusion of 'Historical heritage for the construction of National Identities, Respect for cultural differences'[232] has similarities to the DP subtopic of 7.1 Relations between state, society, economy and labour and their cultural expressions in Brazil in the process of modernization. However, no similar content to 7.2 Brazil in the international political-ideological web could be identified in BHSC AHSS (BGE).

[225] These topics were drawn from the RJRC for geography.
[226] This topic was drawn from the RJRC for geography.
[227] Same as above.
[228] These topics were drawn from the RJRC for geography.
[229] These topics were drawn from the RJRC for history.
[230] These topics were drawn from the RJRC for history.
[231] These topics were drawn from the RJRC for history.
[232] Brazil, Ministry of Education. (2018). *5.4.1. Applied Human and Social Sciences in High School: Specific competencies and skills.* BNCC.

Finally, BHSC AHSS (BGE) includes some similar content to Topic 8 – Civil-Military dictatorship and democratic construction in Brazil 1964-2006, as it refers to imperialism, monarchies, the Brazilian Federal Constitution (1988), and the history of present time.[233]

Historical or Geographical Investigation

There is no direct reference to an internal investigation like those conducted in DP BSS within BHSC AHSS (BGE).

Other BHSC AHSS (BGE) Content

As there is limited detail regarding the Brazilian history and geography topics to be covered in BHSC AHSS (BGE), it is challenging to identity topics that are not in DP BSS. Generally, however, it can be noted that BHSC AHSS (BGE) does not appear to cover any different Brazilian history and geography content.

Table 45: Brazilian history and geography content in BHSC AHSS (BGE) which is not covered in DP BSS.

Significant content which is not included in DP BSS
Whilst history and geography in BHSC AHSS (BGE) covers more contexts outside of Brazil compared to the DP BSS, no significantly different Brazilian history and geography topics have been identified.

Summary

It is challenging to directly compare to DP BSS, as there is no equivalent social studies subject in the BHSC. However, comparison to DP BSS can be made by considering the AHSS knowledge area, with a focus on its Brazilian history and geography content. As would be expected, BHSC AHSS (BGE) does not solely focus on Brazil's history and geography. However, overall, BHSC AHSS (BGE) and DP BSS have some content alignment in terms of Brazilian history and geography. Indeed, there is at least partial alignment with all DP BSS topics, as BHSC AHSS (BGE) appears to cover at least some of the subtopics within each. Also, it can be noted that no significantly different Brazilian history/geography topics could be identified in BHSC AHSS (BGE). That said, it can be noted that the BNCC does not specify a list of history and geography topics specifically for BHSC AHSS (BGE), thus the level of alignment may differ from state to state. Moreover, the general level of detail regarding the content to be covered in BHSC AHSS (BGE) is less than that in DP BSS, thus some of the alignment conclusions are based on broad comparisons. Overall, there appears to be a similar breadth of Brazilian history and geography in BHSC AHSS (BGE) and DP BSS, though it appears, from the detail provided, that there may be more depth present in the latter.

BHSC Applied Human and Social Sciences (Formative Itinerary) – BHSC AHSS (FI)

In addition to basic general education, students may continue to engage with Brazilian history and geography content as part of a formative itinerary specialising in AHSS. Along with the BHSC, the Rio de Janeiro curriculum (RJRC) is consulted to provide examples of the type of content covered in BHSC AHSS (FI).

The skills for BHSC AHSS (FI) suggest that some further similar content to DP BSS Topic 4 - Environment and society may be covered. Indeed, EMICHCHSA09 states that students should "Propose and test mediation and intervention strategies to resolve problems of a

[233] Ibid.

sociocultural and environmental nature at a local, regional, national and/or global level".[234] The reference to local and national level indicates that sociocultural and environmental problems could be considered in the students' state, as well as Brazil generally.

Moreover, the skills for BHSC AHSS (FI) also indicate that research-based tasks and larger project will be included. However, it is not possible to determine whether the depth of the investigation-type tasks meets the depth of the DP BSS historical/geographical investigation, thus a partial alignment for this component is concluded.

The specialisation pathways offered for AHSS formative itineraries in Rio de Janeiro name some further areas which align with a few more subtopics in DP BSS (though not enough to increase the overall alignment judgement for any of the topics overall). For example, one of the curricular components in the 'Opportunity' pathway focuses on the population of Brazil, which aligns particularly with subtopics within BSS Topic 2 - Demographic dynamics and urbanization in Brazil. Moreover, the Rio de Janeiro 'Political-Social Education' pathway includes the regional development of Brazil from 20th Century, civil rights movements, the development of democracy, and economic policies, which aligns with subtopics in Topic 8 – Civil-Military dictatorship and democratic construction in Brazil 1964-2006.

The table below notes a few Brazilian history and geography areas identified in the Rio de Janeiro pathways that are less present in DP BSS.

*Table 46: Brazilian history and geography content in BHSC AHSS (FI) which is not covered in DP BSS.**

Significant content not in DP BSS
• Regarding the demographics and population of Brazil, there is a higher emphasis in Rio de Janeiro formative itineraries on population aging. Indeed, the Opportunity pathway includes a curricular component named 'the aging Brazilian population' and covers concepts such as the Brazilian age pyramid, the role of elderly, the impact of aging on health and policies, socioeconomic impact and the dependency ratio. • Higher emphasis on citizen rights • Higher emphasis on political structure

*These areas have been extracted from the specialisation pathways offered for AHSS formative itineraries in Rio de Janeiro and should therefore be considered as examples only, as the content of formative itineraries can vary from state to state.

Summary

Overall, despite aligning with some DP BSS topics, a significant amount of the prescribed content from DP BSS subtopics could not be identified in BHSC AHSS (FI). This could be somewhat due to the lesser detail provided regarding the content of for formative itineraries, but also may reflect the formative itineraries as components covering a broader area of knowledge (to encompass history, geography, philosophy, and sociology). Therefore, while the documentation (RJRC) indicates BHSC AHSS (FI) does cover some further Brazilian history and geography content beyond BHSC AHSS (BGE), this does not substantially increase the alignment with DP BSS content. In conclusion, BHSC AHSS (FI) covers a similar breadth of Brazilian history and geography to DP BSS, but the detail provided does not confirm whether this is to a similar degree of detail and depth.

[234] Brazil, Ministry of Education. (n.d.). *Curricular References for the Preparation of Formative Itineraries*.

5.6.3 Demand – Brazilian Social Studies

This section considers the alignment between DP BSS and BHSC AHSS in terms of demand. Using the same demand tool for the analysis of each subject, a demand profile was created for DP BSS, BHSC AHSS (BGE), and BHSC AHSS (FI).

The demand profile for BHSC AHSS (BGE), represents the demand of history and geography in basic general education. The BHSC AHSS (FI) demand profile represents the cumulative demand of studying history and geography in basic general education and then specialising in AHSS in the formative itinerary. It should be noted that the scores reflect the demand of the whole AHSS formative itinerary component, rather than its history and geography content specifically. These demand profiles are presented in the form of radar diagrams, with a superimposed diagram featured to enable the immediate visual comparison of all profiles.

Figure 42: Visual representations of subject demand

The panel of experts carried out a detailed analysis of each course and reached a consensus on the scores shown in the profiles above. The following points were particularly important within the panel discussion:

- Regarding the scores for **Bloom's Cognitive Skills**:
  - DP BSS was found to have a strong presence of analysis skills in its aims and assessment objectives. Though some areas of evaluation and synthesis were also highlighted, they were not seen to warrant a score of 3, as they were not found to be the predominant focus, nor were they embedded repeatedly. Therefore, a score of 2 was awarded.
  - For BHSC AHSS (BGE), a score of 2.5 was given. A clear theme of analysis was found throughout the competencies and skills and there was also some evidence of evaluation and synthesis found, indicating the presence of higher-level thinking skills. For BHSC AHSS (FI), the demand panel decided that a score of 3 was most suitable. Indeed, there was a continued focus on analysis in the formative itinerary skills, with extended focus on synthesis and evaluation of several complex themes. As a progression from basic general education, this built upon the existing skills and pushed the score to a 3.

- Regarding the scores for **Depth of Knowledge**:
  - DP BSS received a score of 2 for the depth of knowledge. Indeed, a strong presence of strategic thinking was found, particularly given the emphasis on analysis found within the aims and assessment objectives. As the topics within DP BSS were judged to be covered in considerable, rather than a high, level of detail, a score of 2 was given.
  - For BHSC AHSS (BGE), it was judged that there was a strong presence of strategic thinking across the competencies and skills, particularly due to the extended use of analysis. The competencies outlined required a complex understanding to enable students to analyse/evaluate multi-faceted issues and problems. Whilst it is hard to determine how consistently this is applied, due to the more granular and flexible nature of the specific competencies and skills, the panel agreed that the depth of knowledge required was higher than that associated with a score of 2, but that extended thinking was not predominant enough for a score of 3 to be awarded, resulting in a 2.5. For BHSC AHSS (FI), a score of 3 for depth of knowledge was deemed suitable. Indeed, the interdisciplinary nature of the formative itinerary and its requirement to synthesise knowledge from different areas to address topics and problems was deemed to pose further opportunity for extended thinking.

- Regarding the scores for **Volume of Work**:
  - The DP BSS subject received a score of 2 for volume of work. The high number of themes and subtopics covered, combined with the fact that the subject requires the understanding of two subject areas (Brazilian history and Brazilian geography), resulted in the decision that there was a moderate to heavy workload in the subject.
  - For BHSC AHSS (BGE), it was judged that the number and nature of the historical and geographical themes covered in the time allocated[235], represented a moderate volume of work, resulting in a score of 1. For BHSC AHSS (FI), a score of 1 for volume of work was also deemed suitable. Although there are some complex tasks involved, the time allocated to the specialisation components of the formative itinerary is very generous. As this would allow enough time for the student to build

[235] Time allocations were drawn from the RJRC.

knowledge and refine the necessary skills, it was deemed that the volume of work was moderate.

- Regarding the scores for **Outstanding Areas of Subject Demand**:
  - For DP BSS, the internal investigation and the interdisciplinary nature of the subject were judged to be stretch areas, resulting in a score of 1.
  - For both BHSC AHSS (BGE) and BHSC AHSS (FI), it was judged that no areas of required stretch were present in the documented reviewed, resulting in a score of 0.

6. Key Findings

This section summarises the alignment and main similarities and differences found between the DP and the BHSC, both at programme-level and subject-level.

6.1 Programme Level

Philosophical Underpinnings

All the key themes extracted from the IB's learner profile, teaching and learning approaches, and philosophy of international-mindedness are strongly present in the principles, pedagogical proposal, and general competencies that inform the curriculum design of the BHSC. Indeed, themes of conceptual thought and understanding, independence and self-management, critical inquiry and reasoning, and principled and community-oriented are evident in both curricula. That said, while the BHSC also focuses on diversity and intercultural understanding, this is more directed to the Brazilian context, rather than international context as in the DP. Moreover, while both curricula aim for learning to be grounded in real-world contexts, the BHSC emphasises preparation for work, and, thus, has a larger focus than the DP on professional contexts. Overall, however, students or teachers moving between the two qualifications would find a high level of consistency between the philosophical underpinnings of both curricula.

Programme Structure

There are some similarities between the DP and BHSC structures; for example, both encourage breadth of study and require students to study subjects from broadly similar subject areas. Overall, however, the structures of the DP and BHSC differ significantly. One key difference is that the DP is organised into single-subject courses, whereas the BHSC is organised into broader areas of knowledge for basic general education and formative itineraries. Whilst basic general education may be taught as single subjects in some Brazilian states, the formative itineraries do not appear to be offered as such and instead integrate subjects within one or more areas of knowledge. Moreover, it can be noted that that the BHSC requires basic general education to span a greater number of subjects than what is studied by students in the DP.

Furthermore, the DP has a shorter duration (two years) than high school in Brazil (three years) and is more prescriptive with regards to curricular organsiation and the allocation of teaching hours per subject than the BHSC. The BHSC also includes a life project component which shares some similar aims to the DP core, although features less extensive requirements than those set for TOK, CAS, and the extended essay. Finally, the BHSC includes the option to persue technical and professional training, which is not the case for the DP – as this is instead the focus of the IB's Career-related Programme.

Entry Requirements

The IB encourages students and teachers to consult subject guides around expected prior learning but does not provide fixed entry requirements. In contrast, entry to high school in Brazil is dependent on the successful completion of elementary school. Students who are not able to successfully demonstrate the expected abilities must repeat the grade or year.

Both the IB Diploma and Brazilian High School Graduation Certificate are used for entry into higher education institutions. However, students in Brazil will often also need, in addition to their certificate, their results from university admission tests, such as the ENEM.

Student Learning Pathways

There is a greater degree of optionality and single-subject specialisation in the DP than the BHSC. Indeed, DP students can choose all their subjects, whereas all Brazilian high school students must study the same subjects in basic general education. Though Brazilian students choose the formative itinerary that they specialise in, this is a choice between subject areas, rather than single subjects. Thus, whereas the BHSC specialisation pathways integrate subjects within a subject area, the DP specialisation pathway is comprised of distinct single-subjects. Moreover, DP HL courses are required to be chosen from several subject areas, whereas formative itineraries need only incorporate one integrated subject area. Therefore, the BHSC allows for pathways that expose students to fewer subject areas at the specialisation level compared to the DP.

However, it can be noted that the BHSC does allow for flexibility in student pathways, as systems and institutions are able to arrange the curriculum to best meet their students' needs. Moreover, the Brazilian High School Graduation Certificate can be obtained from alternative pathways, such as adult learning programmes.

Assessment Methods

The assessment leading to the Brazilian High School Graduation Certificate is decentralised, as the BHSC allows local education systems to make decisions regarding the assessment of student learning. In contrast, the DP follows a more homogenised approach, with assessment objectives, methods, and weightings being set centrally. Due to these differences, it is challenging to meaningfully compare the BHSC assessment methods with those of the DP, though some general trends can be noted. For instance, unlike the IB Diploma, the Brazilian High School Graduation Certificate does not require students to sit the same standardised external examinations (though Brazilian students will experience this form of assessment if they take the ENEM).

It can be noted that some of the assessment activities outlined in Brazilian curriculum guidelines, such as written tests and projects, have similarities to the assessment methods used in the DP. Lastly, there are some similarities between the subject-specific assessment objectives of the DP and the BNCC's specific competencies and skills for areas of knowledge.

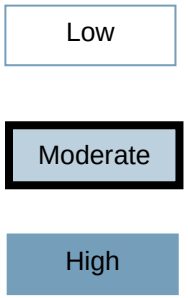
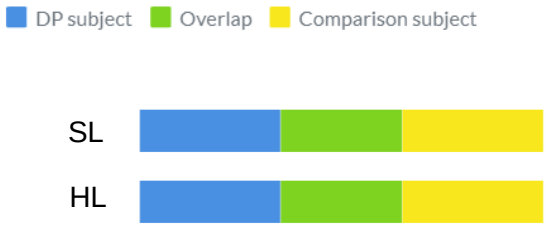
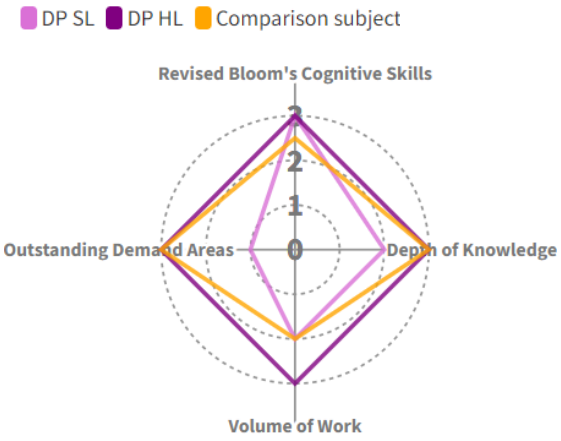
Summary

The philosophical underpinnings constitute the most significant point of similarity between the DP and BHSC. In all other respects, there are notable differences. Some key differences include the emphasis on subject integration vs single-subject study, the number of subjects studied, the nature of specialisation, the degree of optionality, the prescriptiveness of entry requirements, and the degree of assessment centralisation.

6.2 Subject Level

This section provides visual summaries of the subject-level alignment between specific subjects within the DP and the respective comparison points in the BHSC. It should be noted that, while the Rio de Janeiro high school curriculum (RJRC) was used to inform the content and demand analysis of BHSC subjects, Brazil's decentralised approach to education (both with regard to curriculum and assessment) means these findings may differ across education institutions and states. The summaries include key findings on learning outcomes alignment, content alignment and demand alignment, as per the key below:

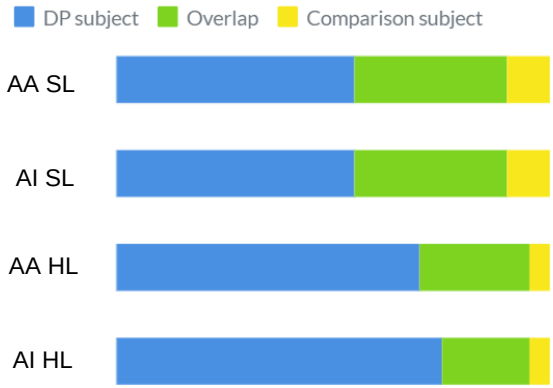
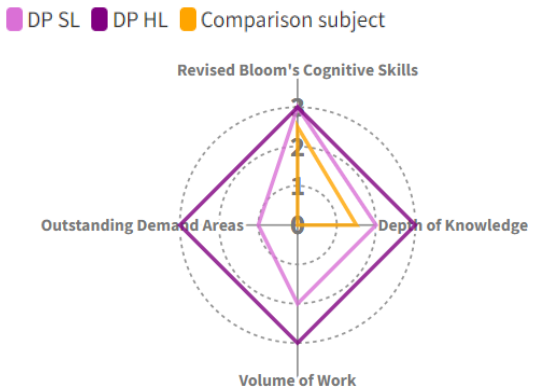
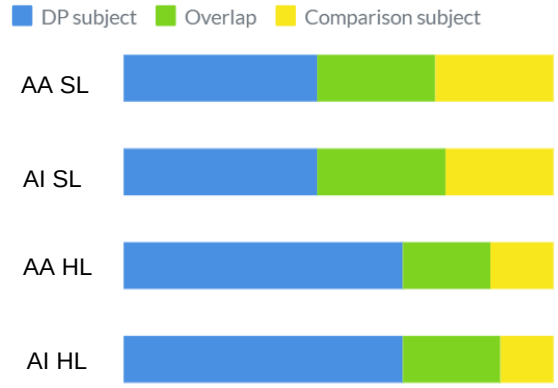
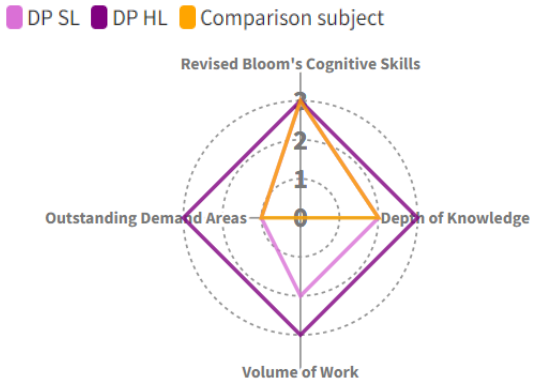
Key:

Comparison subject	Learning outcomes alignment	Content alignment	Demand alignment
Displays the name of the comparison subject	 This represents the learning outcome alignment between the DP subject and the comparison subject. A black border is placed around the selected judgement – 'Moderate' in this example.	 These bars represent the content alignment between the DP subject and the comparison. There is one bar showing alignment with SL content and another for HL content (inclusive of SL content). The **green** section of the bar represents the overlap of content between the subjects. The **blue** section represents content which was in the DP subject only. The **yellow** section represents content which was in the comparison subject only. Therefore, if, say, the blue section was longer than the yellow, this can be interpreted as DP subject having more content unique to itself than the comparison did. A large green bar would indicate that a substantial proportion of content overlaps between the DP and the comparison subject.	 This radar diagram displays the demand judgement scores for the comparison subject(s) and the DP subject – both SL and HL.

6.2.1 Mathematics Alignment

The subject level alignment between DP mathematics (AA and AI, SL and HL) and BHSC Mathematics and Technology (MAT) is represented below:

Figure 43: Visual representations of subject-level alignment (mathematics)

Comparison subject	Learning outcomes alignment	Content alignment	Demand alignment*
BHSC Mathematics and Technology (Basic General Education) *BHSC MAT (BGE)*	Low Moderate **High**		
BHSC Mathematics and Technology (Formative Itinerary) *BHSC MAT (FI)***	Low Moderate **High**		

* DP mathematics: analysis and approaches (AA) and mathematics: applications and interpretation (AI) score the same as each other for SL and the same as each other for HL.
** BHSC MAT (FI) represents the pathway of studying MAT in basic general education and then specialising in a MAT formative itinerary.

- **Learning outcomes alignment**: there is a high level of alignment between the learning outcomes of DP mathematics and BHSC MAT. Indeed, all the DP mathematics learning outcome themes are present in BHSC MAT, including a strong emphasis on considering and using mathematics with respect to wider contexts (such as local and global issues) and developing critical thinking, technological, communication, and transferable learning skills within the subject.

- **Content alignment**: the documentation indicates that there is a low-moderate level of content alignment between BHSC MAT and DP mathematics (AA and AI), with the level of content alignment with DP mathematics being very similar for both BHSC MAT (BGE) and BHSC MAT (FI). Indeed, BHSC MAT (BGE) does cover some, but not all, DP SL content and overall has less breadth and depth than DP SL and HL mathematics subjects. BHSC MAT (FI) increases the breadth of mathematical application; however, the formative itinerary component does not focus on extending the complexity of the mathematics covered; thus, it does not present a stronger alignment with DP mathematics than BHSC MAT (BGE). The content for MAT formative itineraries is described in limited detail, thus the breadth and depth of BHSC MAT (FI) is challenging to ascertain. Generally, it is indicated that the breadth and depth of BHSC MAT (FI) may be similar to DP SL subjects, but with differences in the content covered.

- **Demand alignment**: it can be noted that the demand scores for BHSC subjects are based on documentation which has somewhat limited detail regarding subject content. Generally, the documentation reviewed indicates a low-moderate alignment between the demand scores of DP mathematics (AA and AI) and BHSC MAT. BHSC MAT (BGE) scores lower than DP SL subjects in all categories, whereas BHSC MAT (FI) has stronger alignment with DP SL subjects, scoring the same for most demand categories. BHSC MAT subjects score lower overall compared to DP HL subjects, and lower than all DP mathematics subjects for volume of work.

The **key similarities** identified were the following:

- **Similarities in learning outcomes**: The mathematics learning outcomes for BHSC MAT have strong similarities with DP mathematics with regards to considering and using mathematics in wider contexts and developing critical thinking skills. Furthermore, both encourage inquiry-based approaches by expecting students to investigate conjectures, analyse information, and draw conclusions. Problem-solving skills are also a key emphasis in both mathematics curricula, as well as the use of technology, effective and accurate communication, making connections and generalisations, and understanding and applying mathematical concepts and procedures. Overall, there is a strong alignment in the mathematics learning outcomes of DP mathematics and BHSC MAT.

- **Similarities in content**: Whilst not strongly similar, BHSC MAT and DP SL mathematics subjects have partial content alignment, sharing some content in most topic areas. Moreover, it can be noted that the specific skills for BHSC MAT often include similar real-world contexts, interdisciplinary links, and uses of technology to those suggested in the ‘Connections’ sections of the DP mathematics subject guides,

which reinforces the learning outcome findings that BHSC MAT has a similar emphasis on these aspects. Moreover, while BHSC MAT (FI) does not particularly increase alignment with DP mathematics content beyond that observed for BHSC MAT (BGE), the applied focus of the formative itinerary component has similarities with the applied thematic focus of DP AI.

- **Similarities in demand**: There is moderate alignment between the demand scores of DP SL mathematics subjects and BHSC MAT (FI). Indeed, these profiles receive the same score in all categories except volume of work. These scores reflect a similarity in the emphasis on critical thinking in their learning outcomes and the presence of tasks that promote a deeper engagement with mathematics content (though it can be noted that BHSC MAT content is overall less complex than DP SL and HL mathematics). Moreover, while less aligned with DP HL, BHSC MAT scores similarly with regards to Bloom's cognitive skills.

The **key differences** identified were the following:

- **Differences in learning outcomes:** Though DP mathematics and BHSC MAT share very similar learning outcomes, it can be noted that the formative itinerary skills of BHSC MAT have a greater focus than the DP on some skills involving entrepreneurship and proposing mediation and intervention strategies for global and local issues.

- **Differences in content:** BHSC MAT (BGE) and BHSC MAT (FI) do not cover a considerable amount of content which is in DP mathematics. Indeed, no DP AHL content is covered and, in contrast to DP mathematics subjects, BHSC MAT does not cover any calculus content. Moreover, BHSC MAT content overlaps some DP SL content, but does not cover topics such as functions and statistics in as much detail and depth. Moreover, the formative itinerary component is application-focused and covers areas that are not featured in DP mathematics, such as logic, robotics, and gamification. Overall, the level of content alignment is relatively low, and BHSC MAT features less breadth and depth than DP HL subjects and less depth in the topics it shares with DP SL mathematics.

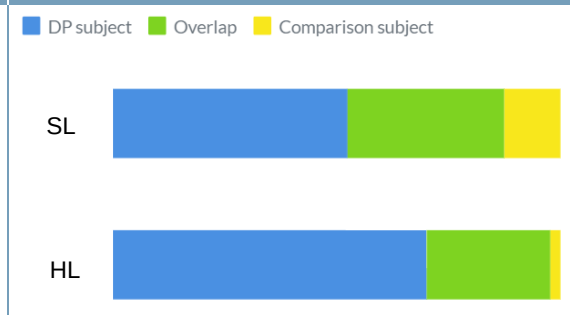
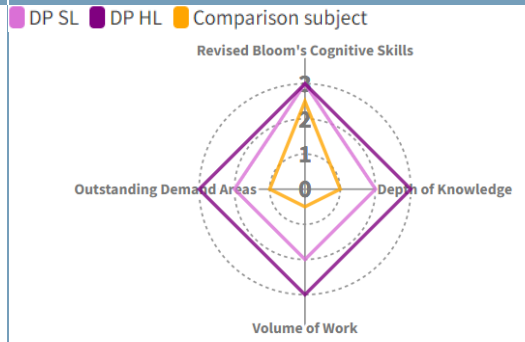
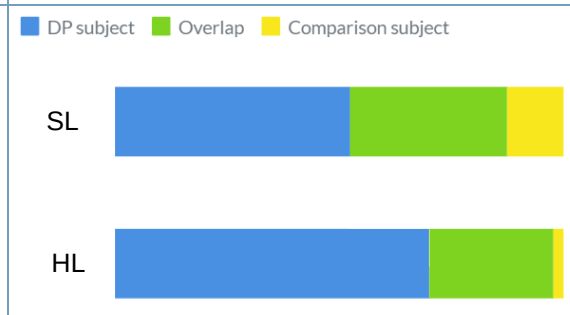
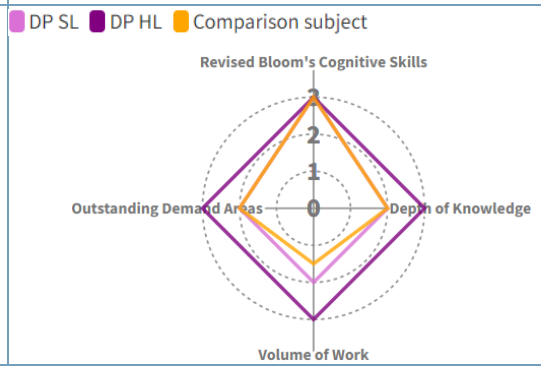
- **Differences in demand:** the demand scores of DP HL mathematics subjects and BHSC MAT subjects are not strongly aligned. Indeed, DP HL subjects score higher with regards to depth of knowledge, volume of work, and outstanding demand areas. Moreover, a generous amount of time is allocated for BHSC MAT subjects, contributing to a lower volume of work score compared to all DP mathematics subjects.[236]

[236] Time allocations were drawn from the RJRC.

6.2.2 Physics Alignment

The subject level alignment between DP physics (SL and HL) and BHSC Natural Sciences and Technology (NST) is represented below:

Figure 44: Visual representations of subject-level alignment (physics)

Comparison subject	Learning outcomes alignment	Content alignment*	Demand alignment
BHSC Natural Sciences and Technology (Basic General Education) *BHSC NST (BGE) Physics-focus*	Low / Moderate / **High**		
BHSC Natural Sciences and Technology (Formative Itinerary) *BHSC NST (FI) Physics-focus***	Low / Moderate / **High**		

*Physics content was broadly described in the documentation for BHSC NST. As such, specific concepts mentioned in DP physics topics were often not identifiable. Where there was limited reference to specific concepts, but broader evidence of coverage, it was concluded that the DP topic/subtopic was 'partially present' in BHSC NST. Therefore, the actual level of alignment may be slightly stronger, or weaker, than what is presented in these key findings.

** BHSC NST (FI) here represents the pathway of studying physics in basic general education and then specialising in an NST formative itinerary. The learning outcomes and demand conclusions for this pathway have considered the NST formative itinerary as a whole, whereas the content judgements only consider the physics content specifically (chemistry and biology content is not considered).

- **Learning outcomes alignment**: the level of alignment between the learning outcomes of DP sciences and BHSC NST is high. Indeed, all DP sciences learning outcome themes are represented either completely or partially in BHSC NST learning outcomes. Specifically, the themes of applying the elements that characterise science, using creativity and critical thinking, developing technological skills, and being aware of the issues and impacts of science, are all evident in the learning outcomes for BHSC NST. The DP themes of developing conceptual understanding and making connections, and of collaboration and communication, are also partially evident.

- **Content alignment**: the significantly more limited detail in BHSC NST documentation regarding the physics content to be covered poses a challenge when ascertaining the level of content alignment with DP physics. Generally, the documentation reviewed indicates that there is low-moderate content alignment between DP physics and BHSC NST, with the level of content alignment with DP physics being very similar for both BHSC NST (BGE) and BHSC NST (FI). The SL content from most DP physics topics is partially present in BHSC NST, but there is limited presence of AHL content. Where found, DP topics tend to have a 'partial', rather than 'strong', presence in BHSC NST – partially due to the BHSC describing the content in far less detail than the DP physics guide. As less physics content appears to be present, both BHSC NST (BGE) and BHSC NST (FI) have less breadth and depth than DP SL and HL physics.

- **Demand alignment**: it can be noted that the demand scores for BHSC subjects are based on documentation which has somewhat limited detail regarding subject content. Generally, the documentation reviewed indicates that there is low-moderate alignment between the demand scores of DP physics and BHSC NST. Indeed, BHSC NST (BGE) scores lower than DP physics SL, whereas BHSC NST (FI) scores the same in most demand categories and is closely aligned with DP physics SL. The BHSC NST subjects do not align strongly with DP physics HL, as both BHSC NST (BGE) and BHSC NST (FI) have lower scores in most categories.

The **key similarities** identified were the following:

- **Similarities in learning outcomes**: the learning outcomes of BHSC NST have many similarities to those of DP sciences. BHSC NST similarly aims for students to use and apply knowledge and procedures typical of natural sciences (including scientific inquiry), use creativity and critical thinking, develop technological skills, and be aware of global and local problems and the impacts of science. Likewise, students are expected to develop conceptual understanding and communication skills, which partially reflects the DP themes of developing conceptual understanding and making connections, and of collaboration and communication.

- **Similarities in content**: There is some overlapping content between DP physics and BHSC NST. Regarding SL physics content, all subtopics from A. Space, time and motion, B. The particulate nature of matter, D. Fields, and E. Nuclear and quantum physics are partially present within BHSC NST. Moreover, some subtopics within C. Wave behaviour – namely, C.2 Wave model and C.3 Wave phenomena – are also

partially present. Physics content within BHSC NST also indicates some alignment with two DP AHL topics – namely B4. Thermodynamics and D4. Induction.

- **Similarities in demand**: It can be noted that BHSC NST (BGE) has the same demand score as DP physics SL for depth of knowledge. Generally, however, BHSC NST (FI) has stronger alignment with DP physics SL, as it receives the same scores for Bloom's cognitive skills, depth of knowledge, and outstanding demand areas. BHSC NST (FI) also shares the same score with DP physics HL for Bloom's cognitive skills.

The **key differences** identified were the following:

- **Differences in learning outcomes:** The learning outcomes for BHSC NST place less emphasis on making connections between science subjects than the learning outcomes for DP sciences. Furthermore, though requiring students to demonstrate respect and take part in group work, the learning outcomes for BHSC NST make less explicit reference than the DP to the development of collaborative skills. Finally, the DP physics syllabus outlines specific experiments to be conducted, whereas, although scientific inquiry is present, there is limited mention of specific experiments within BHSC NST.

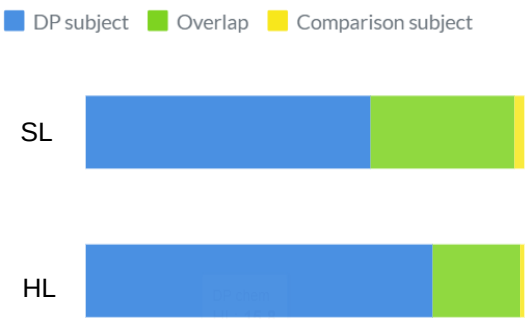
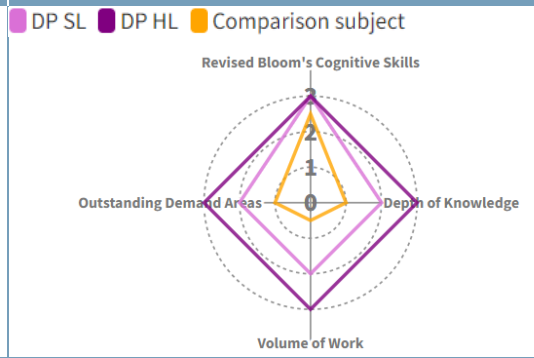
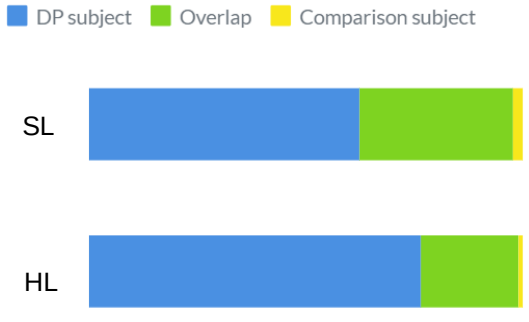
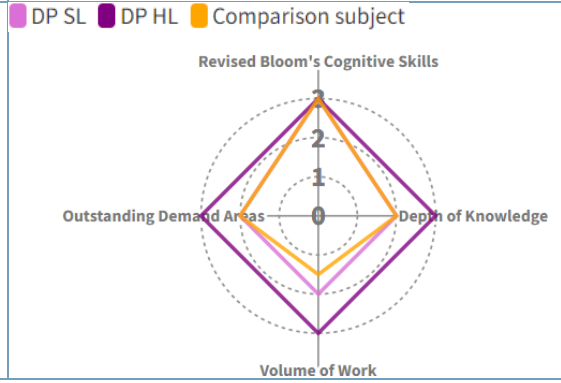
- **Differences in content:** Where alignments are found with DP physics topics, these tend to be partial, as opposed to strong – though this is sometimes due to the limited detail available in the BHSC NST documentation. Furthermore, BHSC NST does not indicate any presence of SL content from three DP subtopics in C. Wave Behaviour – namely C.1 Simple Harmonic Motion, C.4 Standing waves and resonance, and C.5 Doppler effect. Additionally, there is very little DP AHL physics content in BHSC NST. BHSC NST (FI) does not present a stronger alignment with DP physics content than BHSC NST (BGE), as few further SL subtopics and AHL subtopics could be identified. BHSC NST (FI) offers specialisation in science generally, as opposed to physics specially, and provides an opportunity for students to extensively apply scientific concepts to a variety of contexts and issues. Finally, BHSC NST contains less detail on the specific experimental activities to be carried out compared to DP physics' experimental programme.

- **Differences in demand:** There is an overall low-moderate alignment between the demand scores of DP physics and BHSC NST subjects. BHSC NST (BGE) scores lower than DP SL for Blooms' cognitive skills, volume of work, and depth of knowledge. In addition, BHSC NST (BGE) scores lower than DP HL for all demand categories. BHSC NST (FI) scores lower for volume of work than DP SL and scores lower than DP HL for depth of knowledge, volume of work, and outstanding areas of demand.

6.2.3 Chemistry Alignment

The subject level alignment between DP chemistry (SL and HL) and BHSC Natural Sciences and Technology (NST) is represented below:

Figure 45: Visual representations of subject-level alignment (chemistry)

Comparison subject	Learning outcomes alignment	Content alignment*	Demand alignment
BHSC Natural Sciences and Technology (Basic General Education) *BHSC NST (BGE) Chemistry-focus*	Low Moderate **High**		
BHSC Natural Sciences and Technology (Formative Itinerary) *BHSC NST (FI) Chemistry-focus***	Low Moderate **High**		

* Chemistry content was broadly described in the documentation for BHSC NST. As such, specific concepts mentioned in DP chemistry topics were often not identifiable. Where there was limited reference to specific concepts, but broader evidence of coverage, it was concluded that the DP topic/subtopic was 'partially present' in BHSC NST. Therefore, the actual level of alignment may be slightly stronger, or weaker, than what is presented in these key findings.

** BHSC NST (FI) here represents the pathway of studying chemistry in basic general education and then specialising in a NST formative itinerary. The learning outcomes and demand conclusions for this pathway consider the NST formative itinerary component as a whole, whereas the content judgements only consider its chemistry content specifically (physics and biology content is not included).

- **Learning outcomes alignment**: the level of alignment between the learning outcomes of DP sciences and BHSC NST is high. Indeed, all DP sciences learning outcome themes are represented either completely or partially in the BHSC NST. Specifically, the themes of applying the elements that characterise science, using creativity and critical thinking, developing technological skills, and being aware of the issues and impacts of science, are all evident in the learning outcomes for BHSC NST. The DP themes of developing conceptual understanding and making connections; and of collaboration and communication, are also partially evident.

- **Content alignment**: the significantly more limited detail in BHSC NST documentation regarding the chemistry content to be covered poses a challenge when ascertaining the level of content alignment with DP chemistry. Generally, the documentation reviewed indicates there is low-moderate content alignment between DP chemistry and BHSC NST, with the level of content alignment with DP chemistry being very similar for both BHSC NST (BGE) and BHSC NST (FI). DP SL content from most DP chemistry topics is partially present in BHSC NST, though there is little evidence of coverage of AHL chemistry content. Where found, DP topics tend to have a 'partial', rather than 'strong', presence in BHSC NST – partially due to the BHSC describing the content in far less detail than the DP chemistry guide. As less chemistry content appears to be present, BHSC NST (BGE) and BHSC NST (FI) are concluded to have less breadth and depth than DP chemistry SL and HL.

- **Demand alignment**: it can be noted that the demand scores for BHSC subjects are based on documentation which has somewhat limited detail regarding subject content. Generally, the documentation reviewed indicates that there is low-moderate alignment between the demand scores of DP chemistry and BHSC NST. Indeed, BHSC NST (BGE) scores lower than DP chemistry SL, whereas BHSC NST (FI) scores the same in most demand categories and is closely aligned with DP physics SL. The BHSC NST subjects do not align strongly with DP chemistry HL, as both BHSC NST (BGE) and BHSC NST (FI) have lower scores in most categories.

The **key similarities** identified were the following:

- **Similarities in learning outcomes**: the learning outcomes of BHSC NST have many similarities to those of DP sciences. BHSC NST similarly aims for students to use and apply knowledge and procedures typical of natural sciences (including scientific inquiry), use creativity and critical thinking, develop technological skills, and be aware of global and local problems and the impacts of science. Likewise, students are expected to develop conceptual understanding and communication skills which partially reflects the DP learning outcome themes of developing conceptual understanding and making connections, and of collaboration and communication.

- **Similarities in content**: SL content from most DP chemistry topics is partially present in BHSC NST (namely, from 'Structure 1. Models of the particulate nature of matter', 'Structure 2. Models of bonding and structure', 'Structure 3. Classification of matter', 'Reactivity 1. What drives chemical reactions?', and 'Reactivity 2. How much, how fast and how far?'). Significantly, the documentation indicates that BHSC NST includes

some SL content from each of the subtopics within these topics. Moreover, it can be noted that DP AHL content from subtopic 'Reactivity 1.2 – Energy cycles in reactions' is also partially present in BHSC NST. Lastly, it can be noted that BHSC NST includes practical work, thus partially aligning with the experimental programme in DP physics.

- **Similarities in demand**: BHSC NST (BGE) has the same demand score as DP chemistry SL for depth of knowledge. Generally, however, BHSC NST (FI) has stronger alignment with DP chemistry SL, as it receives the same scores for Bloom's cognitive skills, depth of knowledge, and outstanding demand areas. BHSC NST (FI) also shares the same score as DP chemistry HL for Bloom's cognitive skills.

The **key differences** identified were the following:

- **Differences in learning outcomes:** The learning outcomes for BHSC NST place less emphasis on making connections between science subjects than the learning outcomes for DP sciences. Likewise, although BHSC NST learning outcomes require students to demonstrate respect and take part in group work, they make less explicit reference than the DP to the development of collaborative skills. Finally, DP Sciences outline the specific experiments that students should conduct, whereas – although scientific investigation is present – there is limited mention of specific experiments within BHSC NST.

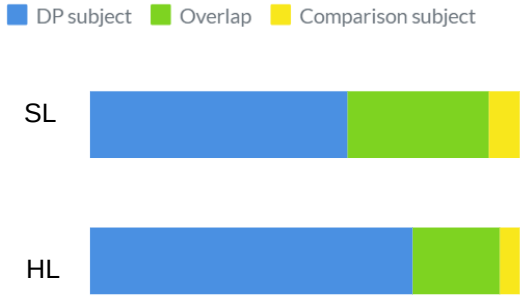
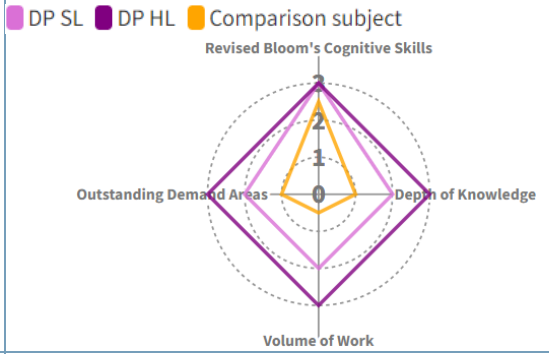
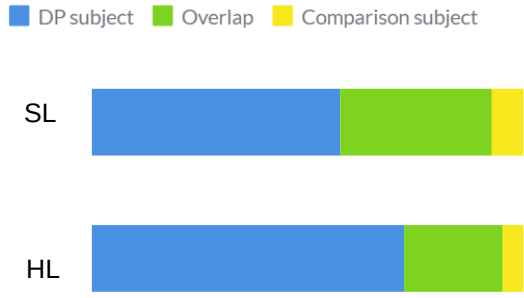
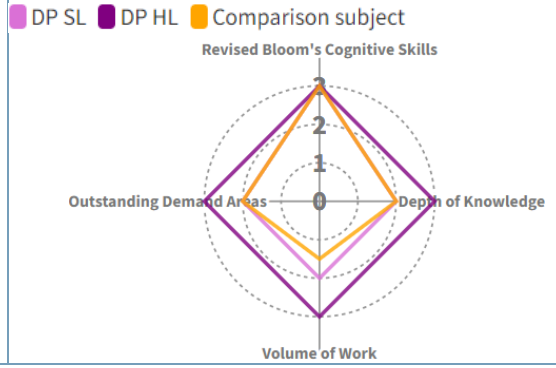
- **Differences in content:** Where alignments are found with DP chemistry topics, these tend to be partial, as opposed to strong – though this is sometimes due to the limited detail available in the BHSC NST documentation. Moreover, little DP SL content from 'Reactivity 3: What are the mechanisms of chemical change?' is present in BHSC NST. Likewise, there is limited DP AHL chemistry content in BHSC NST. BHSC NST (FI) does not present a stronger alignment with DP chemistry content than BHSC NST (BGE), as it covers few additional SL subtopics and AHL subtopics than the latter. BHSC NST (FI) offers specialisation in science generally, as opposed to chemistry specially, and provides an opportunity for students to extensively apply scientific concepts to a variety of contexts and issues. Finally, BHSC NST contains fewer mentions of specific experimental activities compared to DP chemistry's experimental programme.

- **Differences in demand:** There is an overall low-moderate alignment between the demand scores of DP chemistry and BHSC NST subjects. BHSC NST (BGE) scores lower than DP chemistry SL for Blooms' cognitive skills, volume of work, and depth of knowledge. Moreover, BHSC NST (BGE) scores lower than DP chemistry HL for all demand categories. BHSC NST (FI) scores lower for volume of work in comparison to DP chemistry SL and has lower scores than DP chemistry HL for depth of knowledge, volume of work, and outstanding areas of demand.

6.2.4 Biology Alignment

The subject level alignment between DP biology (SL and HL) and BHSC Natural Sciences and Technology (NST) is represented below:

Figure 46: Visual representations of subject-level alignment (biology)

Comparison subject	Learning outcomes alignment	Content alignment*	Demand alignment
BHSC Natural Sciences and Technology (Basic General Education) *BHSC NST (BGE) Biology-focus*	Low / Moderate / **High**		
BHSC Natural Sciences and Technology (Formative Itinerary) *BHSC NST (FI) Biology-focus***	Low / Moderate / **High**		

* Biology content was broadly described in the documentation for BHSC NST. As such, specific concepts mentioned in DP biology topics were often not identifiable. Where there was limited reference to specific concepts, but broader evidence of coverage, it was concluded that the DP topic/subtopic was 'partially present' in BHSC NST. Therefore, the actual level of alignment may be slightly stronger, or weaker, than what is presented in these key findings.

** BHSC NST (FI) here represents the pathway of studying biology in basic general education and then specialising in a NST formative itinerary. The learning outcomes and demand conclusions for this pathway consider the NST formative itinerary component as a whole, whereas the content judgements only consider its biology content specifically (physics and chemistry content is not included).

- **Learning outcomes alignment**: the level of alignment between the learning outcomes of DP sciences and BHSC NST is high. Indeed, all DP sciences learning outcome themes are represented either completely or partially in the BHSC NST. Specifically, the themes of applying the elements that characterise science, using creativity and critical thinking, developing technological skills, and being aware of the issues and impacts of science, are all evident in the learning outcomes for BHSC NST. The DP themes of developing conceptual understanding and making connections, and of collaboration and communication, are also partially evident.

- **Content alignment**: the significantly more limited detail in BHSC NST documentation regarding the biology content to be covered poses a challenge when ascertaining the level of content alignment with DP biology. Generally, the documentation reviewed indicates that there is low-moderate content alignment between DP biology and BHSC NST, with the level of content alignment with DP biology being very similar for both BHSC NST (BGE) and BHSC NST (FI). There is partial presence of DP SL content from most DP biology levels in BHSC NST and very limited presence of AHL biology content. Where found, the levels within DP themes tend to have a 'partial', rather than 'strong', presence in BHSC NST – partially due to the BHSC describing the content in far less detail than the DP biology guide. As less biology content appears to be present, both BHSC NST (BGE) and BHSC NST (FI) are concluded to have less breadth and depth than DP biology SL and HL.

- **Demand alignment**: it can be noted that the demand scores for BHSC subjects are based on documentation which has somewhat limited detail regarding subject content. Generally, the documentation reviewed indicates that there is low-moderate alignment between the demand scores of DP physics and BHSC NST. Indeed, BHSC NST (BGE) scores lower than DP physics SL, whereas BHSC NST (FI) scores the same in most demand categories and is closely aligned with DP physics SL. The BHSC NST subjects do not align strongly with DP physics HL, as both BHSC NST (BGE) and BHSC NST (FI) have lower scores in most categories.

The **key similarities** identified were the following:

- **Similarities in learning outcomes**: the learning outcomes of BHSC NST have many similarities to those of DP sciences. BHSC NST learning outcomes similarly aim for students to use and apply knowledge and procedures typical of natural sciences (including scientific inquiry), use creativity and critical thinking, develop technological skills, and be aware of global and local problems and the impacts of science. Likewise, students are expected to develop conceptual understanding and communication skills, which partially reflects the DP learning outcome themes of developing conceptual understanding and making connections, and of collaboration and communication.

- **Similarities in content**: SL content from most levels in the DP biology themes is partially present in BHSC NST. Specifically, BHSC NST includes some SL content from all levels within C. Interaction and independence; most levels within A. Unity and diversity (Molecules, Cells and Ecosystems); and some levels within B. Form and function and D. Continuity and change (Molecules and Cells; and Organisms and

Climate Change, respectively). Additionally, the presence of scientific investigation in BHSC NST means that there are similarities with the DP's experimental programme, hence partial alignment with this component is concluded.

- **Similarities in demand**: BHSC NST (BGE) has the same demand score as DP biology SL for depth of knowledge. Generally, however, BHSC NST (FI) has stronger alignment with DP biology SL, as it receives the same scores for Bloom's cognitive skills, depth of knowledge, and outstanding demand areas. BHSC NST (FI) also shares the same score with DP biology HL for Bloom's cognitive skills.

The **key differences** identified were the following:

- **Differences in learning outcomes:** The learning outcomes for BHSC NST place less emphasis on making connections between science subjects than the learning outcomes for DP Sciences. Likewise, while BHSC NST learning outcomes require students to demonstrate respect and take part in group work, there is less explicit reference to the development of collaborative skills than in the DP. Finally, DP Sciences outline specific experiments to be conducted, whereas – although scientific investigation is present – specific experiments are not detailed to the same extent in BHSC NST.

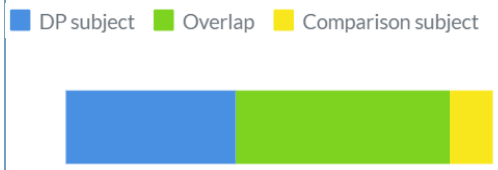
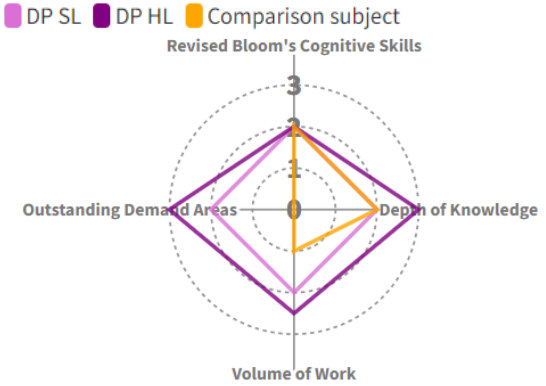
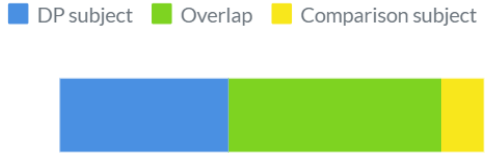
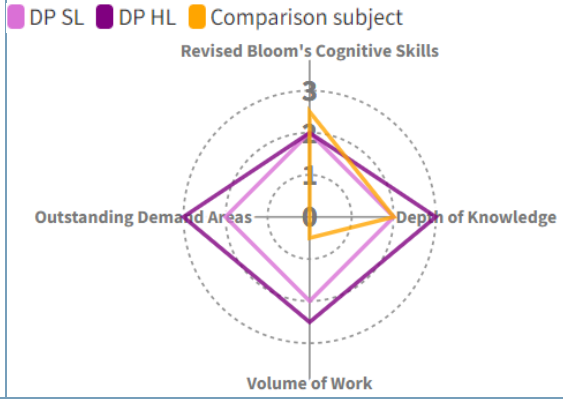
- **Differences in content:** Where alignments are found with the levels within the DP biology themes, these tend to be partial, as opposed to strong – though this is sometimes due to the limited detail available in the BHSC NST documentation. Moreover, there is little presence in BHSC NST of SL content from five DP levels – namely, A3. Organisms, B3. Organisms, B4. Ecosystems, D1. Molecules, and D2. Cells. Furthermore, there is very little DP AHL biology content in BHSC NST. BHSC NST (FI) does not present a stronger alignment with DP biology content than BHSC NST (BGE), as very few additional DP SL topics and AHL topics could be identified. BHSC NST (FI) offers specialisation in science generally, as opposed to biology specially, and provides an opportunity for students to extensively apply scientific concepts to a variety of contexts and issues. Finally, BHSC NST contains fewer mentions of specific experimental activities to be carried out compared to the DP's experimental programme.

- **Differences in demand:** There is an overall low-moderate alignment between the demand scores of DP biology and BHSC NST subjects. Indeed, BHSC NST (BGE) scores lower than DP biology SL for Blooms' cognitive skills, volume of work, and depth of knowledge. Furthermore, the demand scores for BHSC NST (BGE) are lower than DP biology HL for all demand categories. BHSC NST (FI) scores lower than DP biology SL for volume of work and lower than DP biology HL for depth of knowledge, volume of work, and outstanding areas of demand.

6.2.5 Language and Literature Alignment

The subject level alignment between DP language A: language and literature (LA:LL) (SL and HL) and BHSC Language and Technology (LAT) is represented below:

Figure 47: Visual representations of subject-level alignment (language and literature)

Comparison subject*	Learning outcomes alignment	Content alignment	Demand alignment
BHSC Language and Technology - Portuguese Language (Basic General Education) *BHSC LAT-PL (BGE) Portuguese Language-focus*	Low Moderate **High**	 The bar represents the areas and conceptual questions that may be considered, rather than the number of texts studied – as this is not specified in BHSC LAT. The areas of exploration and conceptual questions are the same for DP LA:LL SL and HL, hence only one bar is presented here.	
BHSC Language and Technology (Formative Itinerary) *BHSC LAT (FI) Portuguese Language-focus*	Low Moderate **High**	 The bar represents the areas and conceptual questions that may be considered, rather than the number of texts studied – as this is not specified in BHSC LAT. The areas of exploration and conceptual questions are the same for DP LA:LL SL and HL, hence only one bar is presented here.	

* While BHSC Language and Technology (LAT) encompasses several different subjects (Portuguese Language, English Language, Physical Education, and Art) the analysis and key findings judgements for BHSC LAT focus on its Portuguese Language elements.

- **Learning outcomes alignment**: Overall, there is a high level of alignment between the learning outcomes of DP LA:LL and BHSC LAT (Portuguese Language focus). Indeed, all the DP's learning outcome themes for LA:LL are present in the BHSC LAT, with most being well-evidenced in the latter.

- **Content alignment**: The documentation indicates that there is moderate language and literature content alignment between DP LA:LL and BHSC LAT. Indeed, the documentation indicates students may consider a good number of DP LA:LL conceptual questions from the areas of exploration within BHSC LAT-PL (BGE). Moreover, BHSC LAT (FI) may provide further opportunity to explore language and literature; however, it integrates content from other subjects as well. Therefore, unlike DP LA:LL HL, BHSC LAT (FI) does not solely focus on extending language and literature and the study of further texts. As a result, the level of content alignment with DP LA:LL is very similar for BHSC AHSS (BGE) and BHSC AHSS (FI). Moreover, the documentation indicates that a similarly broad range of text types may be studied in BHSC LAT; however, without specifying the number of different text types to be covered, it is difficult to meaningfully compare the breadth and depth of language and literature content between DP LA:LL and BHSC LAT.

- **Demand alignment**: it can be noted that the demand scores for BHSC subjects are based on documentation which has somewhat limited detail regarding subject content. Generally, the documentation reviewed indicates that there is low-moderate alignment between the demand scores of DP LA:LL and BHSC LAT subjects. Indeed, the BHSC LAT subjects score similarly to both DP LA:LL subjects for Bloom's cognitive skills and DP SL for depth of knowledge. However, BHSC LAT subjects score lower for volume of work and outstanding demand areas, particularly compared to DP LA:LL HL.

The **key similarities** identified were the following:

- **Similarities in learning outcomes**: Both DP LA:LL and BHSC LAT learning outcomes require the development of reading, writing, speaking, and listening skills, and expect students to study a broad range of texts, consider wider contexts and their influence, understand and analyse authors' choices, develop an appreciation of intertextuality and interdisciplinarity, and to develop their identity through the study of language and literature.

- **Similarities in content**: While DP LA:LL promotes more metacognitive thinking through its conceptual guiding questions, BHSC LAT allows depth of thought in aspects of language and literature which are in alignment with some of these questions in DP LA:LL. Indeed, BHSC LAT-PL (BGE) involves analysing a broad range of text-types, during which students will consider how language varies, how meaning is constructed, the choices made by the creator, the historical and cultural contexts, different perspectives, and intertextual and interdiscursive relationships. Regarding texts, like DP LA:LL, different literary and non-literary text-types are considered in BHSC LAT-PL (BGE), including different authors, genres, cultures, periods, and places. Moreover, it can be noted that BHSC LAT (FI) may provide some opportunity for further exploration of language and literature, but it is not its sole focus.

- **Similarities in demand**: As noted, BHSC LAT subjects score similarly to DP LA:LL subjects for Bloom's cognitive skills, as they are deemed to contain a similar emphasis on analysis and other higher-order thinking skills. Moreover, BHSC LAT subjects also score the same as DP LA:LL SL for depth of knowledge, due to a similar consistent emphasis on engaging in thinking beyond recall and application and providing opportunity for strategic thinking.

The **key differences** identified were the following:

- **Differences in learning outcomes:** While there is an overall high level of alignment in learning outcomes, it can be noted that communicating in a clear and logical manner is less explicitly emphasised in BHSC LAT than it is for DP LA:LL. Furthermore, the Portuguese Language skills in BHSC LAT differ to the learning outcomes in DP LA:LL by being related to 'fields of social action' and also by having a stronger requirement for students to produce, as well as study, a range of different text types. Moreover, it can be noted that the evidence for alignment with DP LA:LL primarily comes from the specific competencies and specific skills in BHSC LAT – the formative itinerary skills have fewer clear links with the DP LA:LL learning outcomes. This is likely a reflection of the integrated nature of a LAT formative itinerary (which encompasses other subjects as well as Portuguese Language).

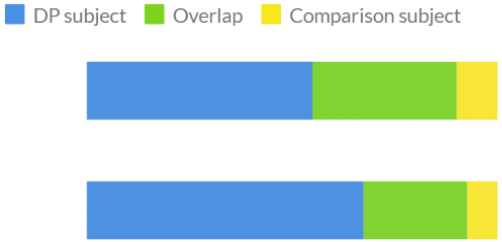
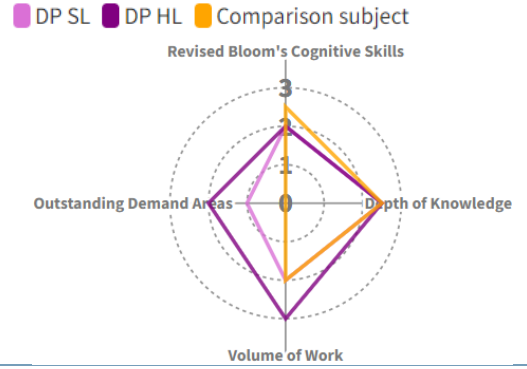
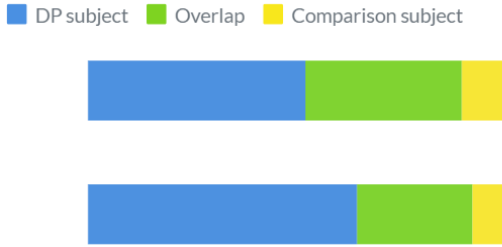
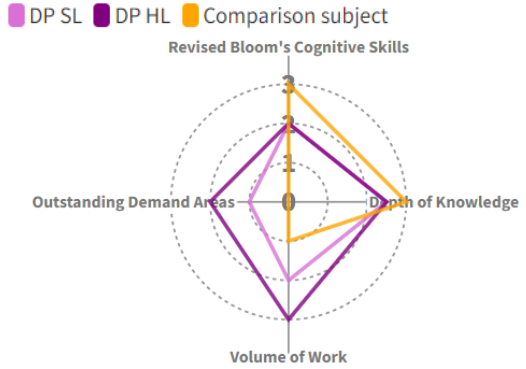
- **Differences in content:** One key difference between DP LA:LL and BHSC LAT subjects is the structure of content. Indeed, the structure of DP LA:LL is broad and led by areas of exploration and conceptual guiding questions, whereas BHSC LAT-PL (BGE) is presented as specific skills which are organised into fields of social action. Moreover, BHSC LAT (FI) is organised into curricular units which integrate Portuguese Language, English Language, art, and physical education content. With regards to the presence of DP LA:LL content, several of the conceptual guiding questions are not strongly present or identifiable in BHSC LAT-PL (BGE). For example, none of the content indicates that students will consider the validity of the notion of classical text. Conversely, BHSC LAT considers some different areas to DP LA:LL, such as the phenomenon of post-truth and the curation of information. BHSC LAT (FI) does not significantly increase alignment with DP LA:LL beyond what is observed for BHSC LAT-PL(BGE) as the formative itinerary component does not focus on extending language and literature knowledge specifically. Lastly, it can be noted that the reading text requirements for DP LA:LL are drawn from more strict criteria than for BHSC LAT subjects.

- **Differences in demand:** BHSC LAT subjects score lower than DP LA:LL SL and HL for volume of work. Indeed, a generous amount of time is allocated to BHSC LAT, resulting in a light/moderate volume of work, rather than moderate-heavy/heavy. However, it should be noted that volume of work is challenging to assess accurately in the absence of requirements regarding the number of texts to be studied in BHSC LAT. Finally, more areas of outstanding demand are present in DP LA:LL than BHSC LAT. For DP LA:LL subjects, these include the demand posed by the conceptual guiding questions, the expansive and exploratory nature of the syllabus, and the requirement to read translated texts.

6.2.6 History Alignment

The subject level alignment between DP history (SL and HL) and BHSC Applied Human and Social Sciences (AHSS) is represented below:

Figure 48: Visual representations of subject-level alignment (history)

Comparison subject	Learning outcomes alignment	Content alignment*	Demand alignment
BHSC Applied Human and Social Sciences (Basic General Education) *BHSC AHSS (BGE) History-focus*	Low Moderate **High**	 Each of the bars above represents the overlap that BHSC AHSS has with all the DP history topics available in SL and in HL. In practice, DP students only study a selection of these topics.	
BHSC Applied Human and Social Sciences (Formative Itinerary) *BHSC AHSS (FI) History-focus***	Low Moderate **High**	 Each of the bars above represents the overlap that BHSC AHSS has with all the history topics available in SL and in HL. In practice, DP students only study a selection of these topics.	

* History content was broadly described in the documentation for BHSC AHSS. As such, specific concepts mentioned in DP history topics were often not identifiable. Where there was limited reference to specific concepts, but broader evidence of coverage, it was concluded that the DP topic/subtopic was 'partially present' in BHSC AHSS. Therefore, the actual level of alignment may be slightly stronger, or weaker, than what is presented in these key findings.

** BHSC AHSS (FI) here represents the pathway of studying history in basic general education and then specialising in an AHSS formative itinerary. The learning outcomes and demand conclusions for this pathway reflect the whole AHSS formative itinerary component, whereas the content judgements only consider history content specifically (other humanities content is excluded).

- **Learning outcomes alignment**: There is a high level of alignment between the learning outcomes of DP history and BHSC AHSS. Indeed, BHSC AHSS includes most of the learning outcome themes extracted from DP history. BHSC AHSS learning outcomes likewise seek to develop similar skills, including analysis, critical evaluation, and an understanding of various historical contexts.

- **Content alignment**: The significantly more limited detail in BHSC AHSS documentation regarding the history content to be covered poses a challenge when ascertaining the level of content alignment with DP history. Generally, the documentation reviewed indicates that BHSC AHSS (BGE) and BHSC AHSS (FI) have low-moderate alignment with DP history SL and DP history HL. Indeed, some similar periods and events are covered within BHSC AHSS and DP history, and similarities can be drawn regarding the themes that the topics cover.[237] However, a significant number of specific case studies, topics, and periods offered in DP history are not referenced in BHSC AHSS. It is difficult to draw meaningful comparisons regarding breadth and depth of history content in DP history and BHSC AHSS. That said, it can be noted that the Rio de Janeiro curriculum allocates 160 hours to history content in BHSC AHSS (BGE), which is similar to that of DP history SL.

- **Demand alignment**: It can be noted that the demand scores for BHSC subjects are based on documentation which has somewhat limited detail regarding subject content. Generally, the documentation reviewed indicates that there is a moderate level of alignment between the demand scores of DP history and BHSC AHSS subjects. Indeed, the demand scores for BHSC AHSS (BGE) generally align with DP history SL, whereas the demand scores for BHSC AHSS (FI) are slightly higher than DP history subjects for some demand categories, and lower in others.

The **key similarities** identified were the following:

- **Similarities in learning outcomes**: Both DP history and BHSC AHSS learning outcomes show that students are expected to develop an understanding of historical contexts, critically study sources, engage with multiple perspectives, and formulate arguments through application, analysis and synthesis.

- **Similarities in content**: BHSC AHSS has at least partial alignment with all prescribed subjects and world history topics in DP history. Indeed, the documentation for BHSC AHSS indicates that similar themes to the prescribed subjects – such as leadership, protests, and causes for expansion – may be covered.[238] Moreover, several of the events covered by the DP's world history topics, such as the industrial revolution and 20th-century wars, are included in BHSC AHSS.[239] Lastly, BHSC AHSS (FI) indicates some (but not strong) alignment with the HL depth study of the History of the Americas and the DP historical investigation.

[237] These themes were drawn from history content in the RJRC.
[238] Ibid.
[239] Ibid.

- **Similarities in demand**: there are strong similarities between the demand scores of BHSC AHSS (BGE) and DP history SL. Indeed, the profiles score the same or similar for Bloom's cognitive skills, depth of knowledge, and volume of work.

The **key differences** identified were the following:

- **Differences in learning outcomes:** Some learning outcome themes are stronger in DP history than BHSC AHSS. Indeed, the theme of reflecting on the nature, methods, and theories of history is more present in the DP, as is the theme of metacognition and understanding of the self and the present day. Conversely, in BHSC AHSS, the formative itinerary skills have more emphasis on proposing mediation and intervention strategies.

- **Differences in content:** None of the case studies in the prescribed topics of DP history are referred to in BHSC AHSS. Furthermore, it is unclear from the BHSC AHSS documentation whether periods and contexts are covered in as much depth as the world history topics and HL depth studies of DP history. Since the documentation indicates that several prescribed subject themes and world history topics from DP history are considered to some extent in BHSC AHSS (BGE), it may be that it emphasises covering a breadth of historical contexts, rather than a few in depth. BHSC AHSS (FI) does not have much more alignment with DP history than BHSC AHSS (BGE), as the formative itinerary component does not focus on extending history knowledge specifically. Indeed, BHSC AHSS (FI) involves exploring broad areas, such as social participation in the Brazilian State[240], using an integration of philosophical, geographical, sociological, political, and historical considerations.

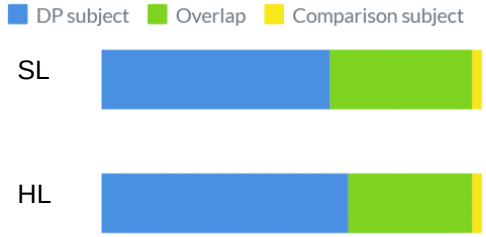
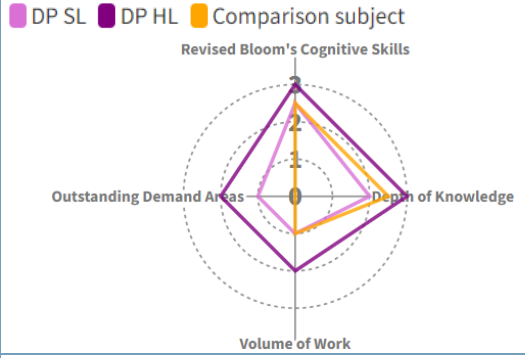
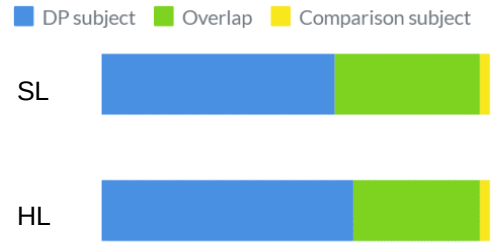
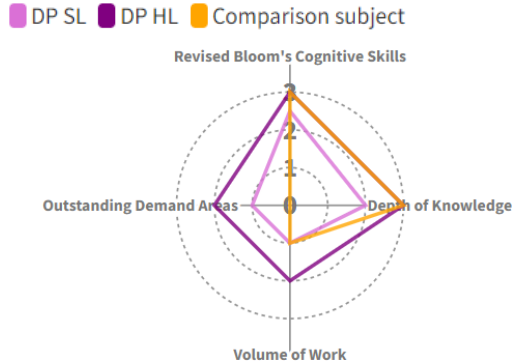
- **Differences in demand:** Neither the scores for BHSC AHSS (BGE) nor BHSC AHSS (FI) align strongly with DP history HL. Furthermore, BHSC AHSS (FI) also does not strongly align with the scores of DP history SL, as it scores higher for Bloom's cognitive skills and depth of knowledge, but lower for volume of work and outstanding areas of demand. The nature of BHSC AHSS (FI) contributes to the higher scores in some categories, as it requires the higher-order thinking skill of synthesis when bringing together concepts from different subject areas to address problems and examine topics. However, the allocation of teaching hours to this component indicates a lighter volume of work compared to DP history.[241] Moreover, DP history contains more stretch areas, such as the historical investigation and the regional expertise in the HL depth studies.

[240] This example has been taken from the RJRC.
[241] Teaching hours have been drawn from the RJRC.

6.2.7 Philosophy Alignment

The subject level alignment between DP philosophy (SL and HL) and BHSC Applied Human and Social Sciences (AHSS) is represented below:

Figure 49: Visual representations of subject-level alignment (philosophy)

Comparison subject	Learning outcomes alignment	Content alignment*	Demand alignment
BHSC Applied Human and Social Sciences (Basic General Education) *BHSC AHSS (BGE) Philosophy-focus*	Low Moderate **High**	 Each of the bars above represents the overlap that BHSC AHSS has with all the DP philosophy topics available in SL and in HL. In practice, DP students study a selection of these topics.	
BHSC Applied Human and Social Sciences (Formative Itinerary) *BHSC AHSS (FI) Philosophy-focus***	Low Moderate **High**	 Each of the bars above represents the overlap that BHSC AHSS has with all the DP philosophy topics available in SL and in HL. In practice, DP students study a selection of these topics	

* Philosophy content was broadly described in the documentation for BHSC AHSS. As such, specific concepts mentioned in DP philosophy topics were often not identifiable. Where there was limited reference to specific concepts, but broader evidence of coverage, it was concluded that the DP topic/subtopic was 'partially present' in BHSC AHSS. Therefore, the actual level of alignment may be slightly stronger, or weaker, than what is presented in these key findings.

** BHSC AHSS (FI) here represents the pathway of studying philosophy in basic general education and then specialising in an AHSS formative itinerary. The learning outcomes and demand conclusions for this pathway reflect the whole AHSS formative itinerary component, whereas the content judgements only consider philosophy content specifically (other humanities content is excluded).

- **Learning outcomes alignment**: Overall, there is a high level of alignment between DP philosophy and BHSC AHSS with regards to learning outcomes. All the DP philosophy learning outcome themes are present within the specific competencies and skills for BHSC AHSS. Most DP learning outcome themes are strongly present, whilst others are inferred. Conversely, the BHSC AHSS does not contain any significant learning outcome themes relating to philosophy that are not also in the DP philosophy learning outcomes.

- **Content alignment**: The lower level of detail in the BHSC AHSS documentation regarding the philosophical themes and topics to be covered poses a challenge when ascertaining the level of content alignment with DP philosophy. Generally, the documentation reviewed indicates that BHSC AHSS (BGE) and BHSC AHSS (FI) have a low-moderate level of alignment with DP philosophy, as their content partially aligns with most of the philosophy themes offered in the DP syllabus. While challenging to compare breadth and depth, it can be noted that the Rio de Janeiro curriculum allocates 80 hours to philosophy in BHSC AHSS (BGE), which is less than the time allocated for DP philosophy SL and HL. Therefore, it can be concluded that BHSC AHSS emphasises breadth of philosophical themes, rather than depth.

- **Demand alignment**: it can be noted that the demand scores for BHSC subjects are based on documentation which has somewhat limited detail regarding subject content. Generally, the documentation reviewed indicates that there is a moderate level of alignment between the demand scores of DP philosophy and BHSC AHSS. Indeed, overall, the demand scores for BHSC AHSS (BGE) align with DP philosophy SL. However, the BHSC AHSS subjects do not strongly align with DP philosophy HL, despite BHSC AHSS (FI) scoring the same for Bloom's cognitive skills and depth of knowledge.

The **key similarities** identified were the following:

- **Similarities in learning outcomes**: Most of the DP philosophy learning outcome themes are clearly present within the specific competencies, specific skills, and formative itinerary skills for BHSC AHSS. Indeed, both DP philosophy and BHSC AHSS learning outcomes include the development of knowledge and understanding of philosophical concepts, analysis and evaluation of philosophical concepts, considerations of ethics and diversity, and analysis and evaluation of philosophical materials.

- **Similarities in content**: BHSC AHSS includes some similar topics from the DP's core theme – Being human. Indeed, the documentation suggests that topics such as identity and freedom are included, as well as personhood and the Self and other. Moreover, the documentation indicates that BHSC AHSS covers some similar content to the DP philosophy optional themes – such as epistemology, political philosophy, and ethics. In addition, BHSC AHSS aligns with one area of the DP philosophy HL extension, namely Philosophy and Technology. Lastly, both DP philosophy and BHSC AHSS require students to read original philosophical texts within the study of philosophy (though BHSC AHSS does not prescribe a specific list of texts).

- **Similarities in demand**: DP philosophy SL and BHSC AHSS (BGE) score the same, or similar, for Bloom's cognitive skills, depth of knowledge, and volume of work. Moreover, DP philosophy HL and BHSC AHSS (FI) score the same for Bloom's cognitive skills and depth of knowledge.

The **key differences** identified were the following:

- **Differences in learning outcomes:** Some DP philosophy learning outcome themes – such as those relating to the articulation of ideas in written formats and understanding the diversity of thinking and approaches in philosophy – are not explicitly covered by BHSC AHSS, although they can be partially inferred from the specific competencies. Moreover, it can be noted that the formative itinerary skills in BHSC AHSS place a stronger emphasis than the DP on developing intervention and mediation strategies.

- **Differences in content:** Not all six concepts in the DP's core theme – Being human – are present in BHSC AHSS, with Consciousness and Human nature being absent. Moreover, the DP philosophy optional theme of Aesthetics is also not present in BHSC AHSS, nor are the HL topics of 'Philosophy and the environment' and 'The nature, function, meaning and methodology of philosophy'. Furthermore, while there are some similarities at the theme-level, specific concepts and topics that DP philosophy covers within themes are often not identifiable in BHSC AHSS – partially due to philosophy content being more broadly described in BHSC AHSS documentation. Moreover, BHSC AHSS (FI) does not significantly increase alignment with DP philosophy beyond what is observed for BHSC AHSS (BGE), as the formative itinerary component does not focus on extending philosophy knowledge specifically. Instead, BHSC AHSS (FI) focuses on exploring broad areas, such as social participation in the Brazilian State,[242] integrating philosophical, geographical, sociological, political, and historical considerations.

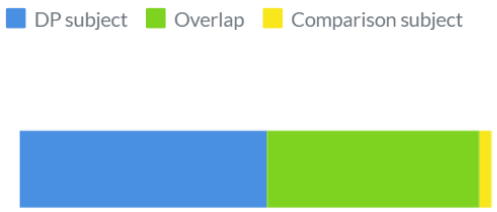
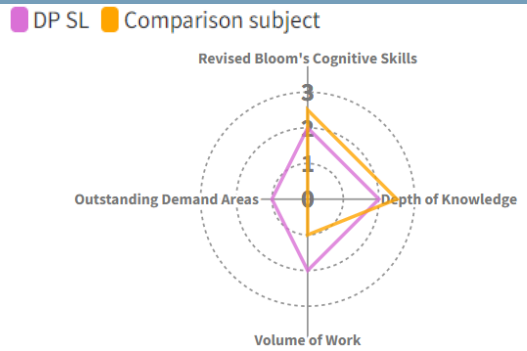
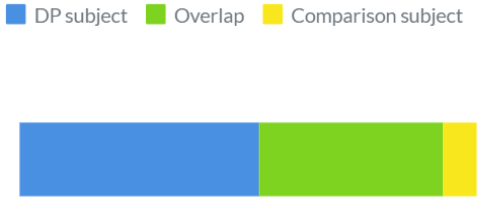
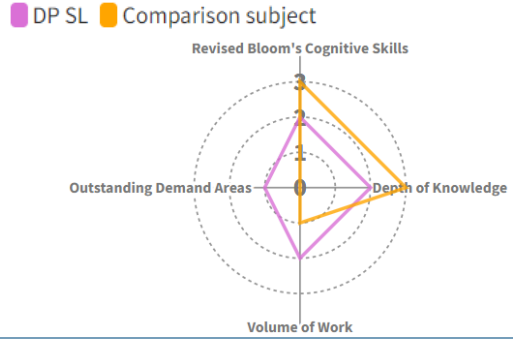
- **Differences in demand:** In contrast to DP philosophy, no areas of outstanding demand are identified in BHSC AHSS (BGE) or BHSC AHSS (FI). Notable areas of demand in DP philosophy include the significant detail to which the optional themes and HL contemporary issues are studied in. Lastly, DP philosophy HL scores higher than BHSC AHSS for volume of work.

[242] This topic was drawn from the RJRC.

6.2.8 Brazilian Social Studies Alignment

The subject level alignment between DP Brazilian social studies (BSS) and BHSC Applied Human and Social Sciences (AHSS) is represented below:

Figure 50: Visual representations of subject-level alignment (Brazilian social studies)

Comparison subject	Learning outcomes alignment	Content alignment*	Demand alignment
BHSC Applied Human and Social Sciences (Basic General Education) *BHSC AHSS (BGE) Brazilian history and geography focus*	Low Moderate **High**		
BHSC Applied Human and Social Sciences (Formative Itinerary) *BHSC AHSS (FI) Brazilian history and geography focus***	Low Moderate **High**		

* History and geography content was broadly described in the documentation for BHSC AHSS. As such, specific concepts mentioned in DP BSS topics were often not identifiable. Where there was limited reference to specific concepts, but broader evidence of coverage, it was concluded that the DP topic/subtopic was 'partially present' in BHSC AHSS. Therefore, the actual level of alignment may be slightly stronger, or weaker, than what is presented in these key findings.

** BHSC AHSS (FI) here represents the pathway of studying history and geography in basic general education and then specialising in an AHSS formative itinerary. The learning outcomes and demand conclusions for this pathway reflect the whole AHSS formative itinerary component, whereas the content judgements only consider Brazilian history and geography content specifically (other humanities content is excluded).

- **Learning outcomes alignment**: Overall, there is a high level of alignment between DP BSS and BHSC AHSS with regards to learning outcomes. All the DP BSS learning outcome themes are present within the specific competencies and skills for BHSC AHSS, and most DP themes are strongly present. Conversely, the BHSC AHSS does not contain any significant learning outcome themes relating to Brazilian history and geography that are not also in DP BSS.

- **Content alignment**: The limited detail in the documentation for BHSC AHSS regarding the Brazilian history and geography topics to be covered poses a challenge when ascertaining the level of content alignment with DP BSS. Generally, the documentation reviewed indicates that BHSC AHSS (BGE) and BHSC AHSS (FI) have moderate alignment with the topics offered in DP BSS. Indeed, Brazilian history and geography topics in BHSC AHSS suggest alignment, with some, but often not all, subtopics within the DP BSS history and geography topics.[243] As it is not clear to what depth Brazilian history and geography topics are covered in the BHSC AHSS, and because BHSC AHSS incorporates history and geography content for contexts outside Brazil, it is difficult to draw clear comparisons regarding breadth and depth. However, the documentation suggests that DP BSS spans a similar breadth to that of Brazilian history and geography in BHSC AHSS, but that the latter does not cover the topics of DP BSS in as much depth.

- **Demand alignment**: it can be noted that the demand scores for BHSC subjects are based on documentation which has somewhat limited detail regarding subject content. Generally, the documentation reviewed indicates that there is low-moderate alignment between the demand scores of DP BSS and BHSC AHSS subjects, with BHSC AHSS subjects scoring either less or more than DP BSS in each demand category.

The **key similarities** identified were the following:

- **Similarities in learning outcomes**: Both DP BSS and BHSC AHSS learning outcomes seek to develop similar skills. Indeed, both involve critically engaging with multiple perspectives and source materials, developing an understanding of the Brazilian culture through its history and geography, understanding global contexts, and forming arguments based on evidence.

- **Similarities in content**: BHSC AHSS (BGE) has at least partial alignment with all DP BSS topics, as some subtopics from each topic appear to be present. The DP BSS topics that BHSC AHSS (BGE) has the clearest alignment with are history topics 5 and 6, which focus on Portuguese colonisation, and citizenship and the formation of the Brazilian state. At subtopic level, BHSC AHSS (BGE) content indicates particularly strong alignment with those relating to the industrialisation process, internal migration, urbanisation, agricultural production, environmental problems, dictatorship, colonialism, and the construction of citizenship. Moreover, BHSC AHSS (FI) content indicates some slightly further coverage of DP BSS subtopics, such as environment and the society, and demographic dynamics.

[243] These topics are drawn from the RJRC.

- **Similarities in demand**: The scores for BHSC AHSS (BGE) somewhat align with DP BSS for Bloom's cognitive skills and depth of knowledge, demonstrating that both focus on analytical skills and provide opportunity for strategic thinking.

The **key differences** identified were the following:

- **Differences in learning outcomes:** The learning outcomes of DP BSS and BHSC AHSS have strong similarities, although it can be noted that the requirement to carry out an historical/geographical investigation is not explicit in the specific competencies and skills for BHSC AHSS. That said, investigation has a stronger presence in the formative itinerary skills of BHSC AHSS; thus, it may be that this element is more of a feature of BHSC AHSS (FI), rather than BHSC AHSS (BGE). Lastly, it can be noted that there is a higher emphasis in the formative itinerary skills of BHSC AHSS on developing intervention and mediation strategies than what is observed in DP BSS.

- **Differences in content:** A significant number of subtopics within the DP BSS history and geography topics are not indicated to be strongly present in BHSC AHSS, and some do not appear to be present at all. This may partially be due to history and geography content being more broadly described in BHSC AHSS documentation. BHSC AHSS (FI) does not significantly increase alignment with DP BSS beyond what is observed for BHSC AHSS (BGE) as the formative itinerary component does not focus on extending (Brazilian) history and geography knowledge specifically. Instead, BHSC AHSS (FI) focuses on exploring broad areas, such as social participation in the Brazilian State,[244] using an integration of philosophical, geographical, sociological, political, and historical considerations. Lastly, it can be noted that BHSC AHSS (FI) may cover some different Brazilian geography and history content to that in DP BSS regarding demographics and citizen rights.[245]

- **Differences in demand:** BHSC AHSS (FI) scores do not align with those for DP BSS. Indeed, BHSC AHSS (FI) scores higher for Bloom's cognitive skills and depth of knowledge, but lower than DP BSS for outstanding demand areas and volume of work. Also, BHSC AHSS (BGE) scores lower than DP BSS for volume of work and outstanding demand areas.

[244] This example has been taken from the RJRC.
[245] Same as above.

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Appendix A

This Appendix provides further detail on the criteria utilised by Ecctis' experts and external panel members with subject expertise to measure demand for each of the subjects analysed in this study.

Demand Profile – Subject-level Judgement

- **Revised Bloom's Cognitive Skills** score (0-3): this is an overall score of course demand, based entirely on a review of learning outcomes. Levels have been defined based on increasing emphasis on Bloom's Higher Order Thinking Skills.

    - Level 0 – remembering and understanding: learning outcomes (as well as assessment and content) are primarily focused on recall and understanding, with limited or no evidence of higher order thinking skills.
    - Level 1 – applying: learning outcomes (as well as assessment and content) comprise a mix of recall-, understanding- and application-focused objectives, with only limited presence of higher order thinking skills.
    - Level 2 – analysing: learning outcomes (as well as assessment and content) comprise a mix of recall-, understanding and application-focused goals but also feature a substantial focus on analysis. Learning outcomes can also potentially feature some (though limited) evidence of evaluation and creation-focused goals.
    - Level 3 – evaluating and creating (or synthesising): learning outcomes (as well as assessment and content) feature a predominant focus on analysis-, evaluation- and creation/synthesis.

- **Depth of Knowledge** (adapted from Webb's) score (0-3): this is an overall score evaluating the depth of knowledge or complexity of knowledge required by curriculum standards and expectations. The score is focused on subject content and learning outcomes, complemented by assessment where relevant/possible. Levels have been defined based on the level of detail studied per topic, as well as the levels of thinking described in Webb's depth of knowledge framework.

    - Level 0 – All or most topics are studied in limited detail (pre-upper secondary level). Only basic pre-requisite knowledge is required in order to grasp ideas. The level of cognitive complexity of the information students are expected to know is low (e.g. many tasks may require recall and reproduction of information such as facts, definitions, terms, or simpler procedures – acquired knowledge).
    - Level 1 – Some topics are studied in considerable detail. Moderate levels of pre-requisite knowledge are required in order to grasp ideas in some topics. The level of cognitive complexity of the information students are expected to know is low to moderate (e.g. many tasks may require engagement of some mental processing beyond habitual responses, including comparison and basic reasoning – knowledge application).

  - Level 2 – Most topics are studied in considerable detail. Considerable pre-requisite knowledge is required in order to grasp ideas in some topics. The level of cognitive complexity of the information students are expected to know is average to high (e.g. some tasks require complex reasoning, planning, using evidence, and a higher level of thinking than the previous two levels. The cognitive demands are often complex and abstract – analysis).
  - Level 3 – All or most topics are studied in very high detail. Considerable pre-requisite knowledge is required in order to grasp ideas in most topics. The level of cognitive complexity of information students are expected to know is mostly high (e.g. many tasks may require complex reasoning, planning, developing, information synthesis, interpretation of data for problem solving, and thinking most likely over an extended period – extended thinking).

- **Volume of Work** score (0-3): this is a trifactor score, considering breadth of content and depth of content, evaluated against the programme's specified timeframe. The three factors – breadth, depth, and time – were all considered in defining the levels.

  - Level 0 – light: small number of themes and sub-themes covered; a significant majority of time is spent on straightforward or basic themes; generous time allocation per theme.
  - Level 1 – moderate: typical number of themes and sub-themes covered; more time spent on conceptually complex themes compared to Level 1 (though majority of time still spent on themes of basic depth); standard time allocation per theme.
  - Level 2 – moderate heavy: typical to high number of themes and sub-themes covered; a significant proportion of time spent on issues beyond basic conceptual depth; standard to short time allocation per theme.
  - Level 3 – heavy: high number of themes and sub-themes covered; a large proportion of time spent on issues beyond basic conceptual depth; short time allocation per theme.

- **Outstanding Areas of Subject Demand** score (0-3): this score reflects the number of content areas typically viewed as more challenging and/or conducive to intellectual stretching of learners. Levels have been defined on a scale of increasing presence of 'stretch areas'.

  - Level 0 – no stretch areas (0)
  - Level 1 – few stretch areas (1-2)
  - Level 2 – a significant number of stretch areas (3-4)
  - Level 3 – a high number of stretch areas (>4)

Appendix B

Learner profile	Approaches to learning	Approaches to teaching	International-mindedness
Inquirers: We nurture our curiosity, developing skills for inquiry and research. We know how to learn independently and with others. We learn with enthusiasm and sustain our love of learning throughout life. **Knowledgeable**: We develop and use conceptual understanding, exploring knowledge across a range of disciplines. We engage with issues and ideas that have local and global significance. **Thinkers**: We use critical and creative thinking skills to analyse and take responsible action on complex problems. We exercise initiative in making reasoned, ethical decisions. **Communicators**: We express ourselves confidently and creatively in more than one language and in many ways. We collaborate effectively, listening carefully to the perspectives of other individuals and groups. **Principled**: We act with integrity and honesty, with a strong sense of fairness and justice, and with respect for the dignity and rights of people everywhere. We take responsibility for our actions and their consequences. **Open Minded**: We critically appreciate our own cultures and personal histories, as well as the values and traditions of others. We seek and evaluate a range of points of view, and we are willing to grow from the experience.	In all IB programmes, there are five categories of skills including: **Thinking skills:** including areas such as critical thinking, creative thinking, and ethical thinking **Research skills:** including skills such as comparing, contrasting, validating, and prioritizing information **Communication skills:** including skills such as written and oral communication, effective listening, and formulating arguments **Social skills:** including areas such as forming and maintaining positive relationships, listening	In all IB programmes, teaching is: **Based on inquiry:** A strong emphasis is placed on students finding their own information and constructing their own understandings. **Focused on conceptual understanding:** Concepts are explored in order to both deepen disciplinary understanding and to help students make connections and transfer learning to new contexts. **Developed in local and global contexts:** Teaching uses real-life contexts and examples, and students are encouraged to process new information by connecting it to their own experiences and to the world around them. **Focused on effective teamwork and collaboration:** This includes promoting teamwork and collaboration between students, but also refers to the collaborative relationship between teachers and students.	The aim of all IB programmes is to develop internationally minded people who recognize their common humanity and shared guardianship of the planet. Central to this aim is international-mindedness. International-mindedness is a multifaceted concept that captures a way of thinking, being and acting characterised by an openness to the world and a recognition of our deep interconnectedness to others. To be open to the world, we need to understand it. IB programmes therefore provide students with opportunities for sustained inquiry into a range of local and global issues and ideas. This willingness to see beyond immediate situations and boundaries is essential as globalization and emerging technologies continue to blur traditional distinctions between the local, national and international. An IB education fosters international-mindedness by helping students reflect on their own perspective, culture and identities, as well as those of others. By engaging with diverse beliefs, values and experiences, and by learning to think and collaborate across cultures and disciplines, IB learners gain the understanding necessary to make progress towards a more peaceful world.

Caring: We show empathy, compassion, and respect. We have a commitment to service, and we act to make a positive difference in the lives of others and in the world around us. **Risk-Takers**: We approach uncertainty with forethought and determination; we work independently and cooperatively to explore new ideas and innovative strategies. We are resourceful and resilient in the face of challenges and change. **Balanced**: We understand the importance of balancing different aspects of our lives – intellectual, physical, and emotional – to achieve well-being for ourselves and others. We recognize our interdependence with other people and with the world in which we live. **Reflective**: We thoughtfully consider the world and our own ideas and experience. We work to understand our strengths and weaknesses in order to support our learning and personal development.	skills, and conflict resolution **Self-management skills:** including both organizational skills, such as managing time and tasks, and affective skills, such as managing state of mind and motivation.	**Designed to remove barriers to learning:** Teaching is inclusive and values diversity. It affirms students' identities, and aims to create learning opportunities that enable every student to develop and pursue appropriate personal goals. **Informed by assessment:** Assessment plays a crucial role in supporting, as well as measuring, learning. This approach also recognizes the crucial role of providing students with effective feedback.	An IB education further enhances the development of international-mindedness through multilingualism. All IB programmes require students to study, or study in, more than one language. This is because we believe that communicating in more than one language helps students to appreciate that his or her own language, culture and world view are just one of many. In this way, it provides excellent opportunities to develop intercultural understanding and respect. International-mindedness is also encouraged through a focus on global engagement and meaningful service with the community. These elements challenge students to critically consider power and privilege, and to recognize that they hold this planet and its resources in trust for future generations. They also highlight the focus on action in all IB programmes: a focus on moving beyond awareness and understanding to engagement, action and bringing about meaningful change to make a more peaceful and sustainable world for everyone.

Appendix C

Task brief – Expert Demand Panel – [Subject]

For each subject, highlight in yellow the descriptor(s) deemed to best fit each demand category, using the following criteria (please refer to the demand tables for descriptors of the levels):

- **Revised Bloom's Cognitive Skills** score (0-3): this is an overall score of course demand, based entirely on a review of learning outcomes. Levels have been defined based on increasing emphasis on Bloom's Higher Order Thinking Skills.

- **Depth of Knowledge** (adapted from Webb's) score (0-3): this is an overall score evaluating the depth of knowledge or complexity of knowledge required by curriculum standards and expectations. The score is focused on subject content and learning outcomes, complemented by assessment where relevant/possible. Levels have been defined based on the level of detail studied per topic, as well as the levels of thinking described in Webb's depth of knowledge framework.

- **Volume of Work** score (0-3): this is a trifactor score, considering breadth of content and depth of content, evaluated against the programme's specified timeframe. The three factors – breadth, depth and time – were all taken into account in defining the levels.

- **Outstanding Areas of Subject Demand** score (0-3): this score reflects the number of content areas typically viewed as more challenging and/or conducive to intellectual stretching of learners. Levels have been defined on a scale of increasing presence of 'stretch areas'.

Demand Judgements – [Subject]

Table 47: [Subject]

Demand Judgement	Score Descriptors (highlight the best-fit descriptor)	Judgement and Key Evidence
Revised Bloom's Cognitive Skills[246]	Level 0 – remembering and understanding: learning outcomes are primarily focused on recall and understanding, with limited or no evidence of higher order thinking skills.	
	Level 1 – applying: learning outcomes (as well as assessment and content) comprise a mix of recall-, understanding- and application-focused objectives, with only limited presence of higher order thinking skills.	
	Level 2 – analysing: learning outcomes (as well as assessment and content) comprise a mix of recall-, understanding and application-focused goals but also feature a substantial focus on analysis. Learning outcomes can also potentially feature some (though limited) evidence of evaluation and creation-focused goals.	
	Level 3 – evaluating and creating (or synthesising): learning outcomes feature a predominant focus on analysis-, evaluation- and creation/synthesis.	
Depth of Knowledge[247]	Level 0 – All or most topics are studied in limited detail (pre-upper secondary level). Only basic pre-requisite knowledge is required in order to grasp ideas. The level of cognitive complexity of the information students are expected to know is low (e.g. many tasks may require recall and reproduction of information such as facts, definitions, terms, or simpler procedures – acquired knowledge).	
	Level 1 – Some topics are studied in considerable detail. Moderate levels of pre-requisite knowledge are required in order to grasp ideas in some topics. The level of cognitive complexity of the information students are expected to know is low to moderate (e.g. many tasks may require engagement of some mental processing beyond habitual	

[246] Evidence pool: Learning outcomes
[247] Evidence pool: Learning outcomes, subject content, assessment types

Demand Judgement	Score Descriptors (highlight the best-fit descriptor)	Judgement and Key Evidence
	responses, including comparison and basic reasoning – knowledge application).	
	Level 2 – Most topics are studied in considerable detail. Considerable pre-requisite knowledge is required in order to grasp ideas in some topics. The level of cognitive complexity of the information students are expected to know is average to high (e.g. some tasks require complex reasoning, planning, using evidence, and a higher level of thinking than the previous two levels. The cognitive demands are often complex and abstract – analysis).	
	Level 3 – All or most topics are studied in very high detail. Considerable pre-requisite knowledge is required in order to grasp ideas in most topics. The level of cognitive complexity of information students are expected to know is mostly high (e.g. many tasks may require complex reasoning, planning, developing, information synthesis, interpretation of data for problem solving, and thinking most likely over an extended period of time – extended thinking).	
Volume of Work[248]	Level 0 – light: small number of themes and sub-themes covered; a significant majority of time is spent on straightforward or basic themes; generous time allocation per theme.	
	Level 1 – moderate: typical number of themes and sub-themes covered; more time spent on conceptually complex themes compared to Level 1 (though majority of time still spent on themes of basic depth); standard time allocation per theme.	
	Level 2 – moderate heavy: typical to high number of themes and sub-themes covered; a significant proportion of time spent on issues beyond basic conceptual depth; standard to short time allocation per theme.	
	Level 3 – heavy: high number of themes and sub-themes covered; a large proportion of time spent on issues	

[248] Evidence pool: Subject content; assessment types and number; course duration; time allocated per topic/subtopic (where available).

Demand Judgement	Score Descriptors (highlight the best-fit descriptor)	Judgement and Key Evidence
	beyond basic conceptual depth; short time allocation per theme.	
Outstanding Areas of Subject Demand[249]	Level 0 – no stretch areas (0)	
	Level 1 – few stretch areas (1-2)	
	Level 2 – a significant number of stretch areas (3-4)	
	Level 3 – a high number of stretch areas (>4)	

[249] Evidence pool: Subject content.

Appendix D

This appendix displays the BNCC's specific competencies and specific skills for each area of knowledge.

Figure 51: Specific competencies and specific skills for Mathematics and Technology.

1. Use mathematical strategies, concepts and procedures to interpret situations in different contexts, whether daily activities, facts from Natural and Human Sciences, socioeconomic or technological issues, disseminated through different media, in order to contribute to general training.
(EM13MAT101) Critically interpret economic and social situations and facts related to Natural Sciences that involve the variation of quantities, by analyzing the graphs of the represented functions and the rates of variation, with or without the support of digital technologies.
(EM13MAT102) Analyze tables, graphs and samples of statistical research presented in reports published by different media, identifying, when applicable, inadequacies that could lead to interpretation errors, such as inappropriate scales and samples.
(EM13MAT103) Interpret and understand scientific texts or those published by the media, which use units of measurement of different magnitudes and the possible conversions between them, whether adopted or not by the International System (SI), such as those of storage and data transfer speed, linked to technological advances.
(EM13MAT104) Interpret rates and indices of a socioeconomic nature (human development index, inflation rates, among others), investigating the calculation processes of these numbers, to critically analyze reality and produce arguments.
(EM13MAT105) Use the notions of isometric transformations (translation, reflection, rotation and compositions thereof) and homothetic transformations to build figures and analyze elements of nature and different human productions (fractals, civil constructions, works of art, among others).
(EM13MAT106) Identify situations in everyday life in which it is necessary to make choices taking into account probabilistic risks (using this or that contraceptive method, opting for one medical treatment over another, etc.).
2. Propose or participate in actions to investigate challenges in the contemporary world and make ethical and socially responsible decisions, based on the analysis of social problems, such as those related to health situations, sustainability, the implications of technology in the world of work, among others, mobilizing and articulating concepts, procedures and languages specific to Mathematics.
(EM13MAT201) Propose or participate in actions suited to the demands of the region, preferably for your community, involving measurements and calculations of perimeter, area, volume, capacity or mass.
(EM13MAT202) Plan and carry out sample research on relevant issues, using data collected directly or from different sources, and communicate the results through a report containing graphs and interpretation of measures of central tendency and measures of dispersion (amplitude and standard deviation), using or not technological resources.
(EM13MAT203) Apply mathematical concepts in the planning, execution and analysis of actions involving the use of applications and the creation of spreadsheets (for family budget control, simple and compound interest calculation simulators, among others), to make decisions.

3. Use strategies, concepts, definitions and mathematical procedures to interpret, build models and solve problems in different contexts, analyzing the plausibility of results and the adequacy of proposed solutions, in order to build consistent arguments.
(EM13MAT301) Solve and elaborate everyday problems, in Mathematics and other areas of knowledge, which involve simultaneous linear equations, using algebraic and graphical techniques, with or without the support of digital technologies.
(EM13MAT302) Build models using 1st or 2nd degree polynomial functions, to solve problems in different contexts, with or without the support of digital technologies.
(EM13MAT303) Interpret and compare situations involving simple interest with those involving compound interest, through graphical representations or spreadsheet analysis, highlighting the linear or exponential growth in each case.
(EM13MAT304) Solve and elaborate problems with exponential functions in which it is necessary to understand and interpret the variation of the quantities involved, in contexts such as Financial Mathematics, among others.
(EM13MAT305) Solve and elaborate problems with logarithmic functions in which it is necessary to understand and interpret the variation of the quantities involved, in contexts such as earthquakes, pH, radioactivity, Financial Mathematics, among others.
(EM13MAT306) Solve and elaborate problems in contexts involving real periodic phenomena (sound waves, phases of the moon, cyclical movements, among others) and compare their representations with the sine and cosine functions, in the Cartesian plane, with or without the support of algebra and geometry applications.
(EM13MAT307) Use different methods to obtain the measurement of the area of a surface (reconfigurations, approximation by cuts, etc.) and deduce calculation expressions to apply them in real situations (such as the relocation and distribution of plantations, among others), with or without the support of digital technologies.
(EM13MAT308) Apply metric relationships, including the laws of sine and cosine or the notions of congruence and similarity, to solve and elaborate problems involving triangles, in various contexts.
(EM13MAT309) Solve and develop problems involving the calculation of total areas and volumes of prisms, pyramids and round bodies in real situations (such as calculating the cost of material for coating or painting objects whose shapes are compositions of the solids studied), with or without support of digital technologies.
(EM13MAT310) Solve and elaborate counting problems involving sortable or non-orderable groupings of elements, using multiplicative and additive principles, using different strategies, such as tree diagrams.
(EM13MAT311) Identify and describe the sample space of random events, counting possibilities, to solve and elaborate problems involving the calculation of probability.
(EM13MAT312) Solve and elaborate problems that involve calculating the probability of events in successive random experiments.
(EM13MAT313) Use, when necessary, scientific notation to express a measurement, understanding the notions of significant figures and doubtful figures, and recognizing that every measurement is inevitably accompanied by error.
(EM13MAT314) Solve and elaborate problems that involve quantities determined by the ratio or product of others (speed, population density, electrical energy, etc.).
(EM13MAT315) Investigate and record, through a flowchart, when possible, an algorithm that solves a problem.

(EM13MAT316) Solve and elaborate problems, in different contexts, that involve calculation and interpretation of central tendency measures (mean, mode, median) and dispersion measures (amplitude, variance and standard deviation).
4. Understand and use, with flexibility and precision, different mathematical representation registers (algebraic, geometric, statistical, computational, etc.), in the search for solutions and communication of problem results.
(EM13MAT401) Convert algebraic representations of 1st degree polynomial functions into geometric representations in the Cartesian plane, distinguishing the cases in which the behavior is proportional, whether or not using algebra and dynamic geometry software or applications.
(EM13MAT402) Convert algebraic representations of 2nd degree polynomial functions into geometric representations in the Cartesian plane, distinguishing the cases in which one variable is directly proportional to the square of the other, whether or not using algebra and dynamic geometry software or applications, among other materials.
(EM13MAT403) Analyze and establish relationships, with or without the support of digital technologies, between the representations of exponential and logarithmic functions expressed in tables and in a Cartesian plane, to identify the fundamental characteristics (domain, image, growth) of each function.
(EM13MAT404) Analyze functions defined by one or more sentences (Income Tax table, electricity bills, water, gas, etc.), in their algebraic and graphical representations, identifying domains of validity, image, growth and decrease, and converting these representations into a to another, with or without the support of digital technologies.
(EM13MAT405) Use initial concepts of a programming language to implement algorithms written in common language and/or mathematics.
(EM13MAT406) Build and interpret frequency tables and graphs based on data obtained in research by statistical samples, including or not the use of software that interrelates statistics, geometry and algebra.
(EM13MAT407) Interpret and compare statistical data sets through different diagrams and graphs (histogram, box-plot, branches, and leaves, among others) others), recognizing the most efficient ones for their analysis.
5. Investigate and establish conjectures regarding different concepts and mathematical properties, employing strategies and resources, such as observation of patterns, experiments and different technologies, identifying the need, or not, for an increasingly formal demonstration in validating said conjectures.
(EM13MAT501) Investigate relationships between numbers expressed in tables to represent them in the Cartesian plane, identifying patterns and creating conjectures to generalize and algebraically express this generalization, recognizing when this representation is a 1st degree polynomial function.
(EM13MAT502) Investigate relationships between numbers expressed in tables to represent them in the Cartesian plane, identifying patterns and creating conjectures to generalize and algebraically express this generalization, recognizing when this representation is a 2nd degree polynomial function of the type y = ax2.
(EM13MAT503) Investigate maximum or minimum points of quadratic functions in contexts involving surfaces, Financial Mathematics or Kinematics, among others, with the support of digital technologies.
(EM13MAT504) Investigate processes for obtaining the measurement of the volume of prisms, pyramids, cylinders and cones, including Cavalieri's principle, to obtain formulas for calculating the measurement of the volume of these figures.
(EM13MAT505) Solve problems about tiling the plane, with or without the support of dynamic geometry applications, to conjecture about the types or composition of polygons that can be used in tiling, generalizing observed patterns.
(EM13MAT506) Graphically represent the variation in the area and perimeter of a regular polygon when the lengths of its sides vary, analyzing and classifying the functions involved.

(EM13MAT507) Identify and associate arithmetic progressions (AP) with related functions in discrete domains, for analyzing properties, deducing some formulas and solving problems.
(EM13MAT508) Identify and associate geometric progressions (PG) with exponential functions of discrete domains, for analyzing properties, deducing some formulas and solving problems.
(EM13MAT509) Investigate the deformation of angles and areas caused by different projections used in cartography (such as cylindrical and conical), with or without the support of digital technology.
(EM13MAT510) Investigate sets of data relating to the behavior of two numerical variables, using or not using information technologies, and, when appropriate, take variation into account and use a straight line to describe the observed relationship.
(EM13MAT511) Recognize the existence of different types of sample spaces, discrete or not, and events, equiprobable or not, and investigate implications in the calculation of probabilities.

Figure 52: Specific competencies and specific skills for Natural Sciences and Technology

1. Analyze natural phenomena and technological processes, based on the interactions and relations between matter and energy, to propose individual and collective actions that improve the production processes, minimize social and environmental impacts and improve local, regional and global living conditions.
(EM13CNT101) Analyze and represent, with or without the use of devices and applications transformations and conservations in systems that involve amount of matter, energy, and motion to make predictions about their behaviors in everyday situations and in production processes that prioritize the sustainable development, the conscientious use of natural resources and the preservation of the life in all its forms.
(EM13CNT102) Perform forecasts, evaluate interventions, and/or build prototypes of thermal systems aimed at sustainability, considering their composition and effects of thermodynamic variables on their functioning, also considering the use of digital technologies to assist in the calculation of estimates and to support the construction of prototypes.
(EM13CNT103) Use knowledge about radiation and its origins to assess the potentialities and risks of its application in equipment of daily use, in the health, the environment, industry, agriculture and electricity generation.
(EM13CNT104) Assess the benefits and risks to health and the environment, considering the composition, toxicity and reactivity of different materials and products, such as also the level of exposure to them, positioning oneself critically and proposing solutions individual and/or collective for their responsible use and disposal.
(EM13CNT105) Analyze biogeochemical cycles and interpret the effects of phenomena and human interference in these cycles, to promote individual actions and/or or collective ones that minimize harmful consequences to life.
EM13CNT106) Evaluate, with or without the use of digital devices and applications, technologies and possible solutions to the demands that involve the generation, the transportation, distribution and consumption of electricity, considering the availability of resources, energy efficiency, cost-effectiveness, geographical and environmental characteristics, waste generation and impacts socio-environmental and cultural aspects.

(EM13CNT107) Perform qualitative and quantitative forecasts on functioning generators, electric motors and their components, coils, transformers, batteries, batteries and electronic devices, based on the analysis of transformation processes and power conduction involved – with or without the use of devices and apps – to propose actions aimed at sustainability.
2. Analyze and use interpretations about the dynamics of Life, the Earth and the Cosmos to develop arguments, make predictions about the functioning and evolution of living beings and the Universe, and to support and defend ethical and responsible decisions.
(EM13CNT201) Analyze and discuss models, theories and laws proposed at different times and cultures to compare different explanations of the emergence and evolution of Life, of the Earth and the Universe with the currently accepted scientific theories.
(EM13CNT202) Analyze the various forms of manifestation of life in its different levels of organization, as well as the favorable environmental conditions and the with or without the use of digital devices and applications (such as simulation and virtual reality software, among others).
(EM13CNT203) Evaluate and predict the effects of interventions on ecosystems, and their impacts on living beings and the human body, based on maintenance mechanisms of life, in the cycles of matter and in the transformations and transfers of energy, using representations and simulations about such factors, with or without the use of digital devices and applications (such as simulation and virtual reality software, among others).
EM13CNT204) Elaborate: explanations, predictions and calculations regarding movements of objects on Earth, in the Solar System, and in the Universe based on the analysis of interactions with or without the use of digital devices and applications (such as simulation and virtual reality software, among others).
(EM13CNT205) Interpret results and make predictions about experimental activities, natural phenomena and technological processes, based on the notions of probability and uncertainty, recognizing the explanatory limits of the sciences.
(EM13CNT206) Discuss the importance of preserving and conserving biodiversity, considering qualitative and quantitative parameters, and evaluate the effects of the action and environmental policies to ensure the sustainability of the planet.
(EM13CNT207) Identify, analyze and discuss vulnerabilities linked to experiences and to the contemporary challenges to which young people are exposed, considering the physical, psycho-emotional and social aspects, in order to develop and disseminate prevention and promotion of health and well-being.
(EM13CNT208) Apply the principles of biological evolution to analyze history human origin, considering its origin, diversification, dispersion across the planet and different ways of interacting with nature, valuing and respecting ethnic diversity and human culture.
(EM13CNT209) Analyze stellar evolution by associating it with the models of origin and distribution of chemical elements in the Universe, understanding their relationships with the conditions necessary for the emergence of solar and planetary systems, their and compositions and the possibilities of the existence of life, using representations and simulations, with or without the use of digital devices and applications (such as software simulation and virtual reality, among others).
3. Investigate problem situations and evaluate applications of scientific knowledge and its implications in the world, using procedures and languages of the Natural Sciences, in order to propose solutions that consider local, regional, and/or global demands, and communicate their findings and conclusions to varied audiences, in different contexts and through different media and digital information and communication technologies (DICT).
(EM13CNT301) Construct questions, develop hypotheses, predictions and estimates, employ measuring instruments and represent and interpret explanatory models, data and/or experimental results to construct, evaluate and justify conclusions in coping of problem situations from a scientific perspective.

EM13CNT302) Communicate, to varied audiences, in different contexts, the results of analyses, research and/or experiments, elaborating and/or interpreting texts, graphs, tables, symbols, codes, classification systems and equations, by means of different languages, media, digital information and communication technologies (ICTs), in order to participate in and/or promote debates on scientific and/or technological topics of socio-cultural and environmental relevance.
(EM13CNT303) Interpret texts of scientific dissemination that deal with themes of the Natural Sciences, available in different media, considering the presentation of the data, both in the form of texts and in equations, graphs and/or tables, consistency of the arguments and the coherence of the conclusions, in order to construct selection strategies from reliable sources of information.
(EM13CNT304) Analyse and discuss controversial situations on the application of knowledge in the field of Natural Sciences (such as DNA technologies, stem cell treatments, neurotechnologies, production of defense technologies, pest control strategies, among others), based on consistent arguments, legal, ethical and responsible, distinguishing different points of view.
(EM13CNT305) Investigate and discuss the misuse of knowledge from the sciences of Nature in the justification of processes of discrimination, segregation and deprivation of individual and collective rights, in different social and historical contexts, to promote equity and respect for diversity.
EM13CNT306) Assess the risks involved in everyday activities, applying knowledge of the Natural Sciences, to justify the use of equipment and resources, as well as safety behaviors, aimed at physical integrity, individual and collective, and socio-environmental, being able to make use of devices and applications that enable the structuring of simulations of such risks.
(EM13CNT307) Analyze the properties of materials to assess the suitability of their use in different applications (industrial, everyday, architectural, or technological) and/or or propose safe and sustainable solutions considering their local and everyday context.
(EM13CNT308) Investigate and analyze the operation of electrical equipment and/or electronics and automation systems to understand contemporary technologies and assess their social, cultural, and environmental impacts.
(EM13CNT309) Analyze related socio-environmental, political and economic issues the dependence of today's world on non-renewable resources and discuss the need to introduce alternatives and new energy technologies and materials, comparing different types of engines and new production processes materials.
(EM13CNT310) Investigate and analyze the effects of infrastructure programs and other basic services (sanitation, electricity, transportation, telecommunications, vaccination coverage, primary health care, and food production, among others) and identify local and/or regional needs in relation to these services in order to evaluate and/or promote actions that contribute to the improvement of quality of life and health conditions of the population.

Figure 53: Specific competencies for Language and Technology and specific skills for Portuguese Language (arranged by field of action).

Specific competencies
1. Understand the functioning of different cultural languages and practices (artistic, bodily and verbal) and mobilize this knowledge in the reception and production of discourses in different fields of social activity and in different media, to expand forms of social participation, understanding and possibilities of explanation and critical interpretation of reality and to continue learning.
2. Understand the identity processes, conflicts and power relations that permeate social language practices, respecting the diversities and plurality of ideas and positions, and act socially based on principles and values based on democracy, equality and Human Rights, exercising self-knowledge, empathy, dialogue, conflict resolution and cooperation, and combating prejudices of any nature.
3. Use different languages (artistic, body and verbal) to exercise, with autonomy and collaboration, protagonism and authorship in personal and collective life, in a critical, creative, ethical and supportive way, defending points of view that respect others and promote Human Rights , socio-environmental awareness and responsible consumption, at a local, regional and global level.
4. Understand languages as a (geo)political, historical, cultural, social, variable, heterogeneous phenomenon and sensitive to contexts of use, recognizing their varieties and experiencing them as forms of personal and collective identity expressions, as well as acting to confront prejudices of any nature.
5. Understand the processes of production and negotiation of meanings in bodily practices, recognizing and experiencing them as forms of expression of values and identities, from a democratic perspective and respect for diversity.
6. Aesthetically appreciate the most diverse artistic and cultural productions, considering their local, regional and global characteristics, and mobilize their knowledge about artistic languages to give meaning and (re)construct individual and collective authorial productions, exercising protagonism in a critical and creative way, with respect for the diversity of knowledge, identities and cultures.
7. Mobilize language practices in the digital universe, considering the technical, critical, creative, ethical and aesthetic dimensions, to expand the ways of producing meanings, engaging in authorial and collective practices, and learning to learn in the fields of science, culture , work, information and personal and collective life.
Specific skills: Artistic-literary field
(EM13LP46) Share meanings constructed when reading/listening to literary texts, noticing differences and possible tensions between personal and collective ways of apprehending these texts, to exercise cultural dialogue and sharpen critical perspective.
(EM13LP47) Participate in events (oral competitions, auditions, shows, festivals, cultural and literary fairs, wheels and reading clubs, cooperatives, slams etc.), including for socialize works of own authorship (poems, tales and their varieties, scripts, video minutes, commented playlists of music etc.) and/or interpreting works of others, inserting themselves in the different cultural practices of their time.
(EM13LP48) Identify assimilations, ruptures and permanencies in the process of constitution of Brazilian literature and throughout its trajectory, through reading and analysis of fundamental works of the Western canon, especially Portuguese literature, to understand the historicity of aesthetic matrices and procedures.
(EM13LP49) Understand the structural and stylistic peculiarities of different literary genres (the personal apprehension of everyday life in the chronicles, the free and subjective manifestation of the lyrical self before the world in the poems, the multiple perspective of human and social life in the novels, the political

and social dimension of texts from marginal and peripheral literature, etc.) to experience the different angles from which literature captures the individual and the world.
(EM13LP50) Analyze intertextual and interdiscursive relationships between works by different authors and literary genres from the same historical moment and from different historical moments, exploring the ways in which literature and the arts in general are constituted, dialogue and feed each other back.
(EM13LP51) Select works from the contemporary artistic-literary repertoire available according to your predilections, in order to build a personal collection and appropriate it to insert yourself and intervene with autonomy and criticality in the cultural environment.
(EM13LP52) Analyze significant works of Brazilian literature and those of other countries and peoples, especially Portuguese, indigenous, African and Latin American, based on literary criticism tools (composition structure, style, discursive aspects) or other related criteria to different cultural matrices, considering the context of production (worldviews, dialogues with other texts, insertions in aesthetic and cultural movements, etc.) and the way they dialogue with the present.
(EM13LP53) Produce presentations and appreciative comments and comments critics about books, films, records, songs, theater shows and dance, exhibitions, etc. (redesigns, vlogs and literary and artistic podcasts, commented playlists, fanzines, e-zines etc.).
(EM13LP54) Create authorial works, in different genres and media – through selection and appropriation of textual and expressive resources artistic repertoire –, and/or derived productions (parodies, stylizations, fanfics, etc.), as a form of critical dialogue and/or subjectively with the literary text.
Specific skills: Field of activity in public life
(EM13LP23) Critically analyze the history and political discourse of candidates, political advertisements, public policies, government programs and proposals, in order to participate in the political debate and make conscious and well-founded decisions.
(EM13LP24) Analyze non-institutionalized forms of social participation, especially those linked to artistic manifestations, cultural productions, urban interventions and forms of expression typical of youth cultures that aim to expose a problem or promote reflection/action, positioning oneself in relation to these productions and manifestations.
(EM13LP25) Participate in meetings at school (school and class council, free guild, etc.), associations, collectives or movements, among others, in debates, assemblies, discussion forums, etc., exercising attentive listening, respecting your shift and working time speaks, positioning oneself in a reasoned, respectful and ethical way when presenting proposals and defending opinions, using typical linguistic strategies of negotiation and support and/or consideration of the other's speech (such as requesting clarification, detailing, making direct reference or retake the other's speech, paraphrasing it to endorse, emphasize, complement or weaken it), considering alternative proposals and reformulating its position, when applicable, with a view to understanding and the common good.
(EM13LP26) Relate legal and normative texts and documents of universal, national, local or school scope that involve the definition of rights and duties - especially those aimed at adolescents and young people - to their production contexts, identifying or inferring possible motivations and purposes, such as way of expanding understanding of these rights and duties.
(EM13LP27) Engage in the search for solutions to problems involving the community, denouncing disrespect for rights, organizing and/or participating in discussions, campaigns and debates, producing demanding and normative texts, among other possibilities, as a way of promoting democratic principles and an action guided by the ethics of responsibility, conscious consumption and socio-environmental awareness.

Specific skills: Field of personal life
(EM13LP19) Present yourself through diverse multimodal texts (varied profiles, biographical gifs, biodata, web resume, video resume etc.) and digital tools (gif tool, wiki, website, etc.), to speak of oneself in various ways, considering different situations and objectives.
(EM13LP20) Share tastes, interests, cultural practices, themes/problems/issues that arouse greater interest or concern, respecting and valuing differences, as a way of identifying affinities and common interests, as well as organizing and/or participating in groups, clubs, workshops and the like .
(EM13LP21) Collaboratively produce and socialize commented playlists of cultural and entertainment preferences, magazines fanzines, e-zines or similar publications that disseminate, comment and rate music, games, series, movies, comics, books, plays, exhibitions, dance performances, etc., in order to share likes, identifying affinities, fostering communities, etc.
(EM13LP22) Collaboratively build and/or update records (maps, wiki, etc.) of professions and occupations of their interest (areas of activity, data on training, practices, productions, testimonials from professionals, etc.) that make it possible to glimpse personal and professional trajectories.
Specific skills: Field of study and research practices
(EM13LP28) Organize study situations and use reading procedures and strategies appropriate to the objectives and nature of the knowledge in question.
(EM13LP29) Summarize and review texts, through the use of paraphrases, reported speech marks and quotations, for use in texts to disseminate studies and research.
(EM13LP30) Carry out research of different types (bibliographic, field, scientific experiment, data collection, etc.), using open and reliable sources, recording the process and communicating the results, taking into account the intended objectives and other elements of the production context, such as way of understanding how scientific knowledge is produced and appropriating the procedures and textual genres involved in carrying out research.
(EM13LP31) Critically understand oral, written and multisemiotic scientific dissemination texts from different areas of knowledge, identifying their topical organization and the hierarchy of information, identifying and discarding unreliable sources and problematizing biased or superficial approaches.
(EM13LP32) Select information and data necessary for a given research (without exceeding them) in different sources (oral, printed, digital, etc.) and independently compare these contents, taking into account their production contexts, references and reliability indices, and noticing coincidences , complementarities, contradictions, errors or conceptual and data inaccuracies, in order to understand and critically position oneself on these contents and establish precise outlines.
(EM13LP33) Select, develop and use instruments for collecting data and information (questionnaires, surveys, mappings, opinions) and for processing and analyzing the content obtained, which adequately meet different research objectives.
(EM13LP34) Produce texts for the dissemination of knowledge and of survey and research results – monographic text, essay, popular science article, encyclopedia entry (collaborative or not), infographic (static or animated), report by experiment, report, multimedia field report, report scientific podcast or vlog, oral presentations, seminars, round table communications, dynamic maps, etc. –, considering the context of production and using the knowledge on the genres of scientific dissemination, in order to engage in significant processes of socialization and dissemination of knowledge.
(EM13LP35) Properly use tools to support oral presentations, choosing and using font types and sizes that allow good visualization, topicalizing and/or organizing the content in items, properly inserting images, graphics, tables, shapes, and graphics, scaling quantity text and image per slide and using, in a harmonious way, resources (transition effects, slide masters, custom layouts, recording of audios in slides, etc.).

Specific skills: Journalistic-media field
(EM13LP36) To analyze the interests that move the journalistic field, the Impacts of new digital information and communication technologies and Web 2.0 in the field and the conditions that make information a commodity and information checking a practice (and a service), adopting an analytical and critical attitude towards the texts Journalistic.
(EM13LP37) Know and analyze different publishing projects - institutional, private, public, funded, independent, etc. -, in order to expand the repertoire of possible choices of sources of information and opinion, recognizing the role of plural media for the consolidation of democracy.
(EM13LP38) Analyze the different degrees of partiality/impartiality (at the limit, non-neutrality) in news texts, comparing reports from different sources and analyzing the cut made of facts/data and the effects of meaning caused by the choices made by the author of the text, in a to maintain a critical attitude towards journalistic texts and become aware of the choices made as a producer.
(EM13LP39) Use reporting procedures and published photos (verify/evaluate vehicle, source, date and place of the publication, authorship, URL, formatting; compare different sources; consult tools and checking websites, etc.), in order to combat the proliferation of fake news.
(EM13LP40) To analyze the phenomenon of post-truth – discussing the conditions and mechanisms for the dissemination of fake news and also examples, causes and consequences of this phenomenon and the prevalence of beliefs and opinions about facts – in order to adopt a critical attitude in relationship with the phenomenon and develop a flexible posture that allows review beliefs and opinions when facts contradict them.
(EM13LP41) Analyze the human and automatic curation processes that operate on social networks and other internet domains, comparing feeds from different social network pages and discussing the effects of these curation models, in order to expand the possibilities of dealing with the different and minimize the bubble effect and third-party manipulation.
(EM13LP42) Monitor, analyze and discuss media coverage of events and issues of social, local and global relevance, comparing different approaches and perspectives, through the use of curation tools (such as content aggregators) and consultation of services and sources of checking and curating information, in order to deepen the understanding of a specific fact or issue, identify the preponderant focus of the media and remain critically involved with the facts and issues that affect the community.
(EM13LP43) Act in a reasoned, ethical and critical way in production and in the sharing of comments, news texts and opinion, memes, gifs, assorted remixes, etc. on social networks or others digital environments.
(EM13LP44) Analyze contemporary forms of advertising in digital context (advergame, video ads, social advertising, unboxing, marketing narrative, among others), and pieces of advertising and political campaigns (posters, leaflets, advertisements, advertisements in different media, spots, jingles, etc.), identifying values and representations of situations, groups and social configurations deconstructing stereotypes, highlighting strategies of engagement and viralization and explaining the mechanisms of persuasion used and the effects of meaning caused by the choices made in terms of linguistic-discursive elements and resources, imagery, sound, gestural and spatial sounds, among others.
(EM13LP45) Analyze, discuss, produce and socialize, with a view to topics and events of local or global interest, news, photo-reporting, photo-reporting, multimedia reporting, documentaries, infographics, news podcasts, opinion pieces, media reviews, opinion vlogs, presentation and appreciation texts cultural productions (reviews, essays, etc.) and other genres of the forms of expression of youth cultures (vlogs and cultural podcasts, gameplay, etc.), in various media, experiencing in a variety of ways, the role of reporter, analyst, critic, editorialist or writer, reader, vlogger and booktuber, among others.

Figure 54: Specific competencies and specific skills for Applied Human and Social Sciences.

1. Analyze political, economic, social, environmental and cultural processes at the local, regional, national and global levels at different times, based on the plurality of epistemological, scientific and technological procedures, in order to understand and critically position oneself in relation to them, considering different points of view and making decisions based on arguments and sources of a scientific nature.
(EM13CHS101) Identify, analyze and compare different sources and narratives expressed in different languages, with a view to understanding philosophical ideas and historical, geographic, political, economic, social, environmental and cultural processes and events.
(EM13CHS102) Identify, analyze and discuss the historical, geographic, political, economic, social, environmental and cultural circumstances of conceptual matrices (ethnocentrism, racism, evolution, modernity, cooperativism/development, etc.), critically evaluating their historical significance and comparing them to narratives that consider other agents and discourses.
(EM13CHS103) Develop hypotheses, select evidence and compose arguments relating to political, economic, social, environmental, cultural and epistemological processes, based on the systematization of data and information of different natures (artistic expressions, philosophical and sociological texts, historical and geographic documents, graphics, maps, tables, oral traditions, among others).
(EM13CHS104) Analyze objects and traces of material and immaterial culture in order to identify knowledge, values, beliefs and practices that characterize the identity and cultural diversity of different societies inserted in time and space.
(EM13CHS105) Identify, contextualize and criticize evolutionary typologies (nomadic and sedentary populations, among others) and dichotomous oppositions (city/countryside, culture/nature, civilized/barbarian, reason/emotion, material/virtual, etc.), explaining their ambiguities.
(EM13CHS106) Use cartographic, graphic and iconographic languages, different textual genres and digital information and communication technologies in a critical, meaningful, reflective and ethical way in different social practices, including school ones, to communicate, access and disseminate information, produce knowledge, resolve problems and exercise protagonism and authorship in personal and collective life.
2. Analyze the formation of territories and borders in different times and spaces, by understanding the power relations that determine territorialities and the geopolitical role of nation-states.
(EM13CHS201) Analyze and characterize the dynamics of populations, goods and capital on the different continents, with emphasis on the mobility and settlement of people, human groups and peoples, due to natural, political, economic, social, religious and cultural events, of in order to understand and critically position oneself in relation to these processes and the possible relationships between them.
(EM13CHS202) Analyze and evaluate the impacts of technologies on the structuring and dynamics of contemporary groups, peoples and societies (flows of population, finance, goods, information, ethical and cultural values, etc.), as well as their interference in political, social, and social decisions. environmental, economic and cultural.
(EM13CHS203) Compare the meanings of territory, borders and emptiness (spatial, temporal and cultural) in different societies, contextualizing and relativizing dualistic views (civilization/barbarism, nomadism/sedentary lifestyle, enlightenment/obscurantism, city/countryside, among others).
(EM13CHS204) Compare and evaluate the processes of space occupation and the formation of territories, territorialities and borders, identifying the role of different agents (such as social and cultural groups, empires, National States and international organizations) and considering population conflicts (internal and external) , ethnic-cultural diversity and socioeconomic, political and technological characteristics.

(EM13CHS205) Analyze the production of different territorialities in their cultural, economic, environmental, political and social dimensions, in Brazil and in the contemporary world, with emphasis on youth cultures.
(EM13CHS206) Analyze human occupation and the production of space at different times, applying the principles of location, distribution, order, extension, connection, arrangements, causality, among others that contribute to geographic reasoning.
3. Analyze and critically evaluate the relationships of different groups, peoples and societies with nature (production, distribution and consumption) and their economic and socio-environmental impacts, with a view to proposing alternatives that respect and promote awareness, socio-environmental ethics and responsible consumption at local, regional, national and global levels.
(EM13CHS301) Problematize individual and collective habits and practices of production, reuse and disposal of waste in metropolises, urban and rural areas, and communities with different socioeconomic characteristics, and develop and/or select action proposals that promote socio-environmental sustainability and the fight against systemic pollution and responsible consumption.
(EM13CHS302) Analyze and critically evaluate the economic and socio-environmental impacts of production chains linked to the exploitation of natural resources and agricultural activities in different environments and scales of analysis, considering the way of life of local populations - including indigenous people, quilombolas and other traditional communities - its agroextractive practices and commitment to sustainability.
(EM13CHS303) Debate and evaluate the role of the cultural industry and mass cultures in stimulating consumerism, its economic and socio-environmental impacts, with a view to critically perceiving the needs created by consumption and adopting sustainable habits.
(EM13CHS304) Analyze the socio-environmental impacts arising from practices of government institutions, companies and individuals, discussing the origins of these practices, selecting, incorporating and promoting those that promote socio-environmental awareness and ethics and responsible consumption.
(EM13CHS305) Analyze and discuss the role and legal powers of national and international environmental regulation, control and inspection bodies and international agreements for the promotion and guarantee of sustainable environmental practices.
(EM13CHS306) Contextualize, compare and evaluate the impacts of different socioeconomic models on the use of natural resources and the promotion of the planet's economic and socio-environmental sustainability (such as the adoption of agrobiodiversity and agroforestry systems by different communities, among others).
4. Analyze the relations of production, capital and work in different territories, contexts and cultures, discussing the role of these relations in the construction, consolidation and transformation of societies.
(EM13CHS401) Identify and analyze the relationships between subjects, groups, social classes and societies with different cultures in the face of technical, technological and informational transformations and new forms of work over time, in different spaces (urban and rural) and contexts.
(EM13CHS402) Analyze and compare employment, work and income indicators in different spaces, scales and times, associating them with processes of stratification and socioeconomic inequality.
(EM13CHS403) Characterize and analyze the impacts of technological transformations on contemporary social and work relations, promoting actions aimed at overcoming social inequalities, oppression and violations of Human Rights.
(EM13CHS404) Identify and discuss the multiple aspects of work in different circumstances and historical and/or geographic contexts and their effects on generations, especially young people, taking into account, currently, technical, technological and informational transformations.

5. Identify and combat various forms of injustice, prejudice and violence, adopting ethical, democratic, inclusive and supportive principles, and respecting Human Rights.
(EM13CHS501) Analyze the foundations of ethics in different cultures, times and spaces, identifying processes that contribute to the formation of ethical subjects who value freedom, cooperation, autonomy, entrepreneurship, democratic coexistence and solidarity.
(EM13CHS502) Analyze everyday life situations, lifestyles, values, conduct, etc., denaturalizing and problematizing forms of inequality, prejudice, intolerance and discrimination, and identifying actions that promote Human Rights, solidarity and respect for differences and individual freedoms.
(EM13CHS503) Identify different forms of violence (physical, symbolic, psychological, etc.), their main victims, their social, psychological and affective causes, their political, social and cultural meanings and uses, discussing and evaluating mechanisms to combat them, based on arguments ethical.
(EM13CHS504) Analyze and evaluate the ethical-political impasses arising from cultural, social, historical, scientific and technological transformations in the contemporary world and their consequences in the attitudes and values of individuals, social groups, societies and cultures.
6. Participate in the public debate in a critical way, respecting different positions and making choices aligned with the exercise of citizenship and your life project, with freedom, autonomy, critical awareness and responsibility.
(EM13CHS601) Identify and analyze the demands and political, social and cultural roles of indigenous peoples and Afro-descendant populations (including quilombolas) in contemporary Brazil, considering the history of the Americas and the context of exclusion and precarious inclusion of these groups in the current social and economic order, promoting actions to reduce ethnic-racial inequalities in the country.
(EM13CHS602) Identify and characterize the presence of paternalism, authoritarianism and populism in politics, society and Brazilian and Latin American cultures, in dictatorial and democratic periods, relating them to the forms of organization and articulation of societies in defense of autonomy , freedom, dialogue and the promotion of democracy, citizenship and human rights in today's society.
(EM13CHS603) Analyze the formation of different countries, peoples and nations and their political experiences and the exercise of citizenship, applying basic political concepts (State, power, forms, systems and regimes of government, sovereignty, etc.).
(EM13CHS604) Discuss the role of international organizations in the global context, with a view to developing a critical view of their limits and their forms of action in countries, considering the positive and negative aspects of this action for local populations.
(EM13CHS605) Analyze the principles of the declaration of Human Rights, using the notions of justice, equality and fraternity, identify progress and obstacles to the realization of these rights in different contemporary societies and promote concrete actions in the face of inequality and violations of these rights in different living spaces, respecting the identity of each group and each individual.
(EM13LGG105) Analyze and experiment with different remediation processes for multisemiotic, multimedia and transmedia productions, developing different modes of participation and social intervention.