Critical Thinking Development in the IB Middle Years Programme: An International Multisite Evaluation

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Foreword

The current report details the research study *Critical Thinking Development in the IB Middle Years Programme: An International Multisite Evaluation,* conducted by a team at the Oxford University Centre for Educational Assessment (OUCEA) and funded by the International Baccalaureate (IB). The purpose of the report is to examine the relationship between participation in the IB Middle Years Programme (MYP) and students' levels of critical thinking, as measured by an established critical thinking assessment. The research team collected data in IB and non-IB schools in Australia, England and Norway in 2021 and 2022.

We would like to thank Olivia Halic, Senior Research Manager at the International Baccalaureate for her commitment to the project, and for her feedback on the research instruments, the interim report and analyses, for her support in recruiting schools in the three countries of interest, and for providing key IB documents.

We would also like to thank the participating schools, including teachers in Australia, England and Norway who participated in this research study. We would also like to thank IB MYP teachers who provided their time to share their knowledge and experience on teaching and learning in the IB MYP. This research study could not have been conducted without their valuable input. In addition, we would like to thank all the students and their parents in the three countries who agreed to take part in the study, and to the students who volunteered to be interviewed to elaborate on the issues around critical thinking, learning and assessment.

Table of Contents

Executive Summary

Context

This report outlines a research study by the OUCEA concerning the assessment of the differences in the critical thinking skills of Grade 9 and 10 students in the IB Middle Years Programme (MYP) and those enrolled in the national curricula, in Australia, England and Norway. Both quantitative (critical thinking test and a range of student background data) and qualitative (IB MYP curricula documents and interviews) data were analysed. The primary aim of the report was to evaluate the relationship between participation in the IB MYP and student's levels of critical thinking skills in terms of their performance on the Cornell Critical Thinking test. In addition, the outcome of the document and interview analyses was aimed at gaining a better understanding of the IB MYP curricula and the experiences of critical thinking development within the MYP context.

Scope and objectives

The data was analysed with three main goals: (1) to identify evidence-based features of the IB MYP approach geared towards the development of critical thinking; (2) to assess the difference in critical thinking skills in IB MYP and non-IB MYP students, and (3) to understand how MYP students, teachers and coordinators encounter, experience and develop critical thinking.

Methodological approach

This study was conducted in three phases between August 2021 and July 2022:

- In Phase 1, we conducted a document analysis of 13 internal and public documents and a review of literature related to the MYP and critical thinking teaching and assessment.
- In Phase 2, we collected quantitative data from Grade 9 (IB MYP 4) and 10 (IB MYP 5) students on their critical thinking skills and a range of background details (personality, socio-economic status, cognitive abilities). In total, there were 870 participants, MYP (n = 386) and non-MYP (n = 484) students across Australia, England and Norway, from 21 schools. Propensity score matching and regression approaches were used to compare the difference in critical thinking skills between groups.
- In Phase 3, we collected interview data from 45 teachers and 46 students across 22 interview sessions, in 10 MYP schools. In total, 91 participants were interviewed in Phase 3. Interview schedules covered a broad range of questions related to how MYP students, teachers and coordinators encounter, experience and develop critical thinking. Thematic analysis was used to identify themes in the qualitative interview data.

Main findings

The key findings of the analyses were as follows:

- Overall, students enrolled in the IB MYP possess significantly higher levels of critical thinking skills than their non-IB MYP counterparts.
- This advantage for the MYP group was still present even after accounting for several relevant covariates.
- This advantage held for the MYP group at both grade levels and across Australian and English students, with no significant difference for Norwegian students. However, given that the matching procedure was less effective for the Norwegian sub-sample, the Norwegian findings for the country-level analysis should be cautiously interpreted.

- Qualitative analysis of the interview data revealed that from the student's perspective: (1) self-directed learning, (2) transfer of thinking skills, and (3) distinct features of the Individuals & Societies course, were important aspects for how they experience critical thinking in the MYP. By contrast, from the perspective of MYP coordinators and teachers: (1) individual differences; (2) explicit assessment language; (3) time in the MYP, and (4) professional development, were the key factors underpinning their experience of critical thinking in the MYP.
- Document analysis highlighted that the IB's MYP approach to developing critical thinking aligns with evidence-based best practice.

Recommendations

The findings across the three phases of the present study suggest the following recommendations:

- Given the overall advantage in critical thinking skills among IB MYP students, schools aiming to advance critical thinking skills among their middle years' students would likely benefit from referring to and/or adopting the IB MYP, including incorporating inquiry-based approaches and explicit instruction. Importantly, it is ideal to implement the MYP with a high level of fidelity.
- The IB would benefit from conducting further research on the implementation of the MYP across different contexts, particularly in contexts where there is often a legal requirement to offer the MYP curricula together with the national (local) curricula, as an integrated curriculum. This integration may impact upon the fidelity of MYP implementation, and it would be prudent to assess what impact, if any, adaptations have on students' critical thinking development.
- Further research is required to evaluate the impact of the IB MYP on critical thinking in more specific contexts such as for specific grades and/or countries, including larger sample sizes to facilitate higher quality propensity score matching outcomes to provide greater confidence in the analysis outcomes. This would also be enhanced by the collection of other information on students' social, cultural, and economic background to further enhance the matching procedure.

1. Introduction

In this report, we discuss the evidence regarding how educational instruction affects critical thinking, as well as the types of pedagogical approaches that appear to be most beneficial to developing critical thinking skills. We subsequently explore the extent to which the frameworks, policies, and documents used within the IB MYP programme reflect this evidence base, particularly with respect to the role of the MYP in students' development of critical thinking. It involves an evaluation in three distinct educational environments and cultures, Australia, England, and Norway, and is conducted in three phases:

Phase 1: Review of the literature and IB documents, with a particular focus on the MYP documents, to ensure that the study builds on previous research, and to provide an understanding of how the IB integrates critical thinking within and across its MYP subjects and how these may benefit MYP students' critical thinking skills.

Phase 2: Remote quantitative data collection, including the assessment of MYP and non-MYP students' critical thinking using the previously validated Cornell Critical Thinking test (CCT, Ennis et al., 2005) to assess the potential differences in the critical thinking abilities of the two samples of students.

Phase 3: Qualitative interviews with students, MYP coordinators and teachers from several IB MYP schools that participated in Phase 2 concerning their experiences of learning and teaching critical thinking in the MYP.

The following research questions were addressed in this study:

1. Which features of the MYP are expected to foster the development and enhancement of critical thinking in students? How are these features integrated into the IB documentation for the MYP? [Phase 1]
2. What is the relationship between participation in the MYP and a skill-based measure of critical thinking? Which MYP students' characteristics predict higher levels of critical thinking? [Phase 2]
3. Do MYP students differ on average from their matched non-MYP peers in their levels of critical thinking when other student characteristics are considered? [Phase 2]
4. Drawing on a group of courses that represent a typical route to critical thinking in the MYP, in what ways do MYP students and teachers encounter, experience and develop critical thinking? [Phase 3]

2. Literature Review of Critical Thinking

2.1 Defining critical thinking

The development of critical thinking in students is fundamental for advancing a nation's effectiveness and for tackling the persistent challenges across the world (Pellegrino & Hilton, 2012). Over the last few decades, several studies have addressed how critical thinking is defined, assessed and fostered (Larsson, 2017). Critical thinking can be considered as "an active, persistent, and careful consideration of any belief in light of the ground that supports it" (Dewey, 1909, p. 9). Critical thinking as a skill is underpinned by cognitive processes and includes the ability of an individual to demonstrate "logical enquiry and reasoning" when presented with a problem. Based on the landmark Delphi report, several

experts arrived at a consensus definition of critical thinking that has guided approaches to its teaching and assessment since (Facione, 1990; Facione, 2000). This definition advanced critical thinking as referring to cognitive skills in interpreting, analysing, evaluating, inferring, and explaining and self-regulating. It also highlighted that critical thinking includes characteristics such as being inquisitive, open-minded, flexible, fair-minded, and honest (Davies, 2015; Elder & Paul, 2020; Ennis, 1987; Facione, 2000; Facione & Facione, 1992; Giancarlo et al., 2004; Glaser, 1941; Meral et al., 2021).

One of the main discrepancies in relation to the conceptualisation of critical thinking has been whether it should be considered as domain-general or domain-specific (Davies, 2015; Glaser, 1941; Nygren et al., 2019). In other words, is critical thinking a generic attribute (e.g., skill) or is it bound by context? To date, there has been a relative consensus that critical thinking should be understood as a set of general cognitive skills that may require in-depth understanding of the specific discipline (e.g., content, rules, procedures and strategies consider appropriate in the specific area of knowledge) (Tiruneh et al. 2015; Verburgh, 2019), but that can be applied across domains (Ennis, 1989; Govier, 1985; Siegel, 1988). Clarifying this debate has practical implications because it determines whether critical thinking should be taught through specialised or generalised modules. Moreover, fostering critical thinking goes beyond developing critical thinking skills, instead, a more comprehensive approach to developing critical thinking includes encouraging traits such as being open-minded and inquisitive (Halpern, 2014; Ku et al., 2017; Paul & Elder, 2019; Rear, 2017).

2.2 The importance of critical thinking: Considering online and offline contexts

To curb the spread of COVID-19, by mid-April 2020, 192 countries were advised to issue stay-at-home mandates, which meant that 1.5 billion children – more than 90% of the world's student population – were no longer able to attend their typical learning spaces (UNESCO, 2021; United Nations Sustainable Development Group, 2020). Consequently, in areas with internet access, many aspects of students' daily lives, including their classroom and play environments, were transitioned to an online environment (UNESCO, 2020). In this respect, over 70% of students started taking classes, playing, and socializing more on virtual platforms (UNESCO, 2021). This increase in children's internet usage has given them the opportunity to be further exposed to more diverse sources of information and ideas and, therefore, to be more likely to develop and enhance new interests and skills. Nevertheless, the rapid and unplanned introduction of children to these digital environments on such a large scale has also amplified their risk of exposure to inappropriate or potentially harmful content, including unverified, inaccurate and misleading information (Buchanan, 2020; Day, 2021; Orso et al., 2020; Solomon et al., 2020). Thus, the development of critical thinking in students in both face-to-face and virtual contexts has become pertinent.

Previous authors have also distinguished between critical thinking and critical reading, with a specific focus on highlighting that both skills are required for students to critically engage with information in both online and offline contexts (Collins-Dogrul & Saldaña, 2019; Goertel, 2018; Pilgrim et al., 2019). Critical reading involves understanding what has been read, synthesizing that information, and making high-level inferences (Applegate et al., 2004). Conversely, critical thinking skills refer to the ability to raise and formulate clear and precise questions and problems, assess the information or alternatives, and arrive at a reasoned and well-informed judgment or solution (Facione, 1990; Halpern, 2014). Together, both skills work to enable individuals to better understand and evaluate information (Ennis, 2011; Wolf, 2018). Consequently, they play a central role in making well-informed and rational judgments and decisions. That is, they enable people to be less susceptible to the effects of

misinformation through building necessary skills for effectively engaging with a plethora of at times contradictory information (Akin et al., 2015; Paul & Elder, 2008; Zabihi & Pordel, 2011).

Despite the value of disentangling the definition of critical thinking, scholars have argued that instead of arguing about the meaning of critical thinking from a theoretical perspective, it is perhaps more fundamental to consider how critical thinking is translated at a practical level (Davies & Barnett, 2015; Moore, 2013). In the following sections we contextualise the translation of critical thinking within the assessment and instruction contexts, more broadly as well as specifically within the MYP.

2.3 Assessing critical thinking

The positive effects that critical thinking has on students' academic, personal, and social life has encouraged educators and researchers all over the world to design instructional programs focused on the acquisition and development of this multidimensional construct. Along with training efforts, its effective evaluation has been recognized as a critical component for its proper enhancement (Braun, et al., 2020). Consequently, the assessment of critical thinking has a long and multi-national history (Possin, 2020), and it is therefore unsurprising that several tasks have emerged to measure it (Liu, et al., 2016). These tasks differ in several aspects, such as which facets of critical thinking are included in the assessment, the item-format they employ, their contextual background, the number of questions, the length of completion time, and/or their mode of delivery (i.e., paper or computer-based).

Some of the most widely used standardized instruments to measure domain-general critical thinking are: (a) the Watson-Glaser Critical Thinking Appraisal (W-GCTA), (b) the California Critical Thinking Skills (CCTS); (c) Halpern Critical Thinking Assessment (HCTA); (d) Cornell Critical Thinking Test (CCTT), (e) Ennis-Weir Critical Thinking Essay Test (E-WCTET), and, (f) California Critical Thinking Disposition Inventory (CCTDI) (Fong et al., 2017; Ku, 2009; Liu et al., 2014). Apart from the CCTDI, which measures the dispositional dimension of critical thinking (Facione & Facione, 1992), all other instruments are focused on the assessment of critical thinking skills. Moreover, aside from the E-WCTET, which comprises only open-ended questions, (Ennis & Weir, 1985), the remaining assessments include a combination of closed and open-ended questions. Although these instruments are only a few examples of the numerous instruments researchers and educators use to evaluate critical thinking, they do provide insight about the tendencies of critical thinking assessment. To this end, critical thinking is mostly assessed through domain-general instruments and selected-response items, particularly multiple-choice and Likert-type formats (Liu et al., 2014).

2.4 Fostering critical thinking in the Middle Years

Most school stakeholders would agree that learning to think critically is one of the most desirable goals of formal education. Indeed, critical thinking is an effortful activity that can and should be taught and refined with the right methods and effective guidance (Abrami et al., 2008; Lodge et al., 2015; Tittle, 2011). Many efforts have been made to support the development of students' critical thinking, which has in turn necessitated the evolution of traditional curricula to meet these needs (Cone et al., 2016; Everett et al., 2018). Newer curricula have less focus on teaching and learning as processes of knowledge transfer and recall and have more emphasis on teaching students how to think, rather than what to think (Ennis, 2013, 2018; Kettler,2016).

To this end, a variety of strategies have emerged with an emphasis on skills and content knowledge. These have typically differed in terms of whether they were holistic approaches (e.g., infusion, immersion, general, and mixed) (Darby & Rashid, 2017; Li & Payne, 2016) or a specific type or intervention or teaching strategy. Some of the most cited interventions to foster critical thinking have

included problem-based learning (Al Ghamdi & Deraney, 2013; Cargas et al., 2017; Olivares & Heredia, 2012; Vincent-Lancrin et al., 2019), critical or extensive reading (Husna, 2019; Yildirim & Söylemez, 2018), Socratic questioning (Sahamid, 2016), argument mapping (Eftekhari et al., 2016), peer assessment (Domínguez et al., 2014), inquiry and research-based teaching method (Putri & Sela, 2018; Verawati et al. 2019), cooperative learning (Erdogan, 2019), and role-playing (Rashid & Qaisar, 2017). Additionally, critical thinking instruction has also been focused on a range of topics, including pseudoscience (Dyer & Hall, 2019) and socio-environmental issues (García-Ruiz, et al., 2020). Generally, despite the various studies differing in terms of quality and scale, they tend to report positive effects for critical thinking intervention.

On this point, as Goodsett (2020) noted, there may not be a particular teaching intervention that may benefit every student in every situation and context. Nevertheless, there are at least three general guidelines that can be drawn from previous research. Firstly, explicit instruction on critical thinking, in combination with practice on domain specific information leads to a general improvement in critical thinking (Abrami et al., 2008; 2015; Marin & Halpern, 2011). Although it is commonly agreed in the academic literature that critical thinking is a domain-general construct (Tiruneh et al., 2016) and therefore it may be effectively fostered without discipline knowledge, its general development benefits from discipline-specific instruction (Ennis, 1990). This is further strengthened by offering students authentic learning opportunities alongside engaging in dialogue with their peers, as well as combining these with individualised mentorship opportunities on their own critical thinking (Abrami et al., 2015). Secondly, several authors highlight the importance of explicitly attending to all the dimensions of the construct in an environment that facilitates freedom of speech and mutual respect (Barnett, 2015; Joseph et al., 2017). As previously argued, a critical thinker needs sufficient knowledge to understand the issue at hand, the mastery of a set of cognitive skills, and the commitment to apply both the background knowledge and the skills in an ethical manner (Lai, 2011). Consequently, when fostering critical thinking within educational institutions, special attention should be placed on the readiness to be critical citizens who participate in a meaningful manner in the communities to which they belong (Volman & Dam, 2015). Thirdly, to assist learners to become critical thinkers, teachers should have a clear understanding of what critical thinking is, why it is important, and how it can be fostered, including being critical thinkers themselves (Kincheloe, 2004).

Along with the above discussed research findings, educational systems all over the world have made advancements in responding to the demands of our increasingly globalised world. For example, the Common Core Standards in the United States of America emphasises the importance of strengthening critical thinking skills and the application of those skills (Common Core Standards Initiative, 2016). Similarly, in Australia, there is a requirement for teachers across all subject areas to foster critical and creative thinking. These considerations were also central to the development of the IB MYP, which was developed in 1994 to adhere to the central underpinnings of the IB (IBO, 2014a). Over the years, the MYP has positioned itself as a leader in middle-years education, preparing students for a rapidly changing world, with critical thinking being a priority throughout the programme. For example, within the context of Physical Education (PE), the MYP is aimed at ensuring that students possess "the ability to reflect critically on all aspects of PE, including being a critical performer" (IBO, 2010, p.4). Much of the MYP's framework also incorporates the principles of Bloom's taxonomy, a seminal framework which describes student's progression in thinking skills (Bloom, 1956). This framework presents a hierarchical representation of the distribution of cognitive resources, and the highest level (application) requires students to demonstrate critical thinking skills (Lai, 2011).

Despite these emphases on critical thinking within the MYPS, there is, to date, little empirical evidence to demonstrate the advantage of the MYP in fostering critical thinking skills compared to other

educational curricula. Therefore, the current study aims to examine the relationship between participation in the IB MYP and students' levels of critical thinking, compared to the equivalent national curricula.

2.5. IB MYP and critical thinking

Within the MYP, fostering critical thinking is recognised as a core component of the programme (Calnin et al., 2018; Wright, 2015) that directly contributes to the development of an international education (Hill, 2006). Along with the rapid increase of the number of schools offering MYP (in August 2022, the MYP has been implemented in 1,358 schools in 108 countries [IBO, 2022a]), several authors from different geographical areas have highlighted the emphasis that the IB MYP places on the development of critical thinking (Calnin et al., 2018; Dever, 2019; Hill, 2006; 2012) as well as the positive effect this programme has on the development of students' critical thinking (Daly et al., 2012; Jackson, 2006; Stevenson et al., 2017). Some authors even argue that the potential of the MYP in developing critical thinking is one of the main reasons for offering this programme (Ateşkan et al., 2016; Holland, 2016; Robertson, 2011; Wright et al., 2016). To empirically support the claim that the IB MYP is effective in the development of students' critical thinking, several scholars have attempted to provide scientific evidence. The findings of the overall research tend to strongly suggest that students, parents, teachers, and school leaders perceive that the IB MYP learning experience has a positive impact on students critical thinking development. This perception is reported by stakeholders from schools with varying socioeconomic and ethnic profiles in Australia (Dickson et al. 2020; Perry et al., 2018), Turkey (Ateşkan et al., 2016); Spain (Valle et al., 2017); United Kingdom (Sizmur & Cunningham, 2012), United Arab Emirates (Stevenson et al., 2017), United States of America (Beckwitt et al., 2015; Storz & Hoffman, 2018; Wolanin & Wade, 2012) and several Asian countries, including China, Indonesia, Japan, Thailand and Vietnam (Aoki, 2018; Australian Council for Educational Research [ACER], 2015; Walker et al., 2014; Wright, 2015). According to Wade et al. (2016) the most frequent outcomes reported by students' and teachers' perceptions and, in agreement with the researchers' observational reports were: "gathering and organizing information, considering ideas from different points of view, making connections with learning gained in other subject areas; students explaining or elaborating on their thinking" (p. 37). Together, these positive reports may clearly help to understand the increase in the presence of IB schools during the last two decades. Nonetheless, stakeholders' perceived benefits of the MYP may not correspond with the real impact of the MYP on students' critical thinking development. Thus, more empirical research is needed to determine whether the MYP is more effective in the development of students' critical thinking, when compared with other curricula (Dickson et al., 2018; Wootten, 2019).

2.6 The current study

The current project is conducted in three phases. Phase 1 comprises a qualitative analysis of IB MYP documents, in particular, examining internal IB procedures and policies to hypothesize pathways by which the IB MYP improves critical thinking. This is achieved by considering these documents against the evidence-base presented above. Phase 2 will quantitatively examine whether IB MYP students differ from non-IB MYP students in terms of their critical thinking ability, after statistically accounting for pre-existing differences in student characteristics between IB and non-IB students. Phase 3 includes qualitative interviews with MYP students, coordinators and teachers to examine which aspects of the MYP they find most important in developing critical thinking.

3. Document Analysis of Critical Thinking in IB Documents

3.1 Methodology

A document analysis was performed on a collection of documents that were collaboratively selected between the research team and the International Baccalaureate, as summarized in Table 1. These included formal policy documents, instructional materials, and subject guides. The documents were reviewed and synthesized to address possible pathways by which IB's MYP students develop critical thinking. To accomplish this, the document analysis combined elements from both thematic and content analysis methodologies (Bowen, 2009). This process involved skimming (superficial examination), reading (thorough examination), and interpreting included documents, as well as organizing information according to identified themes. Under this approach, we coded the document text according to their relevance to several themes that were iteratively determined by two members of the research team, and which ultimately resulted in the following 3 themes:

1. Principled action
2. Understanding the nature of language
3. Assessment and accountability

Given the variety and number of documents, the first step in the process was to review the complete set of documents for relevance. A research team member read through all documents and selected those that were most appropriate to the inquiry. This resulted in the selection of 13 documents relevant to the question of how the IB promotes critical thinking. Two researchers reviewed the content of these remaining documents. The content of each document was highlighted according to the previously mentioned themes, analysed, and then synthesized into relevant findings presented in Table 1 and discussed below.

Table 1 . List of IB documents included in the document analysis

Publication	Document title	No of pages
IBO (2021a)	Personal project guide	39
IBO (2021b)	Community project guide	38
IBO (2021c)	Approaches to learning, inquiry and service teacher support material: Example 7 (Curatorial Thinking)	3
IBO (2020)	MYP: Meeting requirements in Challenging Circumstances – June 2020	5
IBO (2018)	What is an IB education?	10
IBO (2014a)	MYP: From Principles into Practice	150
IBO (2014b)	Mathematics guide	61
IBO (2014c)	Language and literature guide	62
IBO (2014d)	Sciences guide	66
IBO (2014e)	Individuals and societies guide	59
IBO (2014f)	Personal project guide	63
IBO (2014g)	Fostering interdisciplinary teaching and learning in the MYP	66
IBO (2012)	Teaching the disciplines in the MYP: Nurturing big ideas and deep understanding	78

3.2 Findings

3.2.1 Principled action

The IB advances the idea of education as a transformative process aimed at making a more peaceful and sustainable world, and critical thinking represents a viable way of cultivating globally engaged critical individuals. That is, it seeks to nurture internationally minded citizens who make and apply informed, reasoned, and ethical judgments to make a positive impact on themselves, others, and the world. To this end, an IB education focuses on the person, the way they behave in the world, and the active role they may play in it. To help students take responsibility for their own learning and their participation in society, the IB's teaching and learning experiences are focused on repeated cycles of sustained inquiry, critical reflection, and principled action. When engaging in this cycle, students are offered opportunities to spread the required skills, attributes and knowledge for thinking critically, as well as to exemplify that capacity in action in the world. Consequently, "principled action, as both a strategy and an outcome, represents the IB's commitment to teaching and learning through practical, real-world experience" (IBO, 2014a, p. 11).

Thus, the principled action theme reflects the active (authentic) steps that are implemented in the MYP to ensure students actively engage in the critical thinking. The analysed IB documents highlighted several instances of how the active concept of principled action served as a viable process that fosters the development of critical thinking. The two core aspects of this principled action are the fostering of an ethos of thinking, as well as the active steps that are taken within the programme to achieve critical thinking.

3.2.1.1. Ethos of thinking

Ethos of thinking in the MYP relates to three dimensions: thinking in relation to oneself, thinking in relation to others, and thinking in relation to the world. A common theme to these three dimensions is the concept of international mindedness, defined as creating "a better and more peaceful world through intercultural understanding and respect" (IBO, 2018, p. 1), and students who exhibit this attribute are those "who understand that other people, with their differences, can also be right" (IBO Mission Statement). As the MYP model in Figure 1 illustrates, international mindedness is reinforced by four components: (a) global contexts, (b) approaches to learning, (c) concepts and (d) approaches to teaching focus on global contexts (IBO, 2021). Together, these skills, knowledge and attributes gained from the fostering of this ethos of thinking may lead to students engaging in more principled action.

Figure 1. The International Baccalaureate Middle Years Programme (MYP) Model (IBO, 2021a, p. 2)
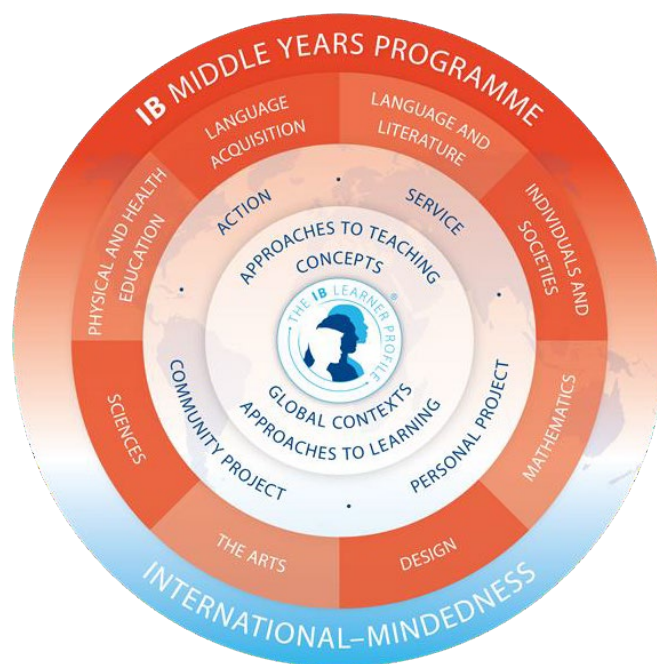
There are several skills underpinning the ethos of thinking. However, with reference to critical thinking, the document analysis highlighted that these skills are related to the "analysing and evaluating issues and ideas" (IBO, 2014a, p. 113) and include both reasoning-related sub-skills, which include indicators such as to "evaluate evidence and arguments", "draw reasonable conclusions and generalizations" and "develop contrary or opposing arguments " (IBO, 2014a, p. 133), as well as problem-solving sub-skills which, in turn, include indicators such as to "practice observing carefully in order to recognize problems", "propose and evaluate a variety of solution" and "evaluate and manage risks"(IBO, 2014a, p. 133). Indeed, critical thinking in MYP is not limited to the argumentative skills of interpretation, analysis, and evaluation of information, but it also includes the recognition and resolution of problems in a logical and systematic manner. Moreover, some of the included critical thinking indicators, such as "consider ideas from multiple perspectives", "recognize unstated assumptions and bias" and "revise understanding based on new information and evidence" (IBO, 2014a, p. 113) recognises both the rational and the ethical dimension of critical thinking, as identified

by previous research in Section 2. In addition, a set of skills that help to solidify critical thinking have been identified. They include: (a) communicative, (b) creative, (c) conceptual thinking, (d) metacognitive, (e) media and information literacy, (f) research, (g) reflective, (h) self-management, and (i) social skills (IBO, 2021b; IBO, 2014a; IBO, 2018). Alongside mastering critical thinking skills, students require access to sufficient knowledge to be able to think with clarity and precision about the issue at hand. Indeed, as "effective inquiry often is not possible without facts and prior knowledge" (IBO, 2014a, p. 66), MYP places emphasis on "the pursuit of significant knowledge and understanding" (IBO, 2014a, p. 9). Accordingly, the diverse opportunities, through which students "learn to draw connections and pursue rich understandings about the interrelationship of knowledge and experience across many fields," (IBO, 2014a, p. 13) help them mature the four dimensions of knowledge -- factual, conceptual, procedural, and metacognitive -- and, in turn, successfully develop critical thinking.

Finally, students need to embody a critical spirit in order to exemplify that ability toward achieving a common good. That is, they need to be committed to applying learned skills and knowledge that are related to critical thinking in an ethical manner, as identified by previous research in Section 2. In this respect, the MYP offers students several opportunities to acquire and evolve an ample range of attributes, such as intellectual curiosity, perseverance, flexibility and open-mindedness, autonomy, and rigour (IBO, 2012; IBO, 2014a; IBO, 2014d; IBO, 2014f; IBO, 2014g). In addition, in alignment with the attention IB pays to the ethical dimension and the growth of internationally minded students in the whole curriculum, integrity-related attributes, such as empathy, honesty or fair-mindedness are central to critical thinking development (IBO, 2014a; IBO, 2014e; IBO, 2014f). Together, these findings highlight that the MYP programme aims for the holistic development of world citizens. This is achieved through inquiry-based learning that leads to taking responsible action (IBO, 2014a).

3.2.1.2. Active (authentic) steps to achieving critical thinking

In applying an inquiry-based approach, "[MYP] teachers construct the statement of inquiry for a unit by combining a key concept, one or more related concepts, and a global context for the unit into a meaningful statement that students can understand" (IBO, 2014a, p. 63). From this and from the statements of inquiry, "students can develop their own questions in ways that satisfy curiosity " (IBO, 2014a, p. 63), move "from their current level of understanding to new and deeper level of understanding" (IBO, 2014a, p. 73), and "lead to meaningful reflection and to responsible action" (IBO, 2014a, p.74). In this respect, inquiry-based learning helps students to progress toward more sophisticated understanding and develop higher-order thinking skills -- namely critical, creative, and metacognitive skills -- as well as intellectual curiosity and perseverance (IBO, 2014a). In addition, within the context of a "broad and balanced curriculum" (IBO, 2021, p.6), several elements that enrich the interplay of inquiry, reflection and action have been identified. They are: (a) multilingualism, (b) interdisciplinarity, (c) the use of a concept-driven and contextualized curriculum, (d) distinct features of academic subjects, and (e) action as an outcome. In the following paragraphs these elements are further discussed.

a) Multilingualism

MYP students' study in more than one language, and the main goal of engaging with foreign languages is "promoting the development of high language proficiency and intercultural sensitivity" (IBO, 2012, p. 36). To that end, "instruction focuses on context-relevant, culturally informed, reflective language uses to achieve language fluency and intercultural sensitivity" (IBO, 2012, p. 47). Aside from the potential cognitive benefits of multilingualism, such as the advantages in metalinguistic awareness and cognitive flexibility, the documents highlight "understanding the new language as a rich source to scaffold learners' understanding, respect and appreciation of other cultures, as well as a source to

promote students' reflective stance towards their own language and culture" (IBO, 2012, p. 34). In this respect, learning a foreign language represents an invitation to inquiry about other cultures and one's own which, in turn, has potential benefits in terms of the development of attributes related to critical thinking. This helps students to access various worldviews, gain cross-cultural awareness and understanding, and nurture perspective taking and open-mindedness, which have been identified by previous research in Section 2 as being important to foster a critical thinking in its entirety. In this respect, it helps to recognise and combat other predispositions of the human mind, including egocentric, ethnocentric, and sociocentric thinking, all of which represent powerful barriers to the development of critical thinking. Importantly, and as discussed in a subsequent theme, multilingualism also helps to gain understanding of the power of language.

b) Interdisciplinary learning

MYP considers that "the most effective way to develop ATL is through ongoing, process-focused disciplinary and interdisciplinary teaching and learning" (IBO, 2014a, p. 20). In alignment with this, "meaningful interdisciplinary learning is the cornerstone of the Middle Years Programme" (IBO, 2012, p. 1). This is distinguished for being "purposeful, integrative, grounded in disciplines" (IBO 14, p. 3). Consistently, "all MYP teachers are responsible for developing meaningful ongoing opportunities for interdisciplinary teaching and learning, both within their disciplines and in the context of interdisciplinary units" (IBO 8, p. 12). Hence, students must be engaged "in at least one collaboratively planned interdisciplinary unit that includes more than one subject group in each year of the programme" (IBO, 2014a, p. 46). In these units, students are explicitly invited to connect and apply concepts, methods and modes of communication acquired and developed in different subjects to understand and address a given issue or problem flexibly and accurately. By providing students with this holistic and explicit approach to the study of complex issues and ideas, document analysis showed that students have the opportunity to (a) gather information from different sources and criteria; (b) transfer understanding; (c) evolve and apply perspective-taking techniques; (d) understand the strength and limitations of disciplines; (e) connect and integrate conflicting insights from alternative disciplines; (f) analyse different perspectives and data; (g) evaluate consequences of alternatives taking into consideration diverse criteria, and, (h) creatively apply knowledge to foster new understandings (IBO, 2012; IBO, 2014a; IBO, 2014g). Together, this finding demonstrates that students are likely to develop not only complex and sophisticated conceptual-thinking skills and structural knowledge, but also a healthy scepticism against oversimplified, biased and unsupported claims, tolerance to ambiguity and paradox, sensitivity to the ethical dimension of issues, flexible thinking, intellectual rigour, and an awareness of the importance of collaboration and teamwork across disciplines.

c) Concept-driven and contextualized curriculum

Document analysis showed that in the MYP, an idea-centred teaching and learning is encouraged by a concept-driven curriculum (IBO, 2014a). To this end, the MYP advances key concepts (overarching) and related concepts (subject-specific) (IBO, 2014a). The former (key concepts) are "powerful, abstract ideas that have many dimensions and definitions" (IBO, 2014a, p. 15). The latter (related concepts) "promote depth of learning and add coherence to the understanding of academic subjects and disciplines. They are grounded in specific subjects and disciplines, and they are useful for exploring key concepts in greater detail" (IBO, 2014a, p. 15). The exploration of both concepts ensures that students demonstrate deeper levels of thinking beyond the surface presentation of concepts, including serving as a gateway for students to better understand issues within a personal and global context. Consequently, and according to the IB documents, they not only facilitate connections between and among subjects, but they also lead students to "deepen disciplinary understanding, build

the capacity to engage with complex ideas and allow transfer of learning to new contexts" (IBO, 2014a, p. 13). In addition, the document analysis showed the importance of contextualised learning in the MYP, and as "contexts for learning in the MYP are chosen from global contexts to encourage international mindedness and global engagement within the programme" (IBO, 2014a, p. 18), contexts "direct learning towards independent and shared inquiry into our common humanity and shared guardianship of the planet" (IBO, 2014b, p. 20). Together, when learning in a global context, students are likely to gain deeper understanding of the application of the subject in the world, put theory into practice and beyond the classroom, value the possibility of new perspectives and refinement of understanding, explore the ethical dimensions of individual, local and global challenges, develop international mindedness, and engage globally (IBO, 2014a).

d) Distinct features of academic subjects

Although critical thinking can and should be developed from every area of knowledge, there are three specific subjects in the MYP framework that are highlighted for their potential impact they may have on the development of students' critical thinking (IBO, 2014b; IBO, 2014d; IBO, 2014e). This may be due to the nature of the disciplines alongside the way they are taught and learned. This primarily includes Individuals and Societies. However, critical thinking is indirectly addressed in the Sciences and Mathematics.

Individuals and societies (IAS) within the MYP cover an essential aspect to become a critical international-minded person -- the ethical dimension (IBO, 2014e). Being immersed in this socially related discipline ensures that MYP students are faced with debatable and controversial methodologies and content, such as "global climate change", "conflicts and ethical issues in economics", and "peace and conflict" (IBO, 2014e, p. 41-42). In this respect, students are exposed to a range of experiences which helps them to better: (a) comprehend a range of ideas and acts that may lead to ethical failings; (b) recognize social rights and duties; (c) understand that ethical actions may entail renouncing to powerful personal desires and benefits; (d) appreciate the diversity of human culture, beliefs, values and behaviours, (e) understand the natural tendencies in the human mind we all have to overcome to think critically, and (f) acknowledge and overcome the own biased individual and group-centred perspectives and beliefs (IBO, 2014e). Consequently, along with the cultivation of a set of critical thinking skills (e.g., observation and ethical reasoning), students develop a deep concern for the welfare of others while actively applying a range of intellectual tools that help them achieve intellectual autonomy and integrity, which cultivate critical thinking as identified in Section 2.

With reference to Science, the benefits of learning science in MYP are closely linked to those of taking an inquiry-based pedagogical approach. To this end, in MYP "the scientific process, which encourages hands-on experience, inquiry, and critical thinking, enables students to make informed and responsible decisions, not only in science but also in other areas of life. (IBO, 2014d p.5). Furthermore, because of the nature of the scientific knowledge, methods and purpose, some further advantages can be highlighted. In science, (a) knowledge is provisional, (b) objectivity is a key aspect for progress, and (c) outcomes are the product of multiple collaborative efforts that have ethical, social, economic, political, cultural, and environmental implications. In this regard, when MYP students "construct meaning by designing, conducting and reflecting on scientific investigations" (IBO, 2014d, p. 5), they not only expand their social and research-related skills (IBO, 2014d), but they are also taking advantage of the international and ethical dimension of science. In this respect, when learning science in MYP students develop "open-mindedness and freedom of thought transcending gender, political, cultural, linguistic, national and religious boundaries" (IBO, 2014d, p. 5) and a "personal, ethical stance on science-related issues" (IBO, 2014d, p. 5). Regarding Mathematics, in MYP "mathematics is cast as a language for problem-solving and decision-making in everyday life and in the workplace, and a

foundation for the study of sciences, engineering, technology, economics, and other social sciences" (IBO, 2012, p. 6). In this regard, the study of Mathematics promotes "a powerful universal language, analytical reasoning, and problem-solving skills that contribute to the development of logical, abstract and critical thinking" (IBO, 2014b, p. 4).

e) Action as an outcome

In the MYP, document analysis highlighted the importance of different types of actions, but more specifically that, "action [represents], as both a strategy and an outcome, [which] represents the IB's commitment to teaching and learning through practical, real-world experience" (IBO, 2014a, p.11). As an outcome, it "can look very different from age 11 to 16" (IBO, 2014a, p. 74) and it "may extend the students' learning, or it may have a wider social impact" (IBO, 2014a, p. 74). In this regard, in the MYP, there are two projects that offer students the opportunity to exemplify the capacity of thinking critically in action in the world. They are both "student-centred and age-appropriate, and (…) enable students to engage in practical explorations through a cycle of inquiry, action and reflection" (IBO, 2021b, p. 4). These are: the Community Project for students in MYP years 3 or 4, and the Personal Project for students in MYP year 5 (IBO, 2021a).

In the MYP Community Project, students are encouraged to "explore their right and responsibility to implement service as action in the community" (IBO, 2014f, p. 4). That is, individually or in groups of a maximum of three members, they are expected to actively engage their social responsibility to transform society, develop awareness of needs in their community, and address them through a "global engagement and meaningful service" (IBO, 2018, p.2). In this regard, as this service should evolve "beyond doing for others to engaging with others in a shared commitment towards the common good" (IBO 2, p.23), the collaborative exchange between MYP students and the community "maximizes the potential benefits for all the people involved, including learning opportunities for students as they develop and strengthen communication abilities" (IBO 2, p.23). Together, the MYP Community Project encourages international-mindedness (IBO, 1) and "supports raising awareness needs in the community, the application of ATL skills, the reflective nature of inquiry as the project progresses, and the language development required for an oral presentation as the culminating activity" (IBO, 2014f, p. 6). With reference to the MYP Personal Project, this is an individual "truly personal and often creative product/outcome" (IBO, 2014a, p.6) whose process "encourages students to practise and strengthen their approaches to learning (ATL) skills, to consolidate prior and subject-specific learning, and to develop an area of personal interest" (IBO, 2014f, p. 4). In this respect, "action involves individual choices that extend MYP learning beyond knowledge and understanding to include not only socially responsible attitudes but also thoughtful and appropriate action" (IBO, 2014f, p. 19). Therefore, although the action in the two MYP projects is different, "the inquiry process remains the same" (IBO, 2014f, p. 19). In this regard, in both projects students are engaged in in-depth investigations through a cycle of inquiry, action and reflection in which they demonstrate responsible action though, or as a result of, learning (IBO, 2014f). Together, the foundational attributes garnered from these projects have been identified as key components of fostering critical thinking, as identified by the previous research in Section 2.

3.2.2 Understanding the nature of language

The second theme from the document analysis pertains to the importance the MYP places on the understanding of how language is constructed and expressed for the development of critical thinking. Indeed, to properly evaluate evidence, arguments or problematic situations, students first need to be able to decode and understand the information provided. Besides, to construct counter arguments, rebuttals or plausible solutions to a problem, students need a broader bank of linguistic resources

(e.g., acknowledge own's ideas or metalanguage to talk about argumentation). Document analysis demonstrated that instruction about the nature of language, including "a core set of principles guiding language use" is important for students to thrive as "critical consumers in todays' societies" (IBO, 2012, p.13). These propositions align with the importance of critical reading, as identified in Section 2. In this regard, the document analysis demonstrates that the MYP promotes a deep and enduring understanding of language as a basis to equip students with the linguistic, analytical and communicative skills necessary for becoming skilful interpreters and producers of information (IBO, 2014c).

With the aim of ensuring students achieve their full linguistic potential, the delivery of the MYP adopts several approaches to advance students' understanding of the nature of language. First, MYP schools are committed to (a) encouraging the learning of languages, (b) supporting mother-tongue development and the learning of the host county (or regional) language, and (c) providing extra help to students that are not proficient in the medium of instruction (IBO, 2014a). Second, language development is focused on the holistic development of effective language users. In this regard, language instruction is focused on the development of six skill areas -- listening, speaking, reading, writing, viewing and presenting -- through four objectives -- analysing, organizing, producing text, and using language. Document analysis demonstrated that a central way the MYP attempts to achieve this is through developing student skills in multiple document literacy. This involves developing "the abilities required to construct meaningful synthesis and complex understanding from multiple texts that addresses the same topic from different perspectives" (IBO, 2012, p. 20). Third, to maximize the effectiveness of language instruction, language development permeates the whole curriculum. That is, students expand their linguistic boundaries from each discipline. For example, "MYP sciences should enable students to access, use and communicate scientific knowledge correctly and confidently in oral, written and visual modes" (IBO, 2014d, p. 4). Fourth, to help students develop awareness and become conscious of their and others' languages choices, they are provided with opportunities to discuss and critically reflect language usage (e.g., "collaborative reasoning" and "questioning the author"), as well as with explicit instruction of language features, particularly on the components of the argumentative discourse. In this regard, the explicit instruction is focused on helping students understand how: (a) language is shaped by the context, audience and purpose of communication (language as context-driven); (b) language forms have multiple and actively co-constructed meanings (language as multiple meanings); (c) language conveys information as well as personal stance (language as position); (d) academic language is mainly argumentative (language as argument); and (e) language is a mean for self-expression and for inquiring and understanding ourselves, others and the word around us (language as exploration). Together, the concentration on an understanding of language within the MYP schools provides as a vehicle for moving from "uncritical assimilation to critical reading" of argumentative discourses (IBO, 2012, p.20).

3.2.3 Assessment and accountability

The document analysis also revealed that assessment is an instrumental element to support and encourage students' critical thinking development in the MYP. Certainly, one of the central aims of assessment as highlighted in the IB documents is to "promote the development of critical and creative thinking skills" (IBO, 2014a, p. 79). Critical thinking is assessed both directly and indirectly in the MYP. The analysed documents showed that there was a clear emphasis on the assessment of "thinking critically" within the Individuals and societies course, as illustrated in Figure 2. The assessment of critical thinking was indirectly considered (e.g., analysing in Language and literature, evaluating in the Sciences) in the remaining MYP subject areas.

Figure 2. The Middle Years Programme (MYP) Assessment Criterion

	A	B	C	D
Language and literature	Analysing	Organizing	Producing text	Using language
Language acquisition	Comprehending spoken and visual text	Comprehending written and visual text	Communicating	Using language
Individuals and societies	Knowing and understanding	Investigating	Communicating	Thinking critically
Sciences	Knowing and understanding	Inquiring and designing	Processing and evaluating	Reflecting on the impacts of science
Mathematics	Knowing and understanding	Investigating patterns	Communicating	Applying mathematics in real-world contexts
Arts	Knowing and understanding	Developing skills	Thinking creatively	Responding
Physical and health education	Knowing and understanding	Planning for performance	Applying and performing	Reflecting and improving performance
Design	Inquiring and analysing	Developing ideas	Creating the solution	Evaluating
MYP projects	Investigating	Planning	Taking action	Reflecting
Interdisciplinary	Disciplinary grounding	Synthesizing and applying	Communicating	Reflecting

Document analysis showed that central to the effectiveness of assessment within the MYP is the accountability that assessment provides within the programme. Indeed, it was stated that "While ATL skills are not formally assessed in the MYP, they contribute to students' achievement in all subject groups. Teachers should provide students with regular, specific feedback on the development of ATL skills through learning engagements and provide formative assessment." (IBO, 2021, p.20). Therefore, although these skills were not formally assessed, there existed accountability structures that enable their development. In this regard, IB assessment "requires teachers to assess the prescribed subject-group objectives using the assessment criteria for each subject group in each year of the programme." (IBO, 2014a, p.79). These criteria are equally weighted, directly aligned with project and subject-group objectives, lead to an inquiry-grounded learning, and encompass the four dimensions of knowledge students are expected to learn (i.e., factual, conceptual, procedural and metacognitive). In this respect, "the range of assessed skills, techniques, and concepts, as well as the complexity of their application, must increase as students' progress through the programme" (IBO, 2014d, p. 12). Each criterion is divided into eight possible achievement levels, which contain their own descriptors and range from limited (1-2) to excellent (7-8) performance. Finally, subject-group criterion levels are converted into a grade based on a scale of 1-7 according to subject-group criteria and general grade descriptors. They "capture and describe in a single descriptor the performance of students at each

grade for each MYP subject group". (IBO, 2014a, p. 99). In the case of interdisciplinary units, "teachers must assess the integration of disciplines using the MYP interdisciplinary criteria" (IBO, 2014g, p. 49). Additional criteria can be added to attend national or local requirements (IBO, 2014a).

In order to maximize the benefits of evaluation and ensure fidelity in assessment protocols, IB implements several accountability procedures. MYP schools have a pragmatic-oriented assessment policy derived from the school and the IB's assessment philosophy and principles. This policy "is constructed around educational and pedagogical values and, therefore, represents a statement of intent and action describing principles and practices for achieving educational goals relating to all aspects of assessment" (IBO 2014a, p. 36). To this end, policies include aspects related to both the philosophy of assessment as well as more practical aspects such as those related to the implementation of assessment or the common practices in recording, reporting, and using students' achievement levels. When determining student achievement, teachers are "guided by mandated criteria that are public, known in advance and precise, ensuring that assessment is transparent" (IBO, 2014a, p. 36). Moreover, when making decisions about achievement levels, teachers are required to ensure that their decision is supported by sufficient evidence that clearly and appropriately address the objectives and is derived from a diversity of assessment strategies, tasks and tools (IBO, 2014a). By assessing students through different assessment methods, they not only make assessment more reliable, but they also offer a wider range of opportunities for students to achieve at the highest level. Similarly, for the personal project (or community project for schools that finish their program in MYP years 3 and 4) and subjects taught by more than one teacher, a process of internal standardization is required before determining the final achievement levels. This procedure "promotes consistency and builds common understandings about student achievement with respect to MYP objectives" (IBO, 2014a, p. 84).

Additionally, it is a requirement that students have a clear acknowledgement of what is expected from them. In this respect, "teachers clarify the expectations for each summative assessment task with direct reference to these assessment criteria. Task-specific clarifications should clearly explain what students are expected to know and do" (IBO, 2014b, p.36). Therefore, the MYP curriculum provides a variety of command terms. These, "define a range of learning objectives and assessment criteria in MYP subject groups; they indicate the level of thinking and type of performance (or behaviour) that is required of students. They are closely related to general and subject specific ATL skills, and they make explicit a shared academic vocabulary that informs teaching and learning in the MYP" (IBO, 2014a, p. 118). These are: create, critique, develop, document, organize, prioritize, recall, select, summarize, synthesise, and translate (IBO, 2014a, p. 118).

The MYP includes three IB-validated assessments: the personal project, the ePortfolio and the on-screen examination. Following previous concerns about not having an external assessment, in 2016, the MYP eAssessment was introduced, which is an optional assessment that students are administered in the final year of the MYP. It provides students with the opportunity to obtain an official, internationally recognised certification of their participation in the MYP. As part of the eAssessment, in addition to the mandatory personal project, schools can submit ePortfolios of coursework and sit on-screen examinations with a duration of up to two hours (IBO, 2022b). Although there exist differences in the three aforementioned IB validated assessments, they all "balance validity and reliability, offering assessment tasks that, for example, require students to demonstrate higher order thinking rather than simple factual recall" (IBO, 2018, p. 5). The personal project, for example, is "a student-centred and age-appropriate extended project in which students consolidate their learning throughout the programme" (IBO, 2014a, p. 97). This is mandatory for all MYP year 5 students and "requires a process of external moderation of the supervisor's internal standardized assessment"

(IBO, 2021a, p. 35). In relation to the e-Portfolios and on-screen examinations, they are optional examinations that are aimed at providing students additional opportunities to demonstrate "disciplinary and interdisciplinary understanding, international-mindedness, critical and creative thinking, problem-solving skills and the ability to apply knowledge in unfamiliar situations" (IBO, 2014a, p. 97). Regarding on-screen examinations, teachers submit predicted grades for each student based on their academic development and are externally marked "through a rigorous qualification and seeding process" (IBO, 2014a, p. 101). In the case of the ePortfolio, this is internally marked and externally moderated to "adjust the achievement level totals submitted by each school mathematically to one global standard, ensuring that achievement is recognized fairly across the community" (IBO, 2014a, p 102).

3.2.4 Summary

Table 2 . Summary of potential pathways to critical thinking development in the IB MYP arranged by theme

Theme	Pathway
Principled action	• Explicitly encouraging an ethos of thinking • Utilising inquiry-based, interdisciplinary and contextualised approaches as an opportunity to gain critical thinking skills • Opportunities for authentic learning as an active, real-world, mechanism to implement critical thinking
Understanding the nature of language	• Multi-lingualism removes barriers and extends students capacity for critical thinking across language • Critical thinking is enhanced through developing critical reading skills.
Assessment and Accountability	• Direct and indirect approaches to assessing critical thinking • Explicit assessment language around critical thinking • Opportunities to strengthen background knowledge • The use of pragmatic-oriented assessment policy to ensure assessment fidelity

Note. The approaches to developing critical thinking in the IB MYP align with previous research that was discussed in Section 2.

4. Quantitative Analysis of Critical Thinking in Middle Years Programme Students

This phase uses quantitative comparisons to evaluate whether participation in the IB MYP is associated with higher critical thinking compared to participating in respective national (or state) programmes.

4.1 Methodology

4.1.1 Participants

In 2021, the OUCEA research team obtained a list of IB schools with MYP schools (n = 89) across Australia, England and Norway. A researcher from the OUCEA examined each school and a second researcher participated in reviewing the final school selections, including the approach to selecting the schools. School websites, along with the school's social media accounts were reviewed, and extensive notes were taken to determine which should be included. Thirty-one schools were initially eliminated as they did not offer the MYP 4 (equivalent to Grade 9) and MYP 5 (equivalent to Grade 10); there were 58 remaining MYP schools across the three countries that were eligible for participation. Schools that had an authorization date up until 2017 (or close to if beyond 2017) were also prioritised, given that this was conceptualised as sufficient time for the MYP to be established within the school. However, given the difficulties with recruitment because of the pandemic, there was leniency in the authorisation year for 3 schools (one in Australia with an authorisation year of 2018 and two in Norway with authorisation years in 2018 and 2019) (see Table 4 in Procedures). All 3 schools had other IB programmes at varying levels (e.g., Primary Years Programme [PYP] or Diploma Programme [DP], or both) that were authorised well before the MYP, and therefore, these schools were quite familiar with the overarching IB frameworks and methodology. In addition, school selections in Australia presented a unique case in that public (state) schools were not prioritised given the complex process of gaining ethics through the local Education Directorate.

The nature of the present study requires a comparison between MYP and non-MYP schools. However, it is not commonplace for schools that offer the MYP curriculum to also offer a separate national (state) curriculum during the Middle Years within that same school to a separate group of students. Based on the inclusion/exclusion criteria, eight MYP schools from each of the three countries were initially selected to participate (and ranked in order of preference) and were then approached to determine their interest in participating. However, to widen participation, and to account for potential attrition, especially due to the uncertainty of the pandemic, the OUCEA Team subsequently over-recruited in each country, particularly in Australia and Norway, where there were high attrition rates/unavailability to devote resources to participate in the study. In total, Headmasters/Principals from MYP schools in Australia (n = 29), England (n = 8) and Norway (n = 17), were invited to participate in the study. In total, and across the three countries, invitations were sent to 54 MYP schools.

Based on which schools indicated interest and provided consent to participate, a list of potential comparison schools that broadly matched the participating IB schools' socio-economic status were compiled. Then, Headmasters/Principals from non-MYP schools in Australia (n = 91), England (n = 39) and Norway (n = 92) were invited to participate in the study. This included a mixture of public and private schools, except for Australia, where only private schools were contacted, given the length of time that it would take to obtain ethical clearance for public (state) schools. In total, and across the three countries, invitations were sent to 222 non-MYP schools.

Participating schools in Australia

Six Australian schools were recruited to the study, all of which were independently funded and located in a city area: Two IB schools and four non-IB schools. One school was a single sex boys' school, one was a single-sex girls' school, and four were coeducational schools. In addition to offering the MYP,

the two IB schools also offer other levels of the IB: one of the IB schools also offered the PYP for students aged 3 – 12, and the other IB school offer the PYP and the DP for students aged 16 – 19.

Participating schools in England

Eight schools in England were recruited to participate: Four IB schools and four non-IB schools. One of the IB schools was a single-sex girls' school, and the remaining seven schools were coeducational. In addition to offering the MYP, the four IB schools also offer other levels of the IB: two of the schools also offer the DP and the other two offer the PYP and the DP. Two of the non-IB schools, and one of the MYP IB schools, had a high percentage of students with English as an additional language. All schools, except one of the non-IB schools, were in a city area. All four IB schools were private, non-selective schools. All four non-IB schools were public schools or followed the British public-school tradition. Two of the non-IB schools were fee paying, selective schools, and offer boarding facilities. The remaining two non-IB schools were non-fee paying, non-selective secondary schools.

Participating schools in Norway

Seven schools in Norway were recruited to participate: Four IB schools and three non-IB schools; all schools were co-educational. In addition to offering the MYP, the four IB schools also offer other levels of the IB: two schools also offer the PYP, one of the schools also offer the PYP and the DP and the final school also offers the DP. All IB schools and two non-IB schools were in a metropolitan area. One Norwegian school was independently funded (private) while the remaining six were state funded (public).

Overview

Overall, 870 students from 21 schools participated in the study from Australia, Norway, and England combined. Students were drawn from Grades 9 and 10 of secondary school (the final two years of the MYP), including Grade 9 (44.2%) and Grade 10 (55.8%). Three hundred and eight-six students were enrolled in the IB programme, and 484 students were enrolled in non-IB national (state) programmes. A breakdown of students by country and programme is provided in Table 3.

Table 3 - Student sample size as a function of country and IB status

	Non-IB	IB
Australia	249 (29 %)	195 (22 %)
England	123 (14 %)	100 (12 %)
Norway	112 (13%)	91 (10%)

4.1.2 Materials

In addition to basic demographic variables, participants completed the following tasks using their own laptop computers or school-provided laptops/desktop computers:

Socioeconomic Status

Participants provided several indicators of socio-economic status, including parental education and number of books in their household (Heppt et al., 2022). Like The Progress in International Reading Literacy Study (PIRLS), students provided information about the number of books in the home, while parents reported on their occupation as well as their level of education according to the following

options: prefer not to say, no I did not attend university, yes, I attended university and have an undergraduate degree or yes, I attended university and have a postgraduate degree. If applicable, the parent/guardian completing the form was also asked to select the best option that represented their partner's educational status. Due to the large amount of missing data for the parental education variable (approximately 75%), it could not be used in the quantitative analyses and so the student reported number of books in their household was used as the only proxy for socio-economic status.

Cornell Critical Thinking Test

Students completed the Cornell Critical Thinking Test (Ennis et al., 2005), a 52-item multiple-choice test of critical thinking. The test covered multiple aspects of critical thinking including, "induction, deduction, evaluation, observation, credibility (of statements made by others), assumption identification, and meaning (including definition, sensitivity to meaning, and-ability-to-handle-equivocation)" (Ennis et al., 2005, p.2). The test takes approximately 50 minutes to administer and is broken into sub-sections with moderate to high reported reliability (.67 to .90) and split half reliability ranges from .55 to .76. Several studies have also confirmed the construct validity of the test (e.g., Behar-Horenstein & Niu, 2011; Ennis, 1993; French et al., 2012; Michael et al., 1980).

Big-5 personality assessment

A 50-item personality battery was administered using items drawn from the International Personality Item Pool (Goldberg et al., 2006). The inventory is based on the five-factor model of personality (Goldberg, 1993) and consists of 10 items for each of the five personality dimensions: neuroticism, extraversion, conscientiousness, agreeableness, and openness to experience. Participants rated each item on the extent to which it described them (extremely inaccurate to extremely accurate). The assessment has high reported internal reliability, with an average alpha value of 0.84 (Goldberg, 1993).

Cognitive Reflection Task (CRT)

Participants completed the 3-item CRT. The task consisted of three questions taken directly from Frederick (2005) that have an intuitive yet incorrect response. The questions assess the participants' ability to deeply process problems and override intuitive thinking.

The International Cognitive Ability Resource (ICAR-16)

Participants also completed the ICAR-16 (Dworak et al., 2021). The ICAR-16 is a 16-item broad intelligence measure. The 16 items measure four aspects of intelligence: verbal reasoning, letter and number series, matrix reasoning and three-dimensional rotation. All items were in multiple choice format and the presentation of items was randomized.

4.1.3 Procedure

The IB research co-ordinator sent supporting letters to IB MYP schools encouraging them to participate in the study before the OUCEA research team contacted school IB co-ordinators and headteachers by email and Microsoft Teams. To widen participation, the research team accepted invitations to deliver (online and in-person) an overview of the study and what participation entailed to students. Given the difficulty with recruiting schools in Australia, a member of the research team also coordinated with the IB Schools Australasia team to advertise the research project in their newsletter. For the non-IB schools, a member of the OUCEA research team reached out to Headmasters and Middle Years Coordinators. In addition, due to school closures in response to the

COVID-19 global pandemic, the entire study was remotely conducted by the research team. However, note that although the research team did not visit the physical location for task administration, some schools administered the task as an in-person session (onsite) in a quiet room on the school grounds (see Table 4).

Prior to commencing task administration, a research member of the team met online with the contact person from each school for 20 to 30 minutes to discuss the nature of participation and to agree on the logistics of gaining consent and administering the task. When a school decided on the specific day(s) and time(s) that students would engage with the tasks, this was communicated to a member of the research team so that they could be available at that time in case the school had any questions during the administration of the task. Before this date, parents and students indicated their interest in participating in the study through the completion of a parent/student consent form. Given that parent/student responses were directly shared with the research team, to manage the consent process a member of the research team created separate, secure folders for each participating school. This folder contained three key documents: (1) consent status of students; (2) consent status of parents and (3) key instructions about participating in the study, including the links to the student background questionnaire and critical thinking test. This folder was only accessible to the key contact persons from a specific participating school and the OUCEA research team. Having access to this folder also enabled contact persons from each school to be aware of students who wanted to participate so that they would know the appropriate number of rooms to prepare before the date of task administration. This was particularly important, given that in some instances, there were restrictions on the number of students that could be in a room at once.

The IB coordinator in each school selected students on a voluntary basis for interviews after they were administered the critical thinking test and the student background questionnaire (e.g., personality, IQ assessments). All tasks were administered online through a secure platform (Qualtrics). Participants first completed the student consent, the questionnaires and cognitive task in the following order: demographic variables, socio-economic indicator, personality, ICAR-16, then the CRT. All students subsequently completed the critical thinking test. All sessions, whether onsite or remote, were supervised by at least one teacher from each of the participating schools and a research member from the OUCEA was on standby-by, through Microsoft teams, on the day of task administration if any questions or technical difficulties emerged. Except for one school (that completed the task remotely), all students completed the tasks in a quiet room at their school. The school that completed the task remotely required all participating students to log into an online platform and students individually completed the task while being remotely supervised. Seventeen schools were able to accommodate student completion of both the student background questionnaire and critical thinking task on the same day. In the remaining four schools, students completed both tasks over a period of two days (one task on each day) to accommodate timetabling requirements and supervision availability (See Table 4). Data was analysed using R, a language and environment for statistical computing (R Core Team, 2013).

Table 4 - Overview of schools, task administration details and MYP authorisation year (when applicable)

School Location & Type	Location	Delivery of Task	MYP Authorisation Year
1.Australia (Private)	Onsite	Same day	2018
2.Australia (Private)	Onsite	Same day	2017
3.Norway (Public)	Onsite	Same day	2008
4.Norway (Public)	Onsite	Same day	2018
5.Australia (Private)	Onsite	Across 2 days	N/A
6.Australia (Private)	Onsite	Same day	N/A
7.Australia (Private)	Onsite	Same day	N/A
8.Australia (Private)	Onsite	Same day	N/A
9.England (Private)	Remote	Same day	1995
10.England (Private)	Onsite	Same day	2004
11.England (Private)	Onsite	Same day	2000
12.England (Public)	Onsite	Same day	N/A
13.England (Public)	Onsite	Same day	N/A
14.Norway (Private)	Onsite	Across 2 days	2008
15.Norway (Public)	Onsite	Across 2 days	N/A
16.Norway (Public)	Onsite	Across 2 days	2019
17.Norway (Public)	Onsite	Same day	N/A
18.Norway (Public)	Onsite	Same day	N/A
19.England (Public)	Onsite	Same day	N/A
20.England (Private)	Onsite	Same day	2015
21.England (Public)	Onsite	Same day	N/A

4.2 Results

4.2.1 Descriptive Analysis

The demographic composition of the sample as a function of IB participation is presented in Figure 3. Preliminary analyses suggested that the IB sample differs significantly from the non-IB sample in terms of gender, $\chi^2 = 207.02$, $p < 0.001$. Males were highly over-represented in the non-IB programme sample (71%) compared to the IB programme sample (21%). There was no significant difference in grade level as a function of IB participation, $\chi^2 = 1.77$, $p = .18$; Year 9 students constituted 42% of the non-IB programme and 47% the IB programme sample. A Wilcoxon rank sum test suggested that the number of books in the household differed significantly between the IB and non-IB samples, $W = 73457$, $p < .001$, with IB students reporting a higher average number. In addition, Grade 9 ($M = 2.38$,

SD = 1.40) and Grade 10 (*M* = 2.53; *SD* = 1.54) MYP students have been enrolled in the IB for a similar number of years.

Figure 3. Demographic variables as a function of IB status
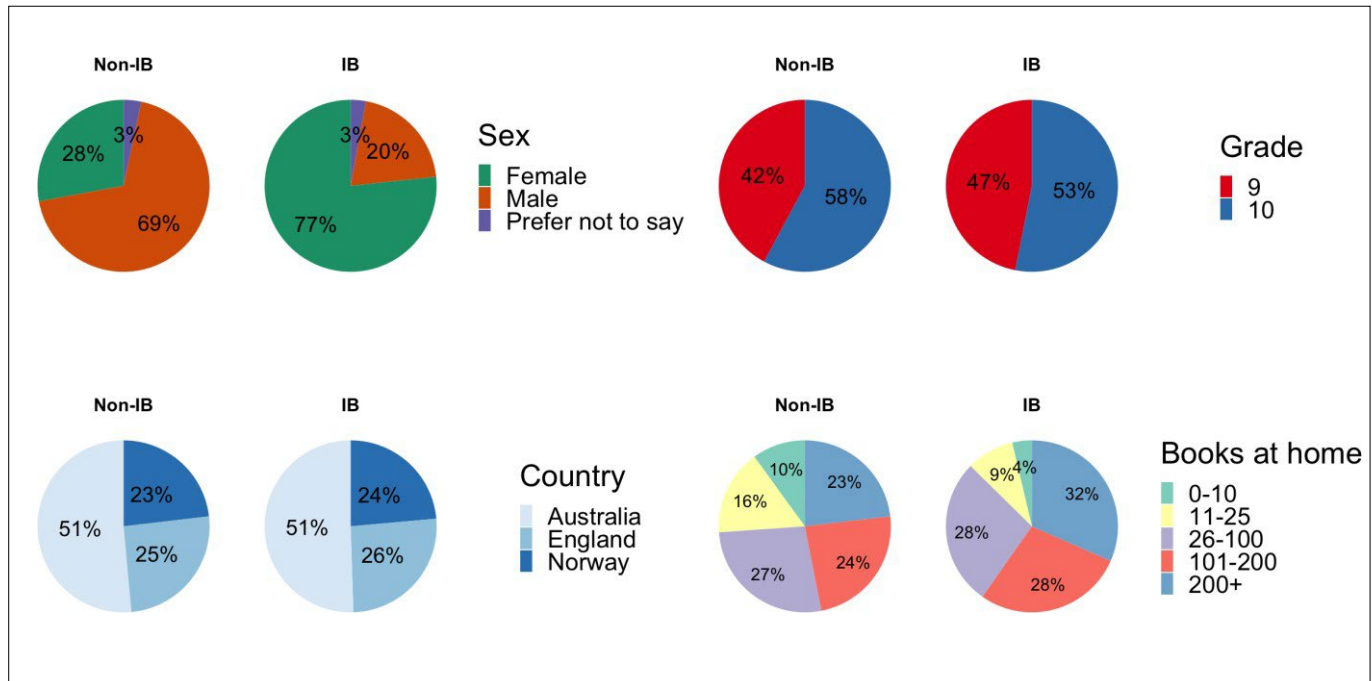
4.2.2 Correlations

Descriptive statistics and correlations of study variables are presented in Table 5. Focusing on critical thinking (CCT), the two measures of cognitive ability (intelligence and cognitive reflection) were moderately, positively correlated with critical thinking, while the personality dimension openness to experience was also a moderate positive predictor of critical thinking. Agreeableness and conscientiousness were small, positive predictors of critical thinking.

4.2.3 Differences in Critical Thinking

An initial analysis was performed to determine if there were substantial differences in critical thinking between the IB and non-IB cohorts without accounting for covariates. Critical thinking was significantly higher in the IB sample (*M* = 24.24, *SD* = 6.19), compared to the non-IB students (*M* = 21.12, *SD* = 6.54), *t*(868) = 7.15, *p* < .001, *d* = .49.

4.2.4 Regression Analysis

Exploratory multi-level regression analyses were performed to examine differences in critical thinking performance after covariates were accounted for. The following variables were entered into the model: cognitive abilities (intelligence and cognitive reflection), personality variables (openness, conscientiousness, neuroticism, extraversion, and agreeableness), socioeconomic status indicator (number of books at home), and demographic variables (age and sex). Note that age was only recorded in whole years rather than as a continuous measure. School was entered as a grouping factor. Note that for this and subsequent analyses, students with incomplete data had their missing responses handled using random forest imputation. This was deemed appropriate, as very few variables had

missing data, and those that did had 2% or fewer missing cases. Sample sizes for each model are noted where appropriate.

The results of the analysis are displayed in Table 6. The multi-level regression indicated that intelligence (ICAR 16), the highest two levels of cognitive reflection, and openness to experience were significant positive predictors of critical thinking, while extraversion was a significant, negative predictor. The highest level of number of books at home was also significant as a positive predictor of critical thinking. Crucially, after accounting for all covariates, IB status was a significant predictor of critical thinking, such that students in the IB programme had significantly higher critical thinking. This effect was moderate in size, $\beta = 0.33$.

Table 5 - Descriptive statistics and correlations between study variables.

Variable	N	IB Mean (SD)	N	Non-IB Mean (SD)	1	2	3	4	5	6	7	8
1. ICAR 16	380	7.13 (3.64)	473	5.31 (3.76)								
2. Openness	386	658.61 (166.7)	484	547.31 (184.09)	0.32***							
3. Conscientiousness	386	558.87 (174.55)	484	551.08 (182.08)	0.13***	0.27***						
4. Extraversion	386	567.62 (195.03)	484	528.15 (191.29)	0.05	0.38***	0.40***					
5. Agreeableness	386	625.71 (168.34)	484	575.21 (177.27)	0.20***	0.37***	0.45***	0.29***				
6. Neuroticism	386	502.27 (190.87)	484	440.08 (190.6)	0.05	0.20***	-0.22***	-0.14***	-0.06			
7. CRT	380	0.99 (1.09)	471	1.06 (1.16)	0.45***	0.12***	0.06	-0.04	0.06	-0.07*		
8. No. of books	380	3.75 (1.11)	471	3.34 (1.27)	0.16***	0.25***	0.14***	0.10**	0.02	-0.03	0.12***	
9. CCT	386	24.24 (6.19)	484	21.12 (6.54)	0.48***	0.32***	0.08*	0	0.11**	0.05	0.33***	0.22***

Note: *** = $p < .001$, ** = $p < .01$, * = $p < .05$

Table 6 - Results of the multilevel regression analysis on critical thinking

Predictors	Estimates	Std. Beta	Standardized CI	p
(Intercept)	15.22	-0.60	-1.80 – 0.61	**<0.001**
IB	2.18	0.33	0.12 – 0.55	**0.003**
ICAR 16	0.53	0.31	0.24 – 0.38	**<0.001**
CRT (1)	0.92	0.14	-0.02 – 0.30	0.084
CRT (2)	1.77	0.27	0.09 – 0.45	**0.003**
CRT (3)	2.25	0.34	0.16 – 0.53	**<0.001**
Openness	0.01	0.18	0.10 – 0.27	**<0.001**
Conscientiousness	0.00	0.02	-0.06 – 0.09	0.698
Extraversion	0.00	-0.14	-0.21 – -0.07	**<0.001**
Agreeableness	0.00	-0.05	-0.13 – 0.03	0.187
Neuroticism	0.00	-0.02	-0.08 – 0.04	0.549
Sex (Male)	0.83	0.13	-0.03 – 0.28	0.111
Age (14)	0.46	0.07	-1.13 – 1.27	0.910
Age (15)	0.58	0.09	-1.11 – 1.28	0.885
Age (16)	1.19	0.18	-1.02 – 1.38	0.767
Age (17)	0.10	0.01	-1.29 – 1.32	0.982
Number of books (11-25)	0.89	0.14	-0.13 – 0.40	0.324
Number of books (26-100)	0.65	0.10	-0.15 – 0.35	0.437
Number of books (101-200)	1.50	0.23	-0.03 – 0.48	0.080
Number of books (200+)	2.02	0.31	0.05 – 0.57	**0.021**
Random Effects				
σ^2	30.99			
$\tau_{00\ Q50}$	1.13			
ICC	0.04			
N_{Q50}	21			
Observations	870			
Marginal R^2 / Conditional R^2	0.281 / 0.306			

4.2.5 Propensity Score Matching

Finally, we performed a propensity score matching analysis. To determine relevant covariates for calculating a propensity score, we relied on both theoretical considerations and the empirical findings from a logistic regression with each of the covariates in the prior regression model but using IB participation as the criterion variable, see Table 7. Intelligence, openness to experience, conscientiousness, sex, and number of books at home were predictors of IB enrolment, such that IB

students tended to have higher intelligence scores, have higher openness to experience and conscientiousness, were more likely to be female, and they tended to have more books in their household. See Figure 4 for the distribution of propensity scores based on the model presented in Table 7.

We then calculated a propensity score based on the covariates in Table 7. The motivation for using a propensity score matching approach was to approximate a randomised experiment scenario where the treatment (i.e., enrolled in MYP) and comparison (i.e., not enrolled in MYP) groups are similar on all relevant background characteristics (Stuart & Green, 2008). Specifically, an optimal full matching procedure was used, as this approach has been argued to be the best matching technique (Hansen, 2004). This approach uses all available people in the sample and groups them into matched sets (i.e., subclasses) based on their similarity across the covariates used for matching and each of the subclasses contains at least one 'treated' individual (IB) and one 'comparison' individual (non-IB). Weights are then assigned to each of the subclasses to 'equalise' the covariates across the treated and comparison groups, with more similar subclasses weighted more than less similar ones. If the matching procedure is successful, the covariates should no longer predict treatment group status.

In our case, the matching success was evaluated both in terms of the average differences in the covariates between the treatment and comparison groups before and after the matching procedure was applied, as well as by re-running the logistic regression presented in Table 7. As can be seen in Figure 5 below, the full matching procedure was highly successful and was able to reduce all covariate differences to an acceptable level, and this was particularly marked for the average differences in sex, intelligence, and openness to experience in the unmatched IB and non-IB samples, which was important given the findings of the initial logistic regression on IB participation. Table 8 presents the re-run logistic regression with the matching weights applied, showing that none of the covariates now predict IB MYP participation status. To evaluate the grade and country level comparisons, the same matching approach was carried out for these sub-samples. The figures presenting the outcomes of the matching procedures for the sub-samples are presented in Appendix 3. Given fewer cases to match on in these sub-samples, it is unsurprising that the matching tended to be less effective for them, although it was generally still of high quality. The matching for the Norwegian sub-sample was the exception to this, and so their country-level findings should be interpreted with a degree of caution.

Table 7 - Results of the logistic regression analysis on IB participation without matching weights applied

| Predictors	Odds Ratios	Std. Beta	Standardized CI	p
(Intercept)	0.27	1.21	0.03 – 42.12	0.452
Sex (Male)	0.09	0.09	0.06 – 0.13	**<0.001**
ICAR 16	1.13	1.58	1.29 – 1.94	**<0.001**
CRT (1)	1.08	1.08	0.68 – 1.73	0.742
CRT (2)	0.97	0.97	0.56 – 1.65	0.897
CRT (3)	0.7	0.7	0.40 – 1.21	0.200
Openness	1	1.72	1.35 – 2.20	**<0.001**
Conscientiousness	1	0.76	0.60 – 0.96	**0.021**
Extraversion	1	1.03	0.83 – 1.27	0.790
Agreeableness	1	1.04	0.83 – 1.32	0.722
Neuroticism	1	0.87	0.72 – 1.05	0.141
Age (14)	1.99	1.99	0.05 – 70.83	0.683
Age (15)	0.67	0.67	0.02 – 23.45	0.813
Age (16)	1.09	1.09	0.03 – 38.45	0.958
Age (17)	30.94	30.94	0.52 – 2368.41	0.092
Number of books (11-25)	1.24	1.24	0.53 – 2.97	0.619
Number of books (26-100)	2.15	2.15	1.02 – 4.71	**0.049**
Number of books (101-200)	2.65	2.65	1.24 – 5.89	**0.014**
Number of books (200+)	2.75	2.75	1.28 – 6.14	**0.011**
Observations	870			
R^2	0.369			
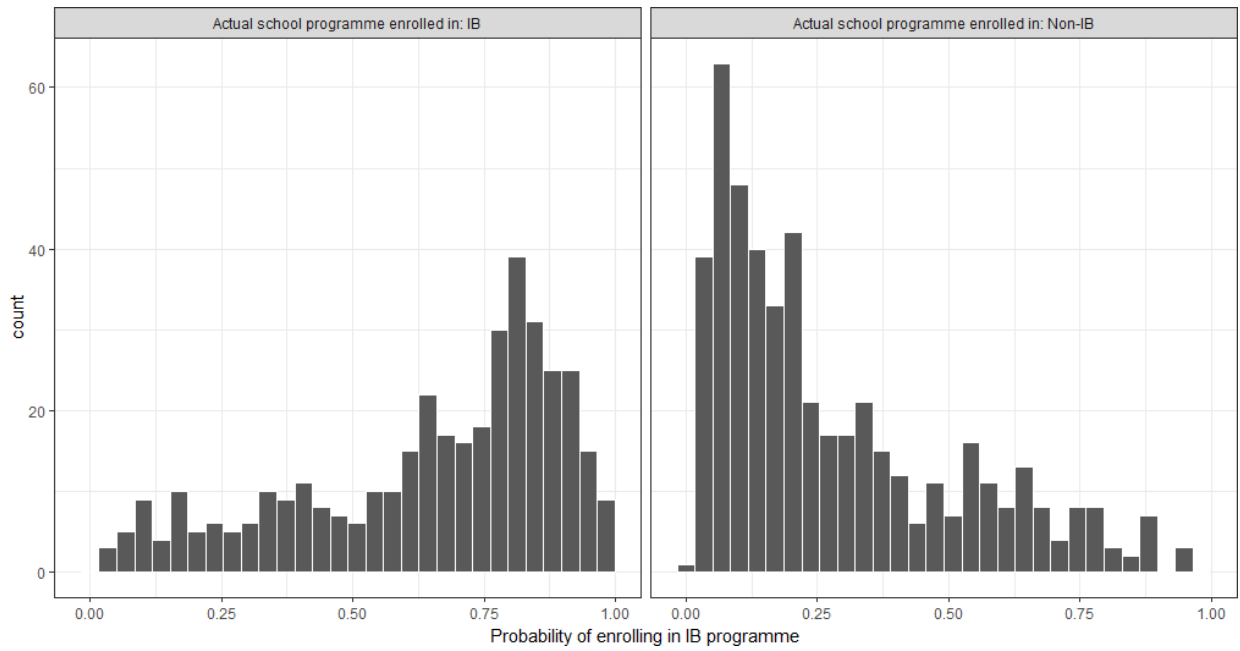
Figure 4. Distribution of propensity scores in the IB and non-IB samples
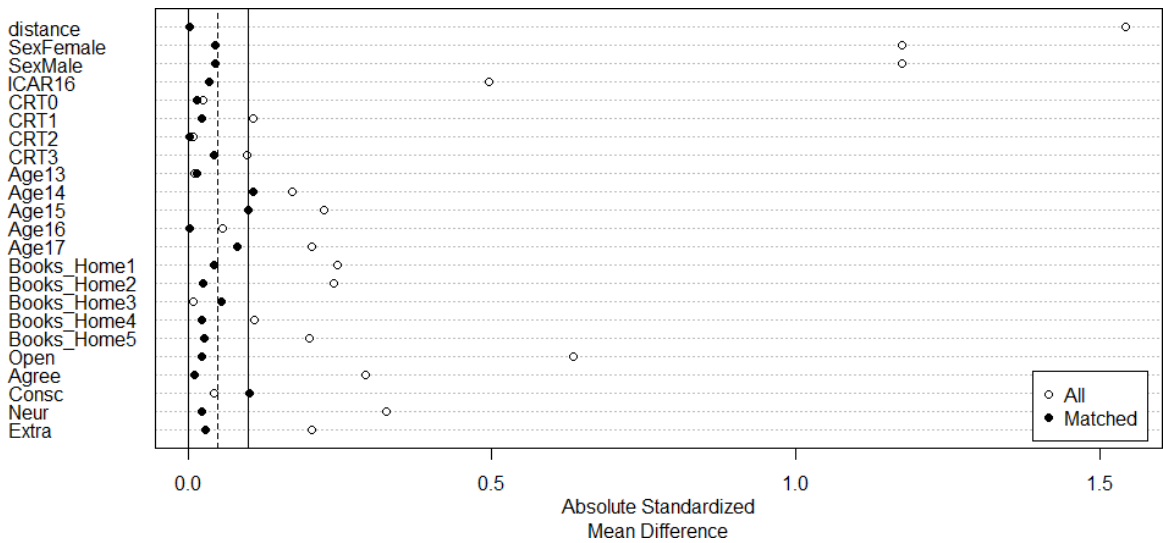
Figure 5. Results of the full matching procedure showing the differences in the covariates between the IB and non-IB groups before and after matching. The dashed line indicates perfect matching and the solid lines either side of it indicate the boundaries for high-quality matching.

Table 8 - Results of the logistic regression analysis on IB participation with matching weights applied

Predictors	Odds Ratios	Std. Beta	Standardized CI	p
(Intercept)	0.9	1.27	0.04 – 63.13	0.950
Sex (Male)	1.04	1.04	0.77 – 1.40	0.803
ICAR 16	1.01	1.04	0.88 – 1.22	0.673
CRT (1)	0.89	0.89	0.60 – 1.32	0.567
CRT (2)	0.97	0.97	0.63 – 1.48	0.887
CRT (3)	1.04	1.04	0.67 – 1.60	0.860
Openness	1	1.03	0.84 – 1.26	0.767
Conscientiousness	1	1.16	0.98 – 1.37	0.089
Extraversion	1	0.92	0.77 – 1.09	0.314
Agreeableness	1	0.97	0.81 – 1.16	0.747
Neuroticism	1	1.03	0.89 – 1.21	0.661
Age (14)	1	1	0.02 – 35.74	0.999
Age (15)	0.68	0.68	0.01 – 23.88	0.804
Age (16)	0.73	0.73	0.01 – 25.88	0.843
Age (17)	3.03	3.03	0.05 – 156.34	0.543
Number of books (11-25)	0.86	0.86	0.47 – 1.58	0.635
Number of books (26-100)	0.77	0.77	0.45 – 1.33	0.352
Number of books (101-200)	0.88	0.88	0.51 – 1.53	0.654
Number of books (200+)	0.89	0.89	0.51 – 1.55	0.676
Observations	870			
R^2	0.013			

The role of IB participation status on critical thinking was then investigated as per the recommendation of Ho et al (2007) by applying a regression analysis on the CCT scores including IB status and the matching covariates as predictors with the matching weights applied. Note that the results for the covariates will not be presented, as the matching weights confound their interpretation. Moreover, to establish the statistical significance of the estimates, cluster-robust standard errors were used to account for clustering in the matching subclasses (Austin & Stuart, 2017).

After matching the IB and non-IB samples on these various covariates, participation in the IB MYP was found to be a positive predictor of critical thinking ability (see Figure 6) and this effect was moderate in size, $\beta = 0.38$. Moreover, after calculating the cluster-robust standard error, this effect was found to be statistically significant, $t(868) = 5.09$, $p < .001$.
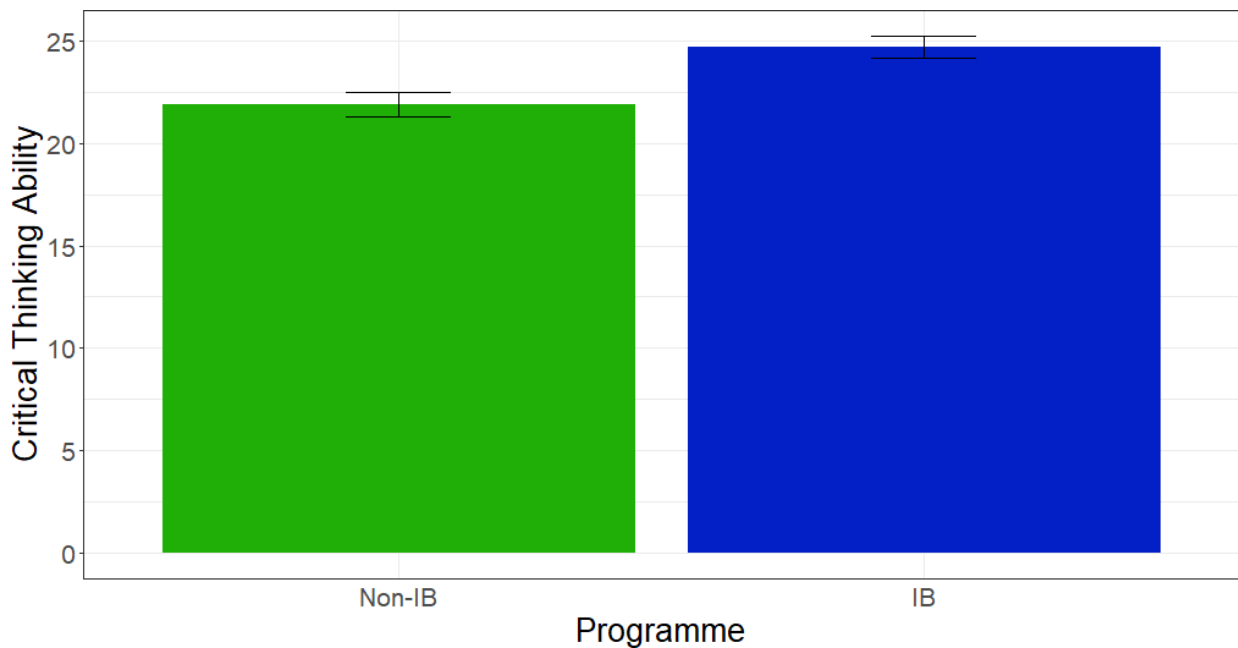

Figure 6. Weighted average of the critical thinking scores (plus and minus the weighted standard error of the average) as a function of IB MYP participation

4.2.6 Grade-level Comparisons

We examined whether the differences between IB and non-IB students differed as a function of grade level and the findings are illustrated in Figure 7. For Grade 9 students, IB status was again found to be a positive predictor of critical thinking and this effect was moderate in size, β = 0.37. Moreover, after calculating the cluster-robust standard error of the difference, this was found to be a statistically significant effect, $t(383) = 3.92$, $p < .001$. Similarly, for Grade 10 students, IB status was again found to be a positive predictor of critical thinking and this effect was moderate in size, β = 0.33. After calculating the cluster-robust standard error, this was found to be a statistically significant effect, $t(483) = 3.37$, $p < .001$. As can be seen in Figure 7, both the overall performance, and difference between IB and non-IB participants, were very similar between the Grades.
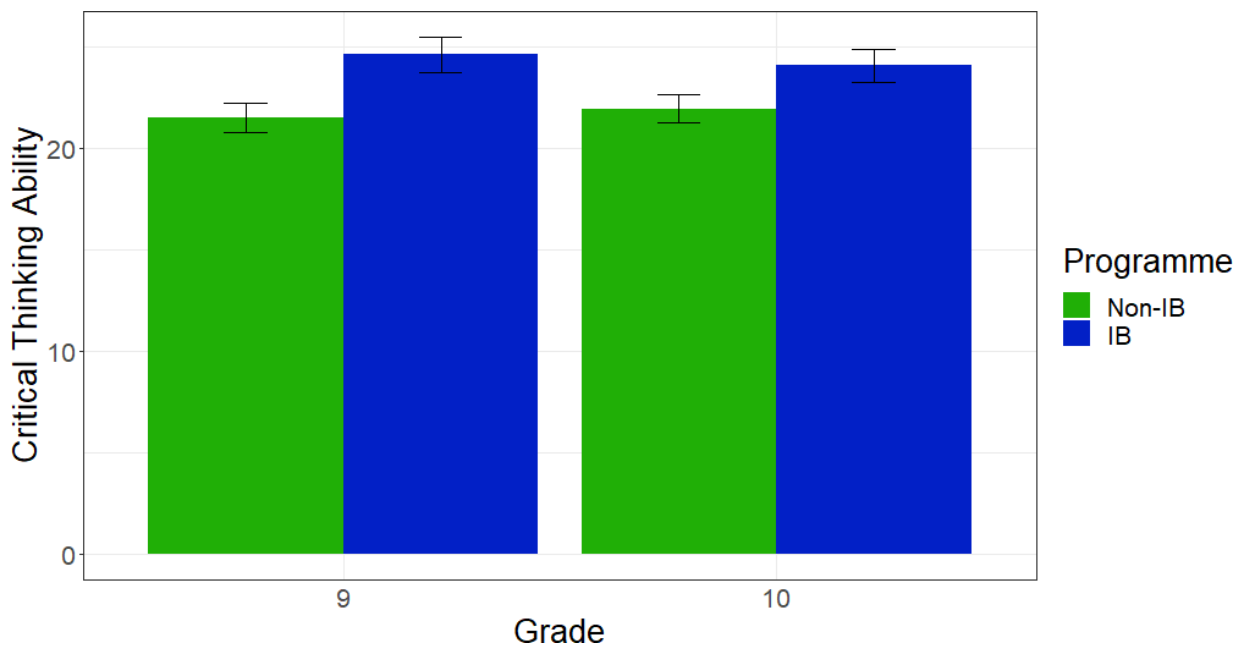
Figure 7. Weighted average critical thinking score as a function of Grade and IB MYP participation

4.2.7 Country-level Comparisons

Finally, we examined whether the differences between IB and non-IB students differed as a function of country. In Australia, IB status was again found to be a positive predictor of critical thinking and this effect was moderate in size, β = 0.30, and found to be statistically significant, $t(442) = 2.30$, $p < .05$. Similarly, in England, IB status was found to be a positive predictor of critical thinking and this effect was moderate to large in size, β = 0.62., and statistically significant, $t(221) = 5.48$, $p < .001$. In Norway, the effect of IB status was not statistically significant, although it negatively predicted the critical thinking score, β = -0.06, $t(201) = -0.31$, $p = .76$.

As can be seen in Figure 8, in general, the non-IB students' average performance was very similar across the three countries, but for IB MYP students, it was noticeably higher in England and particularly compared to the Norwegian matched sample average. Similarly, the difference between the IB and non-IB students' performances was noticeably larger for the English matched groups, as was also

reflected in the substantially larger effect size for this difference, compared to the Australian and particularly the Norwegian matched groups.
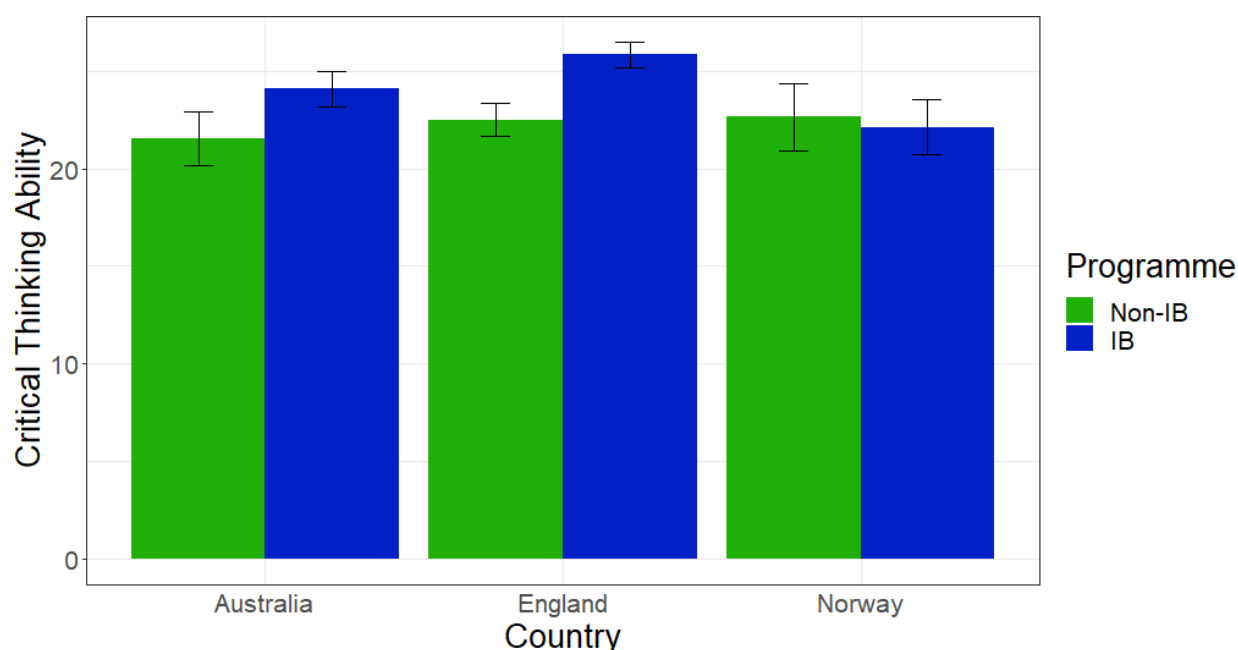
Figure 8. Weighted average critical thinking score as a function of country and IB MYP participation

4.3 Summary of findings

The quantitative findings broadly indicate that the students enrolled in the IB MYP have significantly higher levels of critical thinking ability than their non-IB peers. Importantly, this was observed even after several relevant covariates were accounted for through a series of regression analyses, and when the IB and non-IB groups were matched using propensity score matching. More granular analyses demonstrated that MYP students held an advantage in critical thinking across both grade levels, with a moderate effect size at both levels. Country level analyses showed that these findings were consistent for Australia (moderate effect size) and England (moderate to large effect size), but not for Norway, where IB status was a non-significant predictor. However, it is important to emphasise that this finding for Norway should be cautiously interpreted, as the matching procedure was not as effective for this sub-group compared to other groups.

5. Qualitative Analysis of MYP Students', Coordinators and Teachers' Experiences of Critical Thinking

5.1 Methodology

This section presents the details of the semi-structured interviews that were conducted with MYP students, teachers and coordinators in participating IB schools. The content of the interview protocols was based on three sources: literature review and the document analysis conducted in Phase 1, and feedback from IB teachers. The aim of the interviews was to gain more detailed insight into teachers'

and students' perceptions with respect to teaching, learning and assessment of critical thinking within the MYP. Since the interviews were conducted remotely, there was greater flexibility in the windows within which they were conducted. Interviews for Australia were conducted between November 2021 and February 2022 and interviews for England and Norway were conducted between March and June 2022. This flexibility was also required to accommodate institutional and infrastructure changes emerging from the COVID-19 restrictions (e.g., requirement for participants to be in different rooms during the interviews for those choosing to engage with the interview on the school site or the requirement to access a quiet and spacious room to accommodate social-distancing requirements). Due to policy mandates, some students were required to wear masks during the interview, and at times, it was difficult for the transcription to be recorded accurately. In these cases, these interview transcripts were checked for accuracy by a member of the research team as soon as possible after the interview session. Kvale and Brinkman (2015) highlighted that a semi-structured interview approach enables researchers to use prompts during the conversation to follow-up ideas that emerge from participants' responses. In framing the questions, we adopted the recommendations from Kvale (1996), including how to introduce the interview, follow up questions, probes and specifying. For safe-guarding purposes, a teacher (usually the MYP coordinator) was present in the room (physical or virtual) during the student interviews.

5.1.1 Piloting the instruments

Interview schedules were adapted from an instrument that was developed in a previous OUCEA study (Hopfenbeck et al., 2020). The adapted instruments were piloted with two former IB teachers who have experience with either teaching or coordinating the IB MYP. Both teachers were also invited to offer feedback on the students' interview schedule. Based on the feedback from both teachers in the pilot, the interview schedules were modified to incorporate clearer questions aimed at better addressing the research questions. For example, one of the questions initially asked about both community and personal projects. However, it is usually the case that some MYP schools, especially those offering all five years of the programme, only engage with the personal project. Therefore, questions related to these projects were reworded to better reflect this possibility. In addition, instead of two separate interview schedules for subject teachers and the programme coordinator, as was the case in the Hopfenbeck et al. (2020) study, the IB teachers advised that one schedule was sufficient for both audiences, especially given that the coordinator was often a subject teacher for one or more MYP courses, which was the case in the current study.

Interview schedules probed teachers about their perceptions of the MYP, and their respective courses especially in relation to strengthening students' critical thinking. Teachers were asked to elaborate on how they taught and assessed critical thinking within their respective subjects, including the types of feedback provided to students to enhance their critical thinking. Teachers were also asked about the challenges that they experience with teaching, learning and assessing critical thinking as well as what additional support they require to better facilitate students' critical thinking. Similarly, the student interview schedule probed students about their experience of being a MYP student and the ways in which they perceived the programme and subject areas as facilitating their critical thinking. In addition, students were asked about their experience with their community and/or personal project. Both teachers and students were asked about their experience with the MYP eAssessment, where applicable.

5.1.2 Participants

In total, across Australia, England and Norway, 91 participants were interviewed across 22 semi-structured interview sessions. Of these, 20 were group interviews. To accommodate timetabling requirements, a separate individual interview was conducted with an MYP Coordinator in one of the participating schools in England. Moreover, in one of the Norwegian schools, only the MYP Coordinator was able to participate because of staff unavailability related to COVID-19 (see Table 9). To widen participation, interview protocols and sessions were designed in a way that would not last longer than 30 to 40 minutes; however, some students and teachers made themselves available for a longer duration if time permitted. A researcher remotely conducted the interviews within school hours and times were organised by the MYP Coordinator or the school's Headmaster. Prior to the interview session, participants consented to their responses being recorded and transcribed in real-time through Microsoft Teams; this aligns with data protection laws, including the General Data Protection Regulation (GDPR).

Table 9 - Overview of participants in interviews by country and schools

School location	Teachers	Duration	Students	Duration	Total number of participants	Total number of interviews with schools
1.Australia	5	32:01	4	26:55	9	2
2.Australia	2	46:48	4	23:47	6	2
3.Norway	7	40:57	4	13:11	11	2
4.Norway	4	47:00	7	22:42 22:14	11	3*
5.England	5	31:41 41:11	6	28:59	11	3*
6.England	4	42:09	4	40:48	8	2
7.England	9	38:02	2	22:17	11	2
8.Norway**	3	1:07:32	4	21:25	7	2
9.Norway	1	27:07	7	23:02	8	2
10.England	5	55:09	4	21:50	9	2
Total	**45**	**42:53**	**46**	**24:06**	**91**	**22**

*An additional group and individual interview were conducted in Schools 3 and 5 with students and teachers (MYP Coordinator), respectively, to accommodate timetable scheduling requirements; ** registered for the MYP eAssessment

5.1.2.1 Teacher interviews

Across the three countries, there were 45 teachers (including MYP coordinators) who participated in the interview sessions. Based on the findings from the document analysis (See Section 3.2.1.1 - Point 'd'), we ensured that as a minimum criterion, teachers from the following subjects were represented across the interview sessions: Individuals and Societies, Science and Mathematics; these subject areas were identified as instrumental in facilitating critical thinking in the MYP.

In Australia, we conducted two group interviews. In the first school, we interviewed the MYP Coordinator, who also taught Mathematics, and four MYP subject teachers (two females and three males): an Arts and Design teacher, an English teacher, an Individuals and Societies teacher and a science teacher. The interview was approximately 32 minutes long. In the second group interview, we interviewed the MYP Coordinator, who was also the Science subject teacher and the second teacher taught Interdisciplinary Studies (two females). The interview was approximately 46 minutes.

In England, we conducted four group interviews with teachers (including MYP coordinators). One individual interview was conducted with an MYP Coordinator due to timetabling restrictions. In the first one, we interviewed four teachers (two females and two males) who taught a range of MYP subjects: Science and Biology; Art and Design, Social Studies, Geography, and Language and Literature. The interview lasted for approximately 31 minutes. In a separate, individual interview at this first school, the MYP coordinator (male), who also taught Social Studies, was interviewed and the session lasted for approximately 41 minutes. In the second group interview, we interviewed the MYP coordinator, who also taught English Language Acquisition, and three teachers (all females) for just over 40 minutes. The teachers taught either Arts and Design or Language and Literature. In the third group interview, we interviewed the MYP coordinator, who also taught English Language and Literature, and eight teachers (seven females and two males), who taught a range of MYP subjects: Design, English, Science, Language and Literature, Drama and Mathematics. The interview lasted for approximately 38 minutes. Finally, in the fourth group interview, we interviewed the MYP coordinator, who also taught Science, and four teachers, who taught English, Design, History and Humanities, Science and Environmental Science (three females and two males) for just under an hour.

In Norway, we conducted three group interviews and one individual interview with a single MYP coordinator. In the first school, we interviewed the MYP Coordinator, who also taught Design, and six teachers (four females and three males) who taught a range of MYP subjects: Performing Arts and Design, English Acquisition, Language Acquisition (Spanish), Humanities, Mathematics, and Norwegian Language and Literatures. The interview lasted for approximately 40 minutes. In the second group interview, we interviewed the MYP coordinator, who also taught Design, and three teachers (three males and one female), who taught Individuals and Societies, English and Science, for over 40 minutes. In the third group interview, we interviewed the MYP coordinator, who also taught Individuals and Societies, and two teachers (one female and two males), who taught Performing Arts and English Language and Individuals and Societies. The interview lasted for a little over one hour. Finally, in the fourth interview, we individually interviewed the MYP coordinator (male), who also taught Individuals and Societies, and this session lasted for approximately 27 minutes.

5.1.2.2 Student interviews

Across the three countries, there were 46 students who participated in the interview sessions. In Australia, a total of eight students were interviewed in two participating schools. The first interview involved 4 students (two MYP 4 and two MYP 5) of mixed genders and lasted for around 26 minutes, while the second interview included 4 students (two MYP 4 and two MYP 5), all female, as this was a single-sex school, and lasted just under 24 minutes.

In England, a total of 16 students were interviewed in four participating schools. The first interview included 6 students (three MYP 4 and three MYP 5), all female, as this was a single-sex school, and lasted just under 29 minutes. The second interview involved 4 students (two MYP 4 and two MYP 5) of mixed genders and lasted for around 40 minutes. The third interview involved two students (two MYP 5 males) and lasted for around 22 minutes. The final interview lasted for just under 22 minutes and involved 4 students (two MYP 4 and two MYP 5) of mixed genders.

In Norway, a total of 22 students were interviewed in four participating schools. The first interview included 4 students (two MYP 4 and two MYP 5) of mixed genders and lasted for approximately 13 minutes. In the second school, two separate group interviews were conducted: one with three students (MYP 4) and the other with four students (MYP 5), each with mixed gender and lasting for approximately 22 minutes. The third interview involved four students (all MYP 5), who were all female,

and lasted for a little over 20 minutes. The final interview last for a little over 23 minutes and involved 7 students (six MYP 4 and one MYP 5) of mixed genders.

5.1.3 Procedure

A research team member coded two interview transcripts before sharing the coding details with a second researcher who then coded the same interviews to check for consistency before coding the final interviews. The first researcher analysed and categorised the interviews to address the fourth research question based on the emerging themes and key findings for both the teachers' and students' interviews. In the next section, we present emergent themes supported with examples from the interviews. We report on students' experiences of the MYP and their perceived development of critical thinking throughout the programme. We also outline coordinators and teachers' experiences of teaching critical thinking within a variety of courses, and report on challenges experienced with facilitating critical thinking as well as any professional development requirements that would assist teachers in teaching and assessing critical thinking in their respective domains. In addition, we present details of students' and teachers' views of the quality and extent of support they received in relation to developing critical thinking throughout the programme. Interviews were coding deductively using the broad themes identified from the document analysis (see Appendix 4): *principled action; understanding the nature of language; and assessment and accountability* (see Section 3, Table 2). Inductive coding was also employed to accommodate the inclusion of unexpected findings (Thomas, 2006). The interviews followed semi-structured interview guidelines where researchers prompted coordinators, teachers and students to clarify their responses further or generate specific examples to better understand the participants perspectives. Note that only one school (see Table 9) was registered for the MYP eAssessment and as such questions related to the eAssessment was only directed to this specific school. Interviews were conducted and transcribed remotely through Microsoft Teams and edited for accuracy before being coded and analysed through NVivo – Release 1.2 (QSR International Pty Ltd, 2020).

5.2 Results: Key findings and emerging themes from students' perspective

In the following section, we firstly provide an overview of students' perception of critical thinking before presenting details related to their experience of critical thinking development in the MYP, organised under 3 main themes: (1) Self-directed learning; (2) Transfer of thinking skills; and (3) Distinctive features of Individuals and Societies.

How do students define critical thinking?

"In the previous schools I've been to, it [critical thinking] wasn't as emphasized as it is here [in the MYP]. They [MYP teachers] lay like a really good foundation for every subject that you're in. [It][critical thinking] means having a kind of a better chance at doing anything that you would want."

(Student 45, MYP 4, England)

To establish students' perception of critical thinking, they were asked to define this construct. Students elaborated on both the dispositional and skill components of critical thinking. From a dispositional viewpoint, a MYP 4 student emphasised that critical thinking is not only a skill but also how one might approach a situation: "*I personally think that critical thinking is not just like a form of thinking. I think it's the way you actually work*" (Student 15, MYP 4, Norway). This involves the emergence of a critical spirit through "*considering your own arguments … [and] also taking an*

objective stance and simultaneously questioning yourself" (Student 36, MYP 5, Norway). This also involves questioning others and their approaches, which facilitates finding *"different methods of finding an answer, which is, I think, a big part of critical thinking and developing critical thinking"* (Student 26, MYP 4, England). Together, these perspectives connect with students' emphasis on the important association between critical thinking and creative problem solving:

> I think critical thinking involves a lot of problem solving and how to solve these problems in different [ways] ... thinking outside the box, [and] have different approaches to solving a problem no matter what. Like, if it's a math problem or a problem about like friendship or whatever, I don't know just any problem like that which I think is a big part of critical thinking (Student 26, MYP 4, England).

> It's when you receive a design problem or a problem that you have to tackle, you have to think in ways that you normally wouldn't (Student 15, MYP 4, Norway).

> … so critical [thinking] and creative [thinking] just to come up with ideas and, yeah, just think of new ways to solve problems ... especially with technology and COVID (Student 7, MYP 5, Australia).

Critical thinking was also viewed as being open to different possibilities and engaging with information from different perspectives, including those of their peers:

> … then you often talk to your peers about it [problem], and they might have like looked at it in a different way or like found out something else about it. And then when you communicate that to them, you kind of, you learn more by going off on your own and like sharing like what you found with others than just like being told what it is (Student 1, MYP 5, Australia).

> [It's] like even like asking your peers, like oh, like what did you write then? And then you may have two different things, but then they [are] linked together. So, you can write a final paragraph about how like everything comes together (Student 23, MYP 5, England).

> So, you can move from different points of views and see how the issue you're trying to solve is really put together. So critical thinking allows this, like well, viewing the same problem from different perspectives and thereby sort of creating better arguments, better solutions and communicating with everyone better (Student 36, MYP 5, Norway).

"Thinking critically [means] … just being more open-minded" (Student 29, MYP 5, England). Similarly, Student 24 (MYP 5, England) noted the importance of considering your own perspective in a way that enables you to invite new viewpoints: *"I would say it's about like open-mindness and maybe questioning what you already know and like being open to like, yeah, just different perspectives."* Through the process of questioning and communicating with others, more robust solutions and arguments can be generated to *"draw your own conclusions"* (Student 5, MYP 4, Australia), or arrive at *"a reasonable conclusion which can be backed by evidence and logic"* (Student 30, MYP 5, England).

Several students also emphasised the skill component of critical thinking, particularly with respect to the extension and application of one's thinking, *"it's not black and white [thinking]"* (Student 3, MYP 5, England). Instead, critical thinking involves the extension of information, especially within unfamiliar and real-life contexts:

> Well, critical thinking is when you, when you like, apply what you're learning or thinking about in like different areas as well ... You can, I don't know, extend it, extend your thinking (Student 3, MYP 5, Australia).

And I think that critical thinking is also a lot about, like placing the knowledge that you already have into other contexts, which you may not have known before, like knowing when to apply the knowledge instead of just knowing it (Student 17, MYP 5, Norway).

I'd say critical thinking is like using the knowledge you know in like a different aspect like say in the real world, so like you were using like a math problem when trying to figure out how much something costs when you're at the supermarket or something. Just applying what you know in like real-life aspects (Student 2, MYP 4, Australia).

Yeah, I think essentially, it's thinking you know beyond … not putting a limit to your knowledge (Student 22, MYP 5, England).

Students also perceived that making connections between information was central to critical thinking. The nature of the links could be between different viewpoints or concepts that one has previously learnt, the aim of which is often to obtain a better understanding of the problem or situation:

What I think of critical thinking is that we look at, let's say you have like Math, for example, and you have to learn the concept as like maybe, like an example like Y= A+Bx. You have to learn each individual part and then form a connection between them. You have to think in a logical way to put those pieces together. So that's what I sort of think about critical thinking. You have to put pieces together to form one big understanding. And to think critically and make sure it's all in a logical and clear way (Student 13, MYP 4, Norway).

I think in critical thinking, it's very important to make links, you know, to link one idea to the other. It's not one's wrong and one's right. You just have to find the relationship between them (Student 25, MYP 4, England).

... you've got to learn like each concept and then form a relation between them. So yeah, that's basically critical thinking in a nutshell you could say (Student 14, MYP 4, Norway).

5.2.1 Theme 1 – Self-directed learning

"It feels like I'm taking the initiative to learn"
(Student 1, MYP 5, Australia)

Across all students' group interviews (n =11), the importance of ownership over their learning experiences was emphasised by students as a primary contributor to their critical thinking development. This enabled students to develop independence of thought and arrive at conclusions after they have engaged in a research-oriented process to determine the best pathway for their own learning. Students noted that the experience of having "free will" in learning and that teachers did not "restrict" us "boosts [their] thinking" as you start to "think about yourself and your identity" (Student 3, MYP 5, Australia). It was further noted that overtime, this self-directed experience strengthens critical thinking because of the requirement to become managers of their own learning experience:

Most of our INS [Individual and Societies] tasks have been very open ended, which means that you sort of have to go out and find information you need yourself, which then allows us to be sort of in control of what we do, which then I guess we can relate to critical thinking, where you have to sort of make up your mind about what you want to include and what you think is right (Student 18, MYP 5, Norway).

I think it [MYP] helps develop critical thinking skills because there's a lot of like independence for research and like figuring things out for ourselves. And I think that develops skills that will be used later in life … Since it's a lot of independent work, I think that it gives us a chance to review all the skills that

we have developed from classes previously and then put it into like to test … so, I think that will help develop our critical thinking skills (Student 33, MYP 5, Norway).

I think critical thinking is something that builds over time. So, I think in the MYP because we're encouraged to, I guess be more independent and manage ourselves a bit more than I guess other systems [curricula] would. I think that allows us to be able to make decisions in a short amount of time because of the skills you've built up before (Student 44, MYP 5, England).

Although students were engaged in independent learning, which helped to facilitate critical thinking, they emphasised that this was conducted within a scaffolded context. Successful engagement with self-directed experience was improved through strengthening students' background knowledge at two levels. The first level was strengthening their declarative knowledge, including having exposure to a wealth of knowledge from the diverse number of MYP subjects: "the content and what we're learning helps to give ideas" (Student 7, MYP 5, Australia). Students noted that their teachers ensured that they understood the context and big concepts within their learning, from having a better understanding of why "*more people voted like that [in support of Brexit]*" (Student 26, MYP 4, England), to gaining "*background information about the civil rights movements that were happening at the same time as rap*" (Student 33, MYP 5, Norway) to understanding how the "*Ukraine War … related to like World War I*" (Student 21, MYP 4, England). Generally, Student 27 explained that teachers engaged in these exercises with students as the aim was for the students to gain details on "*where you are in terms of your learning and how much you're understanding*" (MYP 4, England). Secondly, students thinking processes within their self-directed experience was also strengthened through the development of their procedural knowledge, through engaging in brainstorming sessions, the use of checklists and action plans, and community projects, all of which were instrumental in facilitating their independence in thinking:

We made our own action plan ... We choose our own way to research, and we also had to choose the ATL [approaches to learning] skills we wanted to focus on. So, I focused on research skills and thinking skills (Student 17, MYP 5, Norway).

So, something I find helpful is that it [MYP] just like, it gives you time to actually take a step up to it. So, for example, you have Grade 6 and Grade 7 … because they give like Service in Action which is just like a volunteering set you need to do for a short term and long term and then like those are just like the practice tests and then the Community project, say would be like the actual like test where you actually end up put[ting] all those stuff which you have learned in place (Student 30, MYP 5, England).

What the school is doing now is this is that they're like helping us brainstorm like ideas and questions for ... like what you're trying to figure out, for like what the personal project is. So, like, they want us to, like, make research questions, which can be very helpful (Student 11, MYP 4, Norway).

Of note is that several students credited the explicitness in expectations (e.g., through feedback) as one of the key success criteria for the role of self-directed learning in strengthening their critical thinking. Several students contextualised this to their year-long assessment – the MYP personal project. As one of the hallmarks of the MYP experience, the year-long personal project is underpinned by an inquiry-based approach and requires students to engage in an independent, critical research processes. Students are expected to submit drafts of work to receive feedback in preparation for their final submission. This involved consistent interaction and feedback with personal supervisors (student to teacher feedback) or from more knowledgeable peers, who have previously completed the final MYP project (peer to peer feedback):

...like handing in drafts to teachers and getting the feedback back on that, and then like analyzing what they're saying and trying to improve your own work, I think you have to use some aspects of critical thinking (Student 7, MYP 5, Australia).

We're ... right now, we've submitted the report draft and we're currently getting feedback from our personal supervisors ... we're all assigned one teacher and they help us through the project [and] through the process ... I [also] think it really helped when I was doing the Community project (Student 29, MYP 5, England).

They [MYP 5 students who have completed the Personal Project] give us advice on what they struggled with or what they found was important, so we could know what to focus on next year (Student 33, MYP 5, Norway).

Students further shared that they were also encouraged to engage in self-feedback: "*We are really encouraged before handing in any type of assignment to read over the criteria to tick it off to see am I really explaining it? Could I develop on this?*" (Student 24, MYP 4, England). This was also facilitated by developing their own guidelines for success and associated rubrics that follow the MYP criteria structure, and predict their grades: "*where we actually, decided our own criteria and our own like strands, like what we should be assessed on*" (Student 17, MYP 5, Norway). In particular, feedback was a reflective process in which students were required to document their learning journey in a detailed manner, with a view towards understanding their strengths, but also areas for improvement, in the development of their critical thinking:

The whole entire project [MYP Personal Project], I think it's like a whole critical thinking project because we haven't at all been told what to do. We've just been told we need to like pick something to learn and we need to make like a product out of it, and we were told we need to like document our journey throughout the project (Student 1, MYP 5, Australia).

So, what you do is you set yourself these categories for your final product and within those categories you have specific, I guess, traits you want your final like project to have. And at the end you kind of have to look back and while you're making it as well, make sure that you're meeting those specifications (Student 9, MYP 4, Norway).

I think that having that opportunity to reflect on what you've done ... I think that aided me in developing my critical thinking because, I mean, obviously it was a difficult project, but with that [reflecting using assessment criterion] it made it worth it (Student 44, MYP 5, England).

... you have to use like a certain level of critical thinking to figure out really what is needed and what is not in this rubric, because there are a lot of things that we could be assessed on, but we actually have to think about like what would make the most sense with the current summative and how we could most adequately display our knowledge in the subject (Student 16, MYP 5, Norway).

However, other students mentioned that within the MYP context, self-directed learning could be viewed as challenging:

What they [the teachers] want you to do is very clear, but what the steps needed to do what they want you to do would not be so clear (Student 31, MYP 5, England).

No, for some units like it is quite clear what they want you to develop. For example, if it's a unit on like ideologies of a specific like of a specific country and that then it's clear that they want us to develop our like knowledge skills, our critical thinking skills, and our like Internet skills like our source finding and that. But yeah, sometimes it's just not that clear (Student 30, MYP 5, England).

5.2.2 Theme 2 - Transfer of thinking skills

I really found that like, with the regular [non-IB school] ... you learn the formulas; you apply the formulas on a test and then you forget them like the week after. But here [in the IB MYP], you can't really forget them [be]'cause you kind of like link them to so many different things.

(Student 20, MYP 4, England)

Transfer of thinking skills across different subjects: Interdisciplinary learning

Students were explicit about their capacity to transfer thinking across different MYP subjects and the role of transfer in strengthening their critical thinking. Student 15 (MYP 4, Norway) expressed that: *"the MYP has a really great concept which I personally adore, called interdisciplinary units or IDU's, and these basically merge together 2 subjects and allow us to think about how different subjects that are obscure, completely different, can connect and like amalgamate into one subject."* Across each country, students emphasied the role of the IDU's in facilitating this transfer of thinking, and importantly, how this strengthened critical thinking. As illustrated in the quotes below, IDU combinations that include Math and Science are primarily data-focused, whereas combinations that include Individuals and Societies and Geography are focused more on perspective-taking:

> So, I wanted to mention about how we did an interdisciplinary unit between Humanities and Math ... we had to learn about statistics and population in Humanities, and then we got to apply that knowledge by actually using, like, Statistics and Math. And I think that it really helped develop critical thinking because, like, the Humanities aspect of it definitely helped me to get a grasp of the more mathematical aspect of it, and it definitely made me like question the data because, while in Math you have the data, in Humanities, you have to actually check if the data makes sense and if it's like current and updated with what's actually going on (Student 16, MYP 5, Norway).

> In HASS [Humanities and Social Sciences] or Geography, sometimes it will go into Science. So, in science you've done like the science behind it. But then in Geography you learn like how it impacts people ... so, I guess that sparks your thinking (Student 3, MYP 5, Australia).

> So, in Grade 9 you do kind of like a science course that's not specific. You do Biology, Environmental [Science] and Physics and Chemistry, and I think in every single one of those subjects that we've done, especially in Environmental Science ... we don't have to think critically just about the way we collect the data and what it says. We also think critically about how like theories have been [developed]. Like, for example, we were thinking about the Theory of Evolution and natural selection. We think there's room to criticize these theories and kind of think about if they have holes in them and think about possible ways that they could be improved (Student 45, MYP 4, England).

> I think that the class Individuals and Societies really reminds you that ... there are both sides to every single case and every single problem in this world. I mean with the critical thinking it's possible to view different viewpoints on every issue, whatever you're going to solve really. Right. So of course, it can be applied to other subjects (Student 36, MYP 5, Norway).

Transfer of thinking skills to authentic contexts: Real-world application

Students shared several examples of how transferring their thinking to authentic contexts contributed to boosting their thinking skills. They emphasised the importance and outcome of applying their thinking to real-life situations: "*I think the biggest advantage with the Middle Years Programme ... is that it puts you in a very realistic situation and always somehow manages to challenge your view and your way of arguing for or against things really*" (Student 36, MYP 5, Norway). Interestingly within the backdrop of applying thinking to authentic, real-life contexts, the majority of examples emerged from

the domain of Mathematics, or subjects that were closely related to this domain (e.g., Coding), perhaps because in the MYP Math unit: "*you have like a criterion on a real-life application*" (Student 36, MYP 5, Norway) and more specifically, this relates to "*Criterion D: real life contexts, such as finding barcodes*" (Student 31, MYP 5, England). What was clear across the students' responses was that within the context of transfer to real-life situations, there is an opportunity to "*use critical thinking skills to apply mathematics and to real life situations*" (Student 44, MYP 5, England). Interestingly, the mathematical examples focused more on the skill component of critical thinking whereas non-mathematical examples aligned more with the dispositional component of critical thinking:

> We did robotics in coding ... so, like maybe thinking up something to give to someone else which could be used for someone necessary that like can't walk or something like that. And like the teacher helped by, like giving us examples of like, say, [real] world problems that could be fixed by using machinery like that (Student 2, MYP 4, Australia).

> In Maths, … our teachers often give us like examples that would be set in the real world so we could learn how to apply the formulas in the real world and not in just a question that would be like "Use Pythagoras theorem to find A, B and C" or whatever (Student 26, MYP 4, England).

> But I do take a lot of knowledge, especially from what we call Geography in like, just like understanding how people work and communicate in the real world. So, I think those two subjects [Science and Math] are like applying real world concepts to our learning (Student 8, MYP 5, Australia).

> In Math, we receive a lot of real-life applications problems where we have to apply the things we learn in school to real-life applications, and that really makes us think a lot (Student 17, MYP 5, Norway).

> In Maths, we have this project where we had to build a castle like a model of the castle. But one of the most important sections of it was discussing whether our results make sense and if we were to actually build this building in the real world, would it make sense? And it's really challenging, even your own project, like your own creation and like finding its flaws and finding how we can like better that (Student 25, MYP 4, England).

> I was participating in something called MUN or Model United Nations, right? It's like model. It's like United Nations, right? But it's not real ... like everyone gets to be like delegates of sort of their own presented country rights. So, and what you're doing then is really, you're given a country and pretty much you have to consider the standpoints on the world issue in their shoes really (Student 36, MYP 5, Norway).

> I think for example, in Geography, we're doing Urban Environment, and we were looking at a case study in Mumbai and it was through The Sun [newspaper in UK]. And I think [that] that one especially is a very critical thinking one because there was no direct answer and there were so many factors you had to think about. You had to think about the different perspectives (Student 22, MYP 5, England).

5.2.3 Theme 3 – Distinctive features of Individuals and Societies

As demonstrated in the previous two themes, students provided examples from a range of subjects, including the Sciences, Design and Art, to highlight their experience of thinking within the MYP. These responses were provided when speaking more broadly about how the overall experience within the MYP facilitates their critical thinking. However, it was the case that in the context of *both* teaching and assessment, and when asked to generate more specific examples of a subject of their choice that they perceived as facilitating critical thinking, students considered that Individuals and Societies provided a structured, consistent and more explicit environment that advanced their critical thinking, with the general understanding among students that: "*Every assessment, we are graded on critical thinking in INS [Individuals and Societies]*" (Student 39, MYP 4, Norway). In addition, the INS course thrives within

the MYP environment because it offers students the capacity to engage with diversity by genuinely connecting the individual student to a diverse society, one that is filled with differing perspectives and strengthens critical thinking by enabling students to become more open-minded:

> I think with this [IB] programme, you become a much more knowledgeable and open-minded person because seeing all the diversity that we have within our community and the school, and this helps us. Yes, our work is individual but at the same time we're connecting with other people [connecting the Individual with the Society] that are completely different with a completely different background from us and that really makes us open our minds because we're not only looking at one specific [or] one aspect of something. We always tend to look at more open-minded views and see things with a different perspective. (Student 29, MYP 5, England).

Across the school contexts represented in this study, in addition to using the term "Individuals and Societies", INS is sometimes referred to as HASS (Humanities and Social Sciences in Australia) or the Humanities, which often includes History, Social Studies, Geography, Politics and/or Commerce in England and Norway. Despite the name variations, the content of the course remains in alignment with the MYP Individuals and Societies curriculum. At a more granular level, the findings showed that when students referred to INS, most students expressed that the nature of the activities in their History classes (see Figure 9), a component of the INS unit, were most instrumental in strengthening their critical thinking.

Figure 9. Word cloud illustrating student's perception of a specific subject (History) that fostered their critical thinking

In addition, examining different perspectives within a historical framework permitted students to: "*look at what is happening around and what has happened in the past to be able to look in the future and how we as students can make a change*" (Student 28, MYP 5, England). Consequently, Student 2 (MYP 4, Australia) noted that exploring thinking within a historical perspective: "*would make my critical thinking better because I could make connections between 2 and 2 and … like, let's us add our own opinion to it. And then everyone gets to like, share their ideas*" (Student 2, MYP 4, Australia). Indeed, there were a variety of more specific activities that were employed within the INS-History classes that encouraged students to use their critical thinking, including collaborating with peers on consequential events (e.g., World Wars), engaging in metacognitive activities by exploring student's own knowledge, and inclusive discussions about various ideologies from different religions and cultural perspectives:

… [In] one HASS [Humanities and Social Sciences] lesson, the class kind of got together and we wrote down like as if we were the League of Nations or the United Nations. And like what we would do in the position, like after World War II. I mean, after World War I, and like before World War II. We like to see other people's opinions and like [to] collaborate with the rest of the class (Student 3, MYP 5, Australia).

So, I think not only that but also all the reflecting and stuff like we've done with like History ... we've reflected on like our knowledge and like what we've learned (Student 6, MYP 4, Australia).

… INS, Individuals and Societies, in the historical branch. Yeah. Because, you know, we do ideology, so we discussed the ideologies ... particularly in Britain and learning what my ideology is based on my beliefs through, you know, inclusive discussion and what we believe in. I think it's actually helped me shape my views and then use my views for, you know, certain out of school things (Student 31, MYP 5, England).

… in INS [Individuals and Societies], we just did, the ideology of the religions, where we had to see, at least I had to, the different points of views ... I did Zionism. So, I saw the point of view from a Zionist and an anti-Zionist or people against it. So, I had to learn about both views (Student 35, MYP 5, Norway).

I think it [INS] allows us to learn a lot more about like think about the world around us and our culture as well as our history. And I think that's really important going forward in the future because you know the like, the history is only going to get farther away. So, we need to make sure that we remember what happened and why it happened and to not repeat the same mistakes that were made in the past. (Student 16, MYP 5, Norway).

Importantly, the INS offered students the opportunity to learn a specific strategy called source analysis, which was embedded throughout all INS activities, and students elaborated on how this strategy contributed to their critical thinking. Broadly, by engaging in source analysis, this strategy enabled them to evaluate and analyse the trustworthiness of information with which they engage, both in online and offline contexts. In this way, there is the opportunity to connect "media literacy and critical thinking" to decide whether sources are "reliable" and "valid" (Student 9, MYP 5, Norway). It was further explained that source analysis was a central part of MYP assessments: "*We do a lot of it in History, like most of our assessment tasks have at least … like one source and we need to analyze it*" (Student 8, MYP 5, Australia) and "*I think [in the] History elective … what we do is a lot of source analysis in the assessments*" (Student 7, MYP 5, Australia). Students expressed that the source analysis provides clarity about what the MYP would like students to develop, and they are provided with concrete strategies, including the OPVL approach, when engaging with a source:

So, what we use is OPVL, which is origins, purpose, values and limitations and we have to like analyze the source through each of those, like looking at like why it's helpful for like for a Historian and why it might not be helpful, like if it's unreliable or something (Student 5, MYP 4, Australia).

For some units, like it is quite clear what they want you to develop. For example, if it's a unit on like ideologies of a specific like of a specific country and that, then it's clear that they want us to develop ... our critical thinking skills, and our like Internet skills like our source finding and that (Student 30, MYP 5, England).

I think that a lot of the time there's a huge emphasis [in INS] on thinking critically about sources that we find both like primary sources if we're doing our own research where we find a primary source and then secondary sources as well. We always have to analyze our sources and think critically about like, is this something that we can confidently base our like findings off of? (Student 45, MYP 4, England).

I also think that Humanities has also improved our research skills ... I've really, you know, explored different ways of researching. Because it's not only like Google search that can help you. It's maybe like

YouTube videos or books, and, you know other, yeah, other forms of information. Yeah, other forms of sources (Student 17, MYP 5, Norway).

Importantly, source analysis was employed in a variety of domains by students. For example, it enabled students to read more critically by considering the deeper meaning and intentions of the author's voice: "*we found some articles and read through them and tried to really understand not just the surface level knowledge, but really why the author was writing this. So, like a deeper level to the meaning of the article*" (Student 7, MYP 5, Australia). Moreover, Student 15 (MYP 4, Norway) noted that source analysis strategies were useful for detecting "*fake news*" because "*we learn all about how to be critical online and how to be sort of cautious but then also be able to use sort of your own knowledge to be able to make a good judgment from the stuff you read online and not to necessarily believe everything you read.*" In addition to critical reading, the remit of source analysis was also important in facilitating a student's capacity to engage in critical writing, critical speaking and critical listening, all aimed at strengthening student's critical thinking:

> … when we have to write essays about like anything, really, but maybe even like specifically books, you have to choose something that you're for [in agreement with] ... but it's always important to mention the opposing side and the opposite of what you think is correct. So, I think that's also a way we [have] developed the critical thinking skills of like different perspectives in writing essays (Student 32, MYP 5, Norway).

> We talk a lot in our lessons, and we're really pushed to like voice our opinions and what we think about specific matters. And I think that's what makes the MYP like different from maybe a lot of systems [curricula] because we're allowed to voice [our opinions] ... as long as you justify your answer and that's what critical thinking is, you can make a conclusion about almost anything (Student 25, MYP 4, England).

> So, we have two songs that were analyzing Taylor Swift's *Love Story* and *Ready or Not* by The Fugees. And I think we use a lot of critical thinking in this course ... our teacher didn't just want us to identify the references that were made, [or] identify in what way they made a parody, but [they wanted us to also identify] in what way it connects to the audience and in what way it has an effect on the person listening … and why the singer-songwriter actually decided to put it in. What value does that add to the actual song? And so, I think that's a great example of critical thinking in the MYP (Student 15, MYP 4, Norway).

5.2.4 Summary of findings

Students perceived that the MYP provided the opportunity to become immersed in a process of inquiry-based learning, which they considered as strengthening their independence, including their independence in thought, and therefore their critical thinking. Alongside this, they made several references to the advantage that the MYP provides, when compared with the national (state) curriculum. In addition to strengthening their critical thinking, they were able to transfer their thinking to different contexts, which by its nature is part and parcel of the critical thinking construct. Students also appreciated the connection to real-world experiences, citing Mathematics as a key subject area where this is applied. In addition, students readily identified the History component of the INS as being most beneficial to strengthening their critical thinking. More generally, the strategies that they have learnt in INS, particularly source analysis, has enabled them to gain a more critical spirit in assessing the reliability and validity of sources, which can be applied to other subjects. Although students spoke favourably about the MYP, there were some challenges around the student-led nature of the curricula, and this was a particular concern for students as, at times, they were not certain about what was expected of them while they embarked upon independent learning. Therefore, the MYP would benefit

from having more targeted considerations and accommodations around how to transition students most effectively to the MYP methodology of learning and thinking.

5.3 Results: Key findings and emerging themes from MYP Coordinators and teachers' perspective

We present below the key findings based on the teacher interviews we carried out in Australia, England and Norway. We firstly provide an overview of teacher's and MYP coordinators perception of critical thinking before presenting details related to their experience of critical thinking development in the MYP, organised under 4 main themes: (1) Individual differences in thinking; (2) Explicit assessment language; (3) Time within the MYP; and (4) Professional development.

How do MYP coordinators and teachers define critical thinking?

Teachers were asked to consider their perspective on the definition of critical thinking. Like students, teachers' responses reflected a focus on both the dispositional and skill components of critical thinking. With respect to critical thinking disposition, teachers perceived that the importance of "*not taking things at face value, questioning it*" (Teacher 3, Language & Literature, Australia) was an important element of critical thinking, but also to "*not realise that questions have one set answer*" (Teacher 25, English Language & Literature, England):

> So, the way I look at critical thinking is I always tell my students at the start of every school year, I want you to question everything … everything that's given to you, there's a motive behind it. Everything that's told to you, there's a motive behind it, and it's a journey to get to that end goal, to find out why, to find out why things happen (Teacher 40, MYP Coordinator & Individuals and Societies teacher, Norway).

> And I think in my lessons, I would approach critical thinking [in such a way that] it's like a way to research [and] review ... but then constantly questioning what's being put in front of you (Teacher 19, Science and Biology, England).

> Looking at trends from previous [data], [and asking] why has this occurred? Why is this the case? [It also includes] comparing and contrasting … as opposed to accepting and agreeing (Teacher 17, English and Individuals and Societies, Norway).

Teachers also spoke about the skill component of critical thinking with a specific focus on "*being able to do things like source analysis*" (Teacher 6, MYP Coordinator and Science teacher, Australia), and "*it's [critical thinking] about verifying the sources*" (Teacher 26, Languages and Literature, England) which enables one to "*look at information or create information that is both reliable and valid*" (Teacher 7, Interdisciplinary Studies, Australia). This also involves recognising biases in sources, including your own biases: "*It's also … like examining personal bias. So, thinking about like how you know your perceptions or your background or your experience might color the way you see things*" (Teacher 27, Art and Design, England). In doing so, one necessarily engages with the processes of evaluation, analysis, application of information and drawing substantiated conclusions:

> Yeah, same like with my students, I have encouraged them to think about critical thinking as sort of say is analysis and conclusions. So, I'll often say to them like, what's the evidence you've got for this, and this is what *Teacher 21* was saying, what's the evidence that you have and then actually what conclusion are you making about that? Because often I find they'll sort of analyze something and explain

the elements of it, but not really make a conclusion. So, I often find myself saying [to the students], well, what's the significance? (Teacher 20, Art and Design, England).

It's also a way to use information in a way, like not just receive information, but use information to be critical with what you use and what's relevant to what you use and apply as well. It's not just about bringing in; it's about taking out as well (Teacher 8, MYP Coordinator and Design teacher, Norway).

Critical thinking … to me is students building on their knowledge, using their knowledge progressively. So, looking at something and then applying it to other situations and being able to draw conclusions and justify their choices (Teacher 5, Integrated Science, Australia).

5.3.1 Theme 1: Individual differences in thinking

Across several interview sessions, teachers expressed the importance of considering individual differences in critical thinking; they perceived this as an essential initial step to identifying ways of strengthening each student's critical thinking. Teachers expressed several conditions under which they experienced students encountering difficulty with critical thinking: "*Some people are really happy to critically think individually, but if you ask them to go into a pair and think and … discuss it with your partner, it takes a lot [to think critically]*" (Teacher 17, English & Individuals and Societies, Norway).

There was also the sentiment that it may be that, in comparison with a PYP student, the "*MYP age group*", given that they are in their adolescence stage "*they [MYP 4 and 5 students] become more anxious about how they're perceived by peers, wanting that validation. I think they feel less inspired to try and do that critical thinking … [they] want to feel like they're getting the right answer when they're learning. And so, it can make them feel insecure to get them to practice this [critical thinking]*" (Teacher 25, English Language and Literature, England).

More generally, other teachers perceived that some of the difficulties that they encounter with critical thinking development was related to students' interest (or lack thereof) in a topic, the extent of the student's previous exposure to experiences other than their own, insufficient background knowledge in English that prevents them from being critical, and the role of religion and how this relates to students' identity:

...some of the girls don't live very worldly lives. They live quite sheltered lives and so sometimes they find it hard to appreciate multiple perspectives because they don't actually have a schema that allows them to understand or appreciate some of the other perspectives. They try, but I think that that can be a real barrier for them that if they don't have a concept of what that could even remotely look like, that then makes it very hard to understand, you know, how to appreciate another perspective (Teacher 6, MYP Coordinator and Science teacher, Australia).

I think one of the challenges that we have is I would say sometimes the language barrier because we do everything in English and some of the students that we have come in from the Norwegian school system. So, when they're learning English and we're taking it a step further already and we're asking them to critically think in the English language in terms of, like writing and produced writing or put their findings into writing, that can be a bit of a challenge at times. That is probably the thing that we often struggle with (Teacher 40, MYP Coordinator and Individuals & Societies teacher, Norway).

I think some of the subjects which are taught in English, [be]cause some of our students come to our school with very little English. So, it's very difficult for them, first of all, to access the teaching materials and then on top of that to think critically (Teacher 26, Languages and Literature, England).

… we're also faced with very diverse cultures that we work with ... let's take religion for example. It's how much do people want to critically think about their own religion and question, and I suppose when

we are dealing with lots of more contemporary issues, they're still viewed, have to be viewed in some camps, in a very concrete fashion. So, it's quite difficult if you're looking at characters in books and looking at their motivations and then questioning why they behave in a certain way, you're still faced with the blanket [response from students], "Yeah, but that's wrong" and the refusal to open up and I think sometimes we've got to be careful [be]cause ... their identity can be quite often linked to some of these strong ideas (Teacher 15, Individuals and Societies, Norway).

"*[When] you have a whole class of very variant critical thinking skills ... how do I manage this?*" asked one of the teachers as they reflected on strategies to accommodate these individual differences, with the aim of strengthening students' critical thinking (Teacher 15, Science and Biology, England). Generally, teachers perceived individual differences in learning as an opportunity rather than an insurmountable challenge. One of the teachers noted that "*they [the students] have critical thinking, but they can't quite put it into words sometimes*" (Teacher 10, Art & Design, Norway), and despite these experiences, students were viewed as "*good, hard-working kids*" (Teacher 1, MYP Coordinator & Mathematics teacher, Australia) and teachers were especially enthusiastic about "*supporting and working out well, how do you get lower ability students to still be critical … so they're not the ones that make poor decisions later in life because they weren't able to critically think"* (Teacher 7, Interdisciplinary Studies, Australia). Teachers offered a range of strategies that they found useful when accommodating individual differences by ensuring that all students have the requisite background knowledge and strategies to think critically:

> I find that something that's so important is to model it [critical thinking] ... which would be providing an example, maybe from the teacher initially and then maybe you know asking for examples and then having students evaluate [by asking them to say]: "Yeah, so that is an example of critical thinking" [or] "No, that's just repeating something" (Teacher 32, Science, England).

> I think the English department really encourages students to be very particular about the kind of evidence they [students] choose to support their arguments … we're thinking about P-E-E patterns of writings, so making your point [P], gathering their evidence [E], explaining it [E], and so on, like that, before drawing conclusions (Teacher 30, English, England).

> You try to see things from different perspectives. Yeah, and in Norwegian Languages and Literature, we have like this method called TONE (Troverdig, Nøytra, Objektiv, Egnet) which students use to assess their sources. They are using [it to determine if the source] is both like credible and valid and relevant and if it's objective or not (Teacher 14, Norwegian Languages and Literature, Norway).

> We value student voice and for students to be able to share their opinions and their ideas and we had a curriculum learning workshop where we had our diversity, equity and inclusion curriculum committee coming to a staff curriculum workshop and students were questioning us on our unit planning and our, you know, the units that we were delivering and how could we, you know, be more inclusive in our curriculum and in our teaching and learning and that was led by students (Teacher 41, MYP Coordinator & Science teacher, England).

In contexts where English was a particular challenge, for example, in one of the schools where there are "*28 nationalities*" (Teacher 24, MYP Coordinator & English Language Acquisition Teacher, England) including many students from non-English speaking backgrounds, teachers have engineered the school environment to accommodate these differences: "*We actually have 22 Language and Literature, languages our school. So, in those Language & Literature languages. because it's the students first language, in those languages, in those classes, they can use their critical thinking skills. And then those skills that they develop in their first language classes, they can then transfer to other subjects as well, especially when their confidence in English grows*" (Teacher 26, Language and Literature, England).

Importantly, Teacher 32 (Science, England) reminded us that students arrive to the learning scenario with different perspectives and perceptions of what critical thinking means, and therefore it is prudent for teacher to remember that there are important individual differences among learners when we ask them to think critically: *because when we say critical thinking, well, frankly I think all like nine of us [in the interview session] have a slightly different definition of it and a lot of students have no idea what we're talking about."* As a solution to this, Teacher 35 (Design, England) considers that a useful starting point is taking the time to understand the student's perspective: *"just asking people what they think is a really important route into that [thinking critically] … [it's] giving students agency.   An important piece of the jigsaw puzzle is asking students what they think."*

Moreover, several teachers expressed that the structure of the MYP lends itself to accommodating individual differences and engaging student agency, as Teacher 35 mentioned above, through personalisation of learning. This involves students directing their own learning, within an area of their personal interest; students "*understand how to make goals for themselves better"* (Teacher 39, Performing Arts and English, Norway) and engage in "*visible thinking exercise[s], like a fishbowl activity,* to develop their own *"statement of inquiry"* (Teacher 42, History and Humanities, England). To this end, several teachers shared that the MYP provides the opportunity for students to engage in scaffolded formative classroom activities, and personal projects in which teachers provide personalised feedback, with an understanding that students are at different levels of their critical thinking:

> I guess the personal project helps them [students] to be more directive in their own critical thinking in terms of the conversation that we're having. So, they're given an opportunity outside of class to kind of say well, here's something I'm interested in. Here is, specifically, a goal that I have that I want to set myself. And here, specifically, is an outcome that I want to achieve and I'm defining those myself. So, [students would understand that], "I [referring to the student] have to, by way of that process alone, apply my critical thinking skills to achieve those things" (Teacher 20, Art & Design, England).

> MYP 4 continued to work on a passion project. So, they had to first of all build their own whole project including their inquiry question [and] their debatable and conceptual questions. They had to build all of that by themselves … There's the side sort of comments that happens in the classroom as well in terms of breaking that down. With things like looking at different perspectives, the feedback often comes out in group discussions, then you know, like we do a task and then talk about how it went and how hard it was to do different things. And so, the girls are really feeding back through their own reflective processes. They're feeding back to me, which then reflects back to them (Teacher 6, MYP Coordinator & Science teacher, Australia).

> When they're [the students] getting written feedback from me on an assessment and when I'm handing it back, I will go around and speak to them. So, I've set up a task, so that I can speak to everyone at the same time, to go through it with them. So, they get a personalized comment, but also a human explanation (Teacher 25, Language and Literature, England)

> I guess the questions that we ask or the tasks that we provide, we do have to scaffold them in our teaching, and we might have to adjust or adapt the level of questions or the level of expectation within answers for different students based on their ability. So, it's giving them the opportunity to tackle problems and to tackle different tasks. But it does have to be scaffolded and changed and differentiated just, like all things that we teach, because there's some kids [who] just naturally have better critical thinking skills than others (Teacher 16, MYP Coordinator & Design teacher, Norway).

5.3.2 Theme 2: Explicit assessment language

Several teachers pointed to the role of explicit assessment language (linked to explicit instruction) as one of the hallmarks of the MYP. For example, Teacher 4 (Individuals and Societies, Australia) highlighted the explicit nature of the INS in the MYP is what distinguishes it from other curricula:

> I think in HASS — Individuals and Societies — critical thinking in particular is quite explicit compared to, say, the *Name of Australian State* system, because like I tell my students in Year 7 and [Year] 8, I'm not going to test them on remembering the dates of certain events in history or, you know, places. We're actually looking at different perspectives and evaluating different perspectives and coming to our own conclusions about particular things, and the students get quite excited about that.

During one of the interview sessions, Teacher 15 (MYP Coordinator, Individuals and Societies & Languages and Literature teacher, Norway) with a laptop held in their hand, walked around the classroom to showcase the ATLs on a designated classroom wall. Importantly, this ATL framework guides the teaching and assessment of critical thinking, and it plays both a dual role in terms of offering "*a checklist when I'm creating that unit planner*" (Teacher 3, English teacher, Australia) and "*the naming of the ATLs contributed to all of the individual descriptors, so they're actually identified and made much more explicit*" (Teacher 6, MYP Coordinator and Science teacher, Australia). Indeed, Teacher 18 (Science teacher, Norway), agreed in that "*this list [of ATLs] really breaks that [critical thinking] down and it's really useful to have it so clearly defined, because I think I would struggle even as a teacher to derive this list myself, or thinking outside my subject and all the different ways [of teaching and assessing] critical thinking in the classroom.*"

Several teachers spoke extensively about the role of having an explicit assessment framework to develop student's critical thinking. The ATL framework allowed teachers to identify: "*do they [students] have the skills and can they use them? What the MYP does is makes them [the students] aware if they can ... You know, like it doesn't just build the skills, it teaches them when they're using it or when they need to grow it. And so, I think it's that second part that is probably different in the MYP than maybe in other places [programmes]*" (Teacher 6, MYP Coordinator and Science teacher, Australia). Moreover, teachers expressed that they would often use the language of the MYP criteria when providing feedback to students (see Figure 2 in Section 3). For example, Teacher 40 (MYP Coordinator, Individuals and Societies, Norway), highlighted that when feedback is provided about critical thinking skills, "*we try to connect it with the rubric that we've given them. So, they have the different levels of achievement, and they can see where their skill fits in with what the IB is asking them to do. And we give them a little bit of advice on what to do next in order to move on to the next level.*" In this way, "*the skills are taught explicitly*" (Teacher 7, Interdisciplinary Studies, Australia), "*more explicitly than others [other curricula]*" (Teacher 8, MYP Coordinator and Design teacher, Norway).

During the interview session with one of the schools in England, Teacher 26 (Language and Literature) shared her screen to provide more detailed insight into the MYP assessment framework, including the language of the framework. In considering critical thinking, she focused her demonstration on two criteria, A & C: "*look at criterion A: analyzing, here we have the different strands. For example, Strand number one: the student "provides perceptive analysis of content, context, language, structure". So, this is the analyzing element, and they need to analyze the creator's choices and audience. And in Strand 3: "give detailed justification of opinions and ideas with a range of examples.*" Every school adhered to the description of the MYP stipulated criteria, including an explicit communication of the different strands and levels associated with the criteria and associated with their own subject (subject-specific criteria). In particular, and with respect to critical thinking, most teachers referred to Criteria A, which involves analysis, a component of the skill dimension of critical thinking. Like Teacher 26

above, teachers in other subjects focused on either of these criterions (i.e., A & C) when discussing the explicitness of the assessment language around critical thinking:

> Criterion C, which also addresses critical thinking. In here, I think it's mainly this Strand for "the student produces text that reflect critically and demonstrate high degree of awareness of identity, cultural, intercultural, sensitivity, insight and imagination," that I've seen reflect critically on certain matters actually mentioned in the criteria (Teacher 26, Language and Literature, England).

> I think that it very much ties into the higher levels on the assessment criteria and assessment criteria "A": analysis. I think that that really is more explicit in assessing critical thinking skills. Being able to actually not only identify, for example literary devices within a text, but to analyze, you know how and why I think that's very much coming into critical thinking (Teacher 3, Language & Literature, Australia).

> In Language, for example, we have a criteria that's called analyzing and when they analyze, they need to like, they will practice, of course, and we use the concepts a lot with like purpose or for example, perspective. And those concepts will help them see like deeper into like, what is this text about and why is it written and from whose perspective? How can this be influenced and that's how it grows critical thinking. So, like asking questions and inquiry, in-depth learning will be a part of it too (Teacher 14, Language & Literature, Norway).

> So, I think our assessment criteria defines a lot of the tasks that we design with the students. But then there's two criterion which actually cover critical thinking. So, one is A [for] analyzing and one is C [for] producing texts because in C as well you have to produce text that critically reflects certain areas and thinking about some concrete examples. For example, at the moment Language & Literature students are studying mythology (Teacher 26, Language &Literature, England).

> For us, a lot of the critical thinking skills that we would focus on, or some of the descriptors of critical thinking skills are things like data analysis and application, drawing conclusions, those sorts of things, which fit very beautifully with our Criterion 'C' ... Criterion 'C' is analyzing all your data, drawing conclusions, making inferences, and those sorts of things (Teacher 6, MYP Coordinator & Science Teacher, Australia).

Teachers further noted that an explicit assessment language serves at least three purposes within the MYP with respect to fostering critical thinking development. Firstly, these criteria help to showcase to the students, the importance of critical thinking. It's: "*saying they [the criteria] are important to the students because we're reporting on them because the teachers are using them in their lessons*" (Teacher 7, Interdisciplinary Studies, Australia).

Secondly, having access to this shared language offers a clearer understanding of expectations between students and teachers, as well as between students and students, when engaging with critical thinking. But, as one teacher warned, it is important to have a balance between the criteria requirements as they may lead students to focus on meeting every criteria to the detriment of being motivated to use their critical thinking: "*One of the critical thinking bullet points is to evaluate risk, and one of the Science-based criteria is to plan safe experiments and if they don't evaluate the risk in their experiment sufficiently, then they can't get a high grade in that part of it. And even if they might not be willing to use critical thinking skills for their own sake, they're usually willing to use them to achieve a higher grade and that's the way the MYP is made. It's all about meeting these assessment criteria*" (Teacher 18, Science, Norway). However, as part of engaging with the MYP criteria, students are inherently improving their capacity to transfer their learning to different contexts as one MYP coordinator, who is also an English Language and Literature teacher noted: "*if we're doing assessment right, we are getting them to transfer their learning to those unfamiliar situations and in doing that they have to think critically for themselves. They can't just regurgitate what they've acquired or retained in lessons.*" (Teacher 28, England).

Thirdly, having this explicit language helps to maintain the fidelity and accountability in implementing the MYP methodology with the aim of strengthening critical thinking. Teacher 7 (Interdisciplinary Studies, Australia) shared that: "*we've had a lot more conversations than we ever would have, if we weren't having to label these skills and teach them and show evidence of them to what do they actually mean for our subject? What proof have we got? What evidence have we got when the student is developing in it or actually using it or sharing it with others?*" Similarly, Teacher 18 (Science, Norway) highlighted that explicitly naming the ATLs, including critical thinking, is quite useful and, "*in a way, we're forced to use them, because the way units are built requires you to identify the ATL skills that will be used in the unit and … match with the assessment criteria.*" In England, a similar opinion was held: "*you have to really explicitly kind of say that this is the strand of the criteria, and this is the activity that is designed around the strand, and we do this formatively first. So, then by the time they get to, you know, the end of the unit, we're having to kind of do it summatively they can achieve it and engage with it*" (Teacher 42, History and Humanities, England).

However, it is also the case that although these specifications are explicit in terms of what needs to be assessed, Teacher 40 (Norway, MYP Coordinator & Individuals and Societies teacher) noted that within their school environment they "*need to be more consistent in … making reference to the ATL skills whenever we have assessments, whenever we have some kind of assignments to make sure that they're more visible in the day to day.*" Similarly, within the English context, teachers noted that building common assessment language earlier ensures that later students can "*be adept at that kind of [critical] discussion ... so that's something that we're reflecting on as educators, and we're going to be more explicit about [it] next year to incorporate it at every level*" (Teacher 43, English, England). Moreover, Teacher 38 (Individuals and Societies teacher, Norway) shared that although the MYP criteria are very defined and very specific, they are "*so inflexible.*" Finally, Teacher 39 (Performing Arts & English Language, Norway) noted that "*I've always struggled with that, that you should be explicitly teaching ATL skills. I think ATL skills are one of the things actually that are not an explicit aspect in my classroom ... I remember always struggling with that idea that it's an explicit lesson. It's not.*" Finally, in the school that registers students for the MYP eAssessment, Teacher 37 shared that:

> So, it's [MYP eAssessment] really trying to assess skill development over content and that's challenging because you have to deliver a certain type of content. And so, kids might be familiar with certain skills, but they might not be familiar with the content or context in which they're being assessed ... it's the opposite of what the diploma programme does, where the diploma programme has a very explicit set of content and skills that must be taught and that's what being assessed and ... we're extremely handcuffed by the fact that we're preparing those MY[P]5 students for two sets of exams and as the culture pertains in the school, the preparation for the Norwegian exams takes much more importance or priority over the MYP... We kind of have to prioritize one over the other. And of course, we're going to pick the one that we are legally mandated to deliver and that affects 100% of the students as opposed to 20% [who take both the local exams and MYP eAssessment] (MYP coordinator and Individuals and Societies teacher, Norway).

5.3.3 Theme 3: Time within the MYP

MYP coordinators and teachers' conceptualised time from two perspectives, with respect to fostering students' critical thinking: time spent within the MYP (both at the student and teacher level), and time constraints of delivering critical thinking instruction:

Time spent within the MYP

Teachers were mindful that several of their students were from varying educational backgrounds, including those who had spent several years within the MYP and those who may have only experienced a single year within the IB MYP context. Against this background, teachers observed that students who came from a non-IB background or had less time in the MYP experienced difficulty or didn't readily see the benefits of engaging with the reflective, self-directed ethos of learning and independent thinking, which is one of the hallmarks of the MYP:

> They're just so used to being given like that sheet saying this is what you need to know for this test and couldn't then think of why it would be a good learning opportunity to sit down for themselves and think about what they think might be on the test. So, it's interesting that all the ones [students from GCSE backgrounds who had spent a bit of time in MYP] that maybe have been there from the year before, they were like, "Oh yeah, OK, this is a good idea of sitting down and thinking, like, brainstorming together the topics that we covered", and the one or two students that had just moved from a GCSE [school] were just like, "I'm so confused by what we were doing there" (Teacher 19, Science and Biology, England).

> I was also talking to a teacher just yesterday who teaches that class that has a lot of the new students that come in [enrolled in the MYP] for this particular year. And she was comparing our students that come from the, you know, MY[P]1 through MY[P]4. And one thing that she noticed very different about the two [groups] were the reflection skills. Like you ask the kids, OK, like you did this activity, or you did this assessment or whatever. Let's reflect on how you know how it went or reflect on this particular thing. And the students that came from our lower grades [were in the MYP for a longer period of time] were very good at it [reflection] (Teacher 38, Individuals and Societies, Norway).

> One of the challenges actually is when we get students who have come from different programmes actually and in different contexts as well. So, it depends on your kind of geographical regions of the world where you teach. I've taught in China before and there's a lot of students who would like to be spoon fed the material and if they're not confident or they're not comfortable or they're new to the MYP ... critical thinking is not something that's necessarily stressed in [their previous programme] ... I've taught GCSE's before, it's definitely not something that's an important theme there and some students really struggled to adjust to that learning to think for themselves, learning to develop their own styles of learning and learning to learn, talk about how they learn as well. So, it can be a big challenge and, the older the student joins the [IB] programme, the more challenging that that becomes (Teacher 34, English Language & Literature, England).

Importantly, teachers identified that it was noticeable that as students spent a longer time within the MYP, "*they [students] get progressively better at it [critical thinking] because we sort of follow the same system in Year 7, 8, 9 and 10, so we just build on those skills. So, by the time they're in Year 10 [MYP 5, final year of MYP offering], they're actually very good at demonstrating [and] analyzing different perspectives*" (Teacher 4, Individuals and Societies, Australia). Indeed, with the scaffolding that students receive over time: "*through setting up kind of like a visual thinking table and making sure that they can understand how to effectively answer a source analysis. So, it's kind of scaffolded … so by the time they get to the diploma [programme], they just know how to kind of engage with that element of critical thinking*" (Teacher 42, History and Humanities, England). Similarly, Teacher 9 (Arts and Design, Norway), shared that because: "*in Humanities, for example, the criteria of reflecting … follows the students over the years. So, they develop this skill [of reflecting] in depth because, they get feedback on the way that they do it. And then they improve on this feedback and go to the next level [of their critical thinking]. So, it's a progression.*" Teacher 40 (MYP Coordinator and Individuals and Societies teacher, Norway) further noted that:

> To help [teach] students how to think critically, it's something that doesn't come easily, and it takes time. And we notice that when we do like, a unit on Politics that our students come in and whenever we are exchanging ideas many times it is what the family believes, or the parents believe. That is what

they say in the class. So often getting them to think for themselves is a bit of an odyssey. It's a bit of a journey to get to that point.

Several teachers also noted that time was also important for themselves as educators, as well as their newer colleagues, to engage in a period of acclimatising to the requirements of teaching and assessing critical thinking within the MYP:

> I'm in my 7th year teaching in the IB now, and it's only now where I'm starting to feel comfortable where I seem to have a layer for the ATL skills. I'm quite comfortable saying I'm gonna develop a critical thinking element within the idea of propaganda and disruption literature and how we should look at this. But that's come with experience and being ready once I've accomplished the content and then you've got the other things of the conceptual understanding. If you come from an education background where it's not conceptually driven ... from what I understand, that's [facilitating critical thinking in the MYP] a new learning curve (Teacher 15, Individuals and Societies, Norway).

> I suppose I would say this is an MYP challenge, generally, not just for critical thinking, but at least in Social Studies, the criteria that we use to assess students can take a while to understand because they're fairly subjective in their nature. You know, this is my third-year teaching in the MYP, and I feel like I've just about got the hang of it (Teacher 21, Social Studies and Geography, England).

> I think that maybe the newer teachers, especially if they're teaching in the IB, it is too much, I think and it takes a while because IB often, well it's a lot. It's not the easiest curriculum to teach. I'll say that and I notice that with many of the new teachers, it's often overwhelming and it does take some time ... So even myself I've been doing this for some time. Whenever I have to go look at some information that's given by the IB, you know I have to sometimes read it a couple of times to find out, like, so what exactly do they want me to do here? What exactly are they expecting me to do? (Teacher 40, MYP Coordinator and Individuals and Societies Teacher, Norway)

Importantly, one of the key reasons provided with respect to the difficulties in acclimatising was related to the nature of the flexibility with the MYP curricula as there was: "*a shift between you have to cover all this in other systems [using the national curricula], to what do you want to uncover [using the MYP criteria]?* (Teacher 43, English teacher, England). By contrast, there were some instances in which there was inflexibility because of context-specific requirements. For example, Teacher 37 (MYP Coordinator & Individuals and Societies teacher, Norway) shared that within their context, there was a legal mandate to offer the National Curriculum as an integrated part of the MYP curriculum: "*Yeah, all of our MY[P]5 students have to do the national curriculum ... if we wanna have funding for these students, then we have to provide that[1].*"

Time constraint within the MYP

Teacher 6 (MYP Coordinator and Science Teacher, Australia) expressed that: "*I think with everything in education the answer is time ... I think there's lots of things that you could do in that space [of developing critical thinking in students] if you had time, but there's never more time in education. It*

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[1] Given that the MYP 5 was not implemented with high levels of fidelity at this school, the MYP coordinator made the decision to only include MYP 4 students from this school in the current study highlighting that this infidelity in implementation: "drove our decision to keep the MYP5 out of the study, not because they couldn't do it, but there are so inundated by work at this point of the year that they're being stretched by the demands of the MYP programme and the local curriculum, and they're in that year group that doesn't necessarily focus on the MYP. We felt the MYP4 was a better representation. They had a little bit more flexibility with time and demands, but they were also in a year where ... their teachers, myself included, are not distracted by other [curricula requirements]. There's nothing restraining me from providing the programme that I want to deliver, which is not the case in our MY[P]5, unfortunately" (Teacher 37, MYP Coordinator & Individuals & Societies teacher, Norway).

only ever seems to get less." Similarly, teachers in Norway and England highlighted the challenges that they experience with time in relation to the wealth of materials and processes related to critical thinking that they need to cover as part of their subjects:

> ... it becomes tedious. [It's] like you have to follow the process over doing what you want the students to do as I'm teaching Design and we spend a long time teaching them the process ... they have to document everything ... which becomes tedious and it takes away the enjoyment of learning even though, that is learning the process ...The kids start disliking Design, for us, because they have to document everything. Even though the process makes complete sense and it's, you know, it's a good way of thinking, but they have to document it all in written form … and it takes the joy out of it (Teacher 8, MYP Coordinator and Design Teacher, Norway).

> For example, if I'm teaching a lengthy novel and you want to make space for the critical thinking [as an] exact priority, but we don't want to not finish the book. So, you're having to balance those things (Teacher 22, Languages and Literature, England).

> ... [In Design] if you want them to make an artwork and you know that they have been thinking critically but to interrupt the process can be just a time suck more than anything else (Teacher 20, Art & Design, England).

In addition, Teacher 22 highlighted that the natural flux ("*the nature of our international community is that you do have new students, you're having blocks of new students and you have students leaving*") in the IB community contributed to time limitations around the teaching and assessment of critical thinking. Because of this flux, teachers have had to get used to dedicating additional time to constantly revisiting the critical thinking methodology to new students, although, they do often save time as "*students who are more well versed in it [MYP] have been explaining the critical thinking methodology to new students*" (Language and Literature, England). In this way, students who have spent a longer time within the MYP are therefore more familiar with the approach and can help to support teachers, who are often time poor. In addition, students, as well as parents, over time, also come to understand the IB methodology on critical thinking is one that is not exam-driven, and in some ways, this is advantageous in that it provides a bit of extra time:

> I guess the big difference for me is you're not preparing the kids for some big exam at the end like I would GCSE's and IGCSE's where you kind of abandon a lot of good teaching just to prepare the kids for this, you know, sort of Holy Grail of an exam at the end. I think that's a huge advantage and it frees up a lot of time for you to look at different areas where the kids won't look at you and parents and say to you "Oh no, why [are] you doing that? That's not in the exam" (Teacher 1, MYP Coordinator and Mathematics Teacher, Australia).

Teachers have further expressed that the interdisciplinary nature of the MYP has also been advantageous for them with respect to reducing the time allocated to teaching critical thinking. For example, specific subject areas, such as Languages and Literature, do not require students to engage in a tedious process of documentation of step-by-step processes, which is often expected in subjects such as Design (as mentioned previously above by Teacher 8, MYP Coordinator and Design Teacher, Norway) and Individuals and Societies. As such, teachers outside of these subject areas can leverage the skills that students have previously developed, which makes the teaching and application of critical thinking skills in their class quicker:

> In the Language and Literature, I find critical thinking more fun to work with in some ways because, for instance, you have a piece of text that you actually work [with], and then, you don't have this whole [documenting] process that you have in Individuals and Societies … so, I feel that that's more engaging for the students. They get more on top of it right away … But like, [in] previous years, I have benefited from the knowledge that they gained from other subjects … they get really good with evaluating

sources. Their critical thinking skills gets really good ... so, then it goes a bit faster [student's application of critical thinking skills] (Teacher 12, Humanities: Individuals and Societies and Languages and Literatures, Norway).

However, although teachers perceived these documentation steps as being important for critical thinking development, on some occasions, given the time constraints and to increase student engagement, Teacher 12 (Humanities: Individuals & Societies and Languages and Literatures, Norway) noted that: "… *sometimes we give them the shortcut to really go for the passion and really go to pursue their interest [as opposed to engaging in the requirement for detailed documentation]. And so, they would apply the things they have practiced without documenting it so clearly and being so detailed [in being] assessed upon each step*."

5.3.4 Theme 4: Professional development

So, I'm conscious that I need to do some learning on that [critical thinking development] myself

(Teacher 30, English, England)

Several teachers spoke about professional development and its role in strengthening their teaching and assessment of critical thinking. In fact, Teacher 36 (Science teacher, England) noted that although: "*we're all experts in our subjects, I think [this expertise] can also maybe mean that you missed some things or aren't aware of any gaps in knowledge or misconceptions. So then to teach how to critically think about something, if there's, I don't know, maybe a lack of understanding there or something you're not aware of, sometimes can be difficult.*" Teachers seem to find professional development opportunities useful for the provision of strategies that they can readily implement within their classroom. One MYP coordinator, who is also a Science teacher shared that: "*I think most people [teachers] really have enjoyed engaging in it [professional development] and are actively trying to implement new things in their classroom*" (Teacher 6, Australia). In other instances, there were professional development opportunities to advance more inclusive practices, which teachers view as advancing more deeper thinking processes:

> I'm running a project this year with a colleague about intercultural competency, and we're already planning. It's an inclusive classroom workshop for our start back to school so that all teachers will have some training in that so that we can understand the link between making people feel safe and deep thinking that we're likely to get (Teacher 43, English, England).

Teachers and MYP coordinators further expressed that they were also at different levels of their professional development as a school community. For example, Teacher 6 (MYP Coordinator and Science teacher, Australia) noted that they have an instructional rounds committee which comprise "*a group of teachers who set off initially with some observation questions. So, they walk around to a variety of classrooms. They're in the classrooms for 10 or 15 minutes, and they collect data [about] where can you see that they're [e.g., critical thinking skills] implicitly being taught, where can you see that they're explicitly being taught*". The outcome of this was that the teachers from this committee would analyse the data and organise professional development sessions that teachers can use to improve their teaching and assessment of critical thinking, and more broadly of the ATLs. A similarly data-driven approach is adopted by teachers in England: "*the way in which we currently do in terms of measuring how we feel our students are doing in terms of their critical thinking is through our cognitive coaching conversations. So, each teacher has a set of mentees, and it's that sort of qualitative data that we use and the discussions that we have as a team. But the way to quantify that, that's actually that's the next step.*" (Teacher 41, MYP Coordinator and Science teacher, England). By contrast, another school in England reported that: "*it's been a while probably for quite a few of us to*

have gone on those [IB] trainings. So those don't happen every year. They might happen every three or four years. But I can speak in terms of what we're doing in terms of unit planning and there's been a big focus on improving the units in the last couple of years" (Teacher 34, English Language and Literature, England). In other instances, other schools are in the planning stages of new professional development sessions, with the aim of increasing the visibility of ATLs in the classroom:

> So, it is probably an area that we need to work on a bit more as a school in terms of, you know, it's ingrained in everything that we do. However, we want it to be more visible to the students. And I think that up until now we haven't done the best of jobs at that to put more visibility into ATL skills and to maybe develop something between the subjects, some kind of like common activities, common assess[ments]. We're actually having a meeting at the start of the next school year, where we're going to tackle on ATL skills and find out what the best approach would be going forward, because in order for this to be successful, it's not just about me as a coordinator. But I need all the teachers to be involved. So, it is gonna be kind of like a brainstorming session. I'm thinking of setting up like a little ATL committee made up of teachers, where they're gonna be in charge of how to make these ATL more visible and to have the students understand the importance of the skills in their day to day (Teacher 40, MYP Coordinator and Individuals and Societies teacher, Norway).

Despite being at different stages of their familiarity with best practices in fostering critical thinking, it was clear that there is a continued commitment to professional development, particularly through the implementation of collaborative planning among teachers. Interestingly, Teacher 8 from Norway, an MYP Coordinator and a Design teacher, noted that: "*the IB allows everyone, mandates, actually, that we have to have collaborative planning and essentially learn from each other.*"

Indeed, collaborative planning was viewed an important extension of professional development and teachers noted that it was important to plan *both* within-subjects and across subjects. By planning with other teachers, there is greater opportunity to know what students will be exposed to as background knowledge so that students will be provided with more appropriate tasks:

> So, we spent a couple of days as departments presenting to the whole staff the different skills that we were doing within our department and that allowed for a lot of great ideas from other departments, how they were using the skills, interpreting the skills, applying their skills (Teacher 7, Interdisciplinary Studies, Australia).

> We have team meetings where we look at what our coverage is like. And then we have the assessment criteria that we teach within each year, and then we try to identify the skills that are needed to support the criteria and then sort of match that up. So, some subjects obviously lean more to critical thinking (Teacher 16, MYP Coordinator & Design teacher, Norway).

> [Based on collaborative planning] I would say [to the students], I know that you've done this in English class" and I say that a lot when … they're doing kinetic energy equations and they have to rearrange, and I say to them "I know that you're rearranging in Maths class". And they say, "We are?" And I'm like "Yeah, you are, at this very moment." And you could say that and link different subjects together so they can see the same skills are being taught across multiple subjects and how you can use that one skill in many different subjects (Teacher 19, Science & Biology, England)

Teachers further highlighted that engaging in professional development via collaborative planning with their colleagues is a safe-guarding mechanism that helps them to be more accountable in the teaching of the ATLs, including critical thinking, and ensure that learning was connected: "... *at the start of the school year, we had what we called an interdisciplinary unit where we merged my subject with English and both the English teacher and myself, we worked together during the entire unit. So, we had common lessons together. So that particular class does a lot with critical thinking"* (Teacher 40, MYP Coordinator and Individuals and Societies teacher, Norway). Indeed, these collaborative

sessions have been especially valuable in the absence of external training from the IB. This enables teachers to ensure that they are delivering the requisite ATLs, particularly critical thinking, in an explicit manner within their own subject area:

> I think at some points we've all had MYP training and so that will feature in aspects of training, but it's been a while probably for quite a few of us to have gone on those trainings. So those don't happen every year. They might happen every three or four years. But I can speak in terms of what we're doing in terms of unit planning and there's been a big focus on improving the units in the last couple of years. And so, what *Teacher 28's name* [MYP Coordinator] fostered in this year's programme is narrowing down our ATLs per unit for the grades and so in English at least what we've been trying to work towards is focusing on two specific ATLs, making sure we're really linking to those skills, and they all do link to critical thinking in some way or another and being very intentional with how we are teaching those skills. And that's something we've actually added to our unit planners very recently, [which involves] trying to be specific in the way we can do that … we're definitely talking about it and making sure we're making those links explicit in our units (Teacher 34, English Language & Literature, England).

> And so, I think when you are designing the lessons as teachers or as a team of teachers, you try and make sure that individual lessons have an element where students are able to try out critical thinking skills before they're assessing them (Teacher 44, History and Humanities teacher, England).

At an external level, Teacher 40 (MYP Coordinator & Individuals and Societies teacher, Norway) noted that a recent conference that they attended called for more visibility and explicitness of the ATLs, including critical thinking and it is something that has really provided encouragement to be more visible about this with students: "*that was part of the discussion that we had during the conference that I was at. So, it is probably an area that we need to work on a bit more as a school in terms of, you know, it's ingrained in everything that we do. However, we want it [critical thinking] to be more visible to the students.*" Understandably, however, because of COVID-19, teachers did not take part in many external (in-person) training events as they were addressing the needs and requirements of their own contexts.

In addition, teachers shared several resources that they relied on to help students to engage their critical thinking. These were gathered from several sources, including BBC radio programmes and social media accounts:

> I actually just had a really interesting organization come into my Instagram feed, which was an organization called *The First Draft and* I'm wanting to use some of their resources in terms of managing the infodemic ... there's lots of really interesting stuff for me to learn and hopefully employ in the classroom to do with I guess the psychology of misinformation and so for the students to be a bit more aware of their own biases and their own tendencies and to be a bit more open to opposing viewpoints (Teacher 30, English, England).

> There is a really good BBC Radio 4 programme that was aired probably three or four years ago and it had somebody from the IB talking about critical thinking … I'll go and dig it [the BBC link] out now [be]'cause it's a radio program [that] I've heard a couple of times and I if I can find it, it's well worth I think every educator listening to. [See link that Teacher 35 subsequently shared: https://www.bbc.co.uk/programmes/b08x8n8g] (Teacher 35, Design, England).

Although teachers generally expressed a positive role for collaborative planning and externally sourced resources, they suggested several ways in which the IB might be able to help to advance their teaching, learning and assessment of critical thinking, including the provision of more context-specific exemplars, in different modes, of how to teach critical thinking:

> I think in teaching, the best support that often can be given is really great concrete examples that people can look at and can straight away see how they could apply that strategy or approach into their

own classrooms. And I find with the entire MYP that finding examples of those sorts of things can be quite tricky, and even more so then, ones from within our context with our state regulatory requirements is even harder now ... [for example], we find [it] really hard with Japanese to get resources (Teacher 6, MYP Coordinator, Australia).

I think that having good examples of how to do this, how to teach critical thinking, could be very good. Now, I feel like I've reached a point where I'm OK with it, but a lot of it has been just trial and error and I'm if I'm completely honest, the first time I started doing this I failed completely and I kept on pushing. I kept on pushing and now I'm at a point where I'm OK ... So, it would be going to a place or watching some videos where I can see great examples that are easy for us to just kind of take in and use that to build upon what we've developed over the years and become better at it (Teacher 40, MYP Coordinator & Individuals and Societies teacher, Norway).

5.3.5 Summary of findings

MYP coordinators and teachers explained that participating in the MYP was beneficial to strengthening a range of skills among students, including their critical thinking, reflective and research skills. They spoke favourably about the explicit nature of the MYP and the shared assessment language that is offered through the MYP framework. In addition, they agreed that having this shared assessment language provided a gateway through which students were clear about assessment expectations and in a sense, there is transparency in the learning process. Teachers and MYP coordinators noted that the facilitation of critical thinking was at times challenging given the individual differences among students, including their cultural, religious and linguistic backgrounds. Importantly, however, teachers expressed that the nature of the MYP lends itself to creating more personalised opportunities for all students in a way that strengthens their capacity to become critical thinkers. Finally, teachers and coordinators highlighted that the MYP offered several benefits in that they were able to engage in professional development training and collaboration within and across subject planning. Recommendations were primarily focused on having greater access to critical thinking resources and exemplars that would be apt for their own contexts.

6. Discussion of Main Findings

6.1 Which features of the Middle Years Programme are expected to foster the development and enhancement of critical thinking in students?

Globally, many educators would agree that the goal of education should be to holistically prepare globally minded citizens with a range of future-ready skills, including critical thinking. To this end, and given the remit of the MYP, a growing number of schools worldwide are becoming authorised IB schools that offer this programme at the middle years. One of the key philosophies of the MYP, as is the case for the IB, is to offer a holistic approach to education that prepares students to thrive and contribute to a more peaceful and interconnected world (IBO, 2018). The IB has offered several documents on the nature of the MYP and how critical thinking is developed within the programme; this was explored in Section 3 through a detailed document analysis of 13 internal and public documents related to the MYP, which serves students between the ages of 11 to 16 years. Based on this analysis, three key pathways were identified as fostering the development and enhancement of critical thinking in students: (1) Principled action; (2) Understanding the nature of language and (3) Assessment and accountability. One of the key findings was that the MYP is framed around the ATLs and these form the bedrock of the IB programme. Across the three aforementioned pathways, the

MYP, from a pedagogical standpoint, encompasses the use of interdisciplinary learning, which helps students to better connect and action their learning experiences. This is underpinned by a constructivist approach in which students can engage their inquiry and reflective processes within concept and context-based learning experiences. Moreover, given that inter-cultural awareness is one of the core concepts of the MYP, students are provided with the opportunity to engage in language acquisition to appreciate diversity in a globalised world. This also permits learners to use language to activate critical thinking in that they evaluate and analyse sources of information across different language contexts, as well as grasp a better understanding of how language can be effectively constructed but also misconstrued, and therefore misused. Finally, assessment is a central part of the MYP, and with its criterion-reference framework, it gives teachers and students a structured way to effectively engage the feedback processes. To this end, and to strengthen the validated assessment offering, since 2016, the MYP offers schools the opportunity to register their students for an optional MYP eAssessment (IBO, 2018).

6.2 Does participating in the Middle Years Programme predict higher levels of critical thinking in students?

A systematic review of IB programmes showed that very few studies have implemented methodological designs that account for confounding variables or permit conclusions to be suggested about causal influences of participating in the IB. In fact, Dickson et al.'s (2018) review only identified a single study that empirically compared critical thinking skills in IB and non-IB students, and this was in the context of IB graduates from the DP. In this study, Cole et al. (2015) found an advantage of IB students in their critical thinking skills; but this study was limited in that they did not account for student and school characteristics. This was later explored by Hopfenbeck et al. (2020) who, after accounting for several confounding variables, identified an advantage for IB DP students in their critical thinking when compared with their non-DP peers. However, to date, no such study exists that explores this within the MYP with rigour, and, therefore, in the current study, we took up Dickson et al.'s (2018, p.254) call for "comparisons of IB and non-IB students and/or schools with adequate controls."

In Section 4, we presented the findings of the quantitative study in which we compared the critical thinking skills of IB MYP and non-IB, national curricula middle-years students. The findings indicated that students enrolled in the IB MYP had higher levels of critical thinking ability and the role of IB participation was moderate in magnitude. We further observed that this advantage in the IB sample was held even after accounting for key pre-existing differences, including gender, personality factors and general cognitive abilities. This finding was consistent across grade level (Grade 9 and Grade 10) and across Australian and English students.

There was a non-significant effect for the Norwegian country-level comparison, however, there are several reasons why this finding should be cautiously interpreted. Firstly, from a theoretical position, a potential reason for this result rests within the fidelity of the implementation of the IB in Norway. Some of the MYP Coordinators in Norway indicated that, through their own introspection, there was a need to ensure that the ATLs are made more explicit within their school context, and within the next academic year, committees would be developed to improve the visibility of these ATLs among students. Within the MYP (and the IB more broadly), one of the key ATLs is 'thinking skills' and expected outcomes of programmes rest upon the fidelity with which they are implemented (Durlak, 2016). Moreover, several of the schools in Norway had only recently implemented the MYP (e.g., in 2019) and might not have had time to implement the programme with high levels of fidelity, including the provision of explicit instruction in critical thinking, owing to the disruptions caused by the COVID-

19 pandemic. This is an important consideration, as previous research demonstrates the importance of explicit instruction in the development of critical thinking (Abrami et al., 2015). We discuss further the importance of explicit instruction and other considerations regarding this finding in Section 6.3. Secondly, from a methodological standpoint, the matching at the country level was less effective for Norway (see Appendix 3, Figure A3.5), when compared with Australia and England (see Appendix 3, Figures A3.3 and A3.4, respectively). This can emerge with matching on fewer cases, as well as the fact that in the current study, we were limited by the number of Grade 9 students in the non-IB sample in the Norwegian sub-sample. We elaborate on these limitations in Section 6.4. Despite this, overall, the finding of the quantitative study suggests that when matching was effective, and with a larger sample size for matching in the overall analysis, there was a clear advantage for IB MYP students with respect to their critical thinking ability.

6.3 In what ways do Middle Years Programme students and teachers encounter, experience and develop critical thinking?

Of all the IB programmes, the MYP accounts for around 20% of the authorized and implemented IB programmes (IBO, 2022a). It is therefore quite surprising that the MYP continues to be the subject of very little research, especially when compared to other IB programmes, with Dickson et al. (2018) finding only 6% of articles examining the MYP's role in teaching and learning outcomes (3% for MYP only and 3% for MYP and DP), compared to 76% for the DP and 11% for the PYP. Against this background, the current findings are instrumental in filling this research gap and provide insight for some of the primary ways in which the MYP may have contributed to the IB advantage in critical thinking that has been observed in the quantitative component of the study.

IB programmes are guided by the philosophy that learning is student-centred, and concept driven (Erickson, 2007; Ledger, 2017). Students are therefore viewed as co-constructors of their own learning and teachers facilitate this process by employing approaches to learning that develop students' research skills and consequently, their critical thinking skills (Cole et al., 2015; Taylor & Porath, 2006). At the school level, the implementation of the IB has been shown to advance student's academic outcomes, once the appropriate scaffolding is provided (Burris et al., 2008). In the current study, across both teacher and student interviews, we observed at least three approaches to learning that are at play in the MYP with respect to developing students' critical thinking skills: (a) inquiry-based learning, (b) project-based learning and (c) connected learning. Given their centrality and likely interaction, the discussion of the qualitative findings will be framed around each of these approaches, including key points related to assessment, explicit instruction, and teacher professional development within the MYP, with the aim of understanding the ways in which MYP students, coordinators and teachers encounter, experience and develop critical thinking.

Inquiry-based learning

Inquiry-based approaches have been shown to produce positive results for a range of student outcomes, including metacognitive awareness and critical thinking, with teachers in the IB encouraged to adopt this teaching approach (Cole et al., 2015; Phillips, 2011; Sperandio, 2010; Taylor & Porath, 2006; Waterbury, 2018). Much like the students themselves, MYP teachers and coordinators agreed that the MYP structure enabled students to take ownership of their own learning and become independent, critical thinkers. In addition, all three groups (students, teachers and coordinators) made several references to the distinction between critical thinking learning and instruction within MYP and non-MYP contexts, noting that the former context does a better job of providing students with opportunities to engage their thinking and reflection. In fact, several of the MYP coordinators and

teachers noted that they did not perceive the nature of the content to be much different between IB and non-IB schools. But it is the nature of the explicit instruction provided in the IB which yields its advantage for critical thinking. We address the role of explicit instruction later in this section.

Central to the inquiry-based approach is that it positions students at the centre of their own learning process, and compared with other forms of instruction, results in better learning outcomes (Alfieri et al., 2011). The present findings are consistent with this view, particularly from the students' perspective, which demonstrated that self-directed learning is perceived as enabling them to take greater responsibility for their learning, decision making processes and independence in thought. Previous researchers have shown the positive benefits of self-directed learning for critical thinking development. For example, as is the case in the current study, inquiry-based learning that is contextualised to concept-based and authentic, real-life learning contexts is a catalyst for forming deeper understanding of subject material, and enables learners to analyse and synthesize, two key skills that underpin critical thinking (Erikson, 2007). We further observed that when students described their experience of critical thinking within real-world contexts, they referred primarily to the Mathematics domain. This is likely because '*application to real-life contexts*' is steeped within the MYP Mathematics guide as part of a key assessment criterion (see Figure 2). This finding suggests that teachers and coordinators in Mathematics are implementing the critical thinking methodology with fidelity (Durlak, 2016).

Despite the promise of an inquiry-based approach, challenges exist both for students and teachers. For example, the self-directed characteristic of this approach was a point of contention for students and teachers who transitioned from a non-MYP context; they found this approach to be daunting in terms of their teaching and learning. One of the MYP teachers noted that students who recently entered the MYP could not readily understand the purpose of quiet, critical reflection during assessment revision, especially since the MYP does not have an exam-drive culture. Similar findings have been previously reported by recent MYP students from a Turkish international school with respect to the cognitive requirements of the participating the programme (O'Boyle, 2009). Moreover, this finding is consistent with previous research comparing students in other IB programmes (e.g., DP), with their non-IB peers. For example, ACER (2015) found that teachers perceived students who were not previously enrolled in the MYP were lacking in the critical thinking skills that are essential for success in the IB DP.

For teachers, a pre-requisite for successfully delivering the MYP involves a considerable shift in pedagogy and assessment, and this is even more relevant for educators in contexts where training has primarily been teacher-centred (Hill, 2001). Supporting this view, Grewal (2001) noted that engagement with the MYP requires a revision of personal beliefs and necessitates critical reflection for teachers transitioning from a non-MYP context. However, given the non-prescriptive nature of the MYP, schools are permitted to tailor their objectives, content and assessment to the school context (Sperandio, 2010). Thus, the MYP experience for teachers is as much an inquiry-based, self-directed process as it is for students. However, the openness of this characteristic is such that it permits integration of local (national) and MYP curriculum in a way that may not maintain fidelity of MYP implementation, as was highlighted by one of the participating schools from Norway. More specifically, this school indicated there was a legal requirement to offer the Norwegian local curriculum within the MYP framework, which did not permit them to be as flexible in their approach when compared with implementing the MYP curricula on its own. Similar requirements are also observed in Australian MYP schools as mandated by local curricula authorities; although based on the interviews in the current study, this is seemingly more lenient in Australia compared to Norway. Moreover, teachers/coordinators in Norway indicated that they changed the structure of the

programme by offering additional weeks of a subject area beyond that recommended by the IB. This could interfere with the requirement for MYP subjects to have at least 50 hours for each subject group (IBO, 2022c). In other instances, considering time-constraints and the content-heavy nature of documenting step-by step processes, teachers choose to reduce the depth with which students engaged in these documentation activities.

However, to ensure that the MYP is implemented with as much fidelity as possible to observe the expected outcomes, more guidance is needed from the IB on how schools can facilitate critical thinking (Burris et al., 2008). Taken together, the current and previous findings confirm high self-directed expectations within the MYP, but it is also worth considering how these expectations can be balanced, and how professional development opportunities can be effectively leveraged to protect: (a) the fidelity of the MYP implementation to secure the effectiveness of the IB methodology for developing critical thinking; and (b) the well-being of teachers and students who are unfamiliar with the MYP, to develop confidence with engaging in an inquiry-based approach (Dickson et al., 2018; Durlak, 2016; Suldo et al., 2009; Suldo et al., 2013).

Project-based learning

A second type of approach to learning within the MYP that is aimed at facilitating critical thinking is project-based learning. Previous studies have identified project-based learning as most beneficial within a constructivist learning environment that includes both collaboration (i.e., scaffolding between the teacher and learner and between learners) and self-directed learning (Bhattacharjee, 2015; Evans et al., 2018; Hmelo-Silver, 2004; Vygotsky, 1980; Yew et al., 2011). Within the MYP, project-based learning serves as one of the hallmarks of assessment and includes the student-led community (MYP 4) and personal (MYP 5) projects. Students in the current study reported on their experiences with these projects, where applicable, emphasising that successful engagement with the projects required re-organisation of their thinking in a way that was not only critical but also realisable. Moreover, several teachers shared that the entire process was a critical thinking project. Teachers and students alike credited an explicit and widely shared criterion-based assessment guide, in which effective feedback was provided, as contributing to the ways these projects facilitate critical thinking.

Previous research has examined the role of a range of factors, including a shared, explicit assessment language and feedback, in advancing critical thinking (Abrami et al., 2015). Teachers and MYP coordinators in the present study identified the role of explicit assessment language and formative feedback as instrumental to critical thinking development. This is consistent with studies which have found that teachers and school leaders have positive perceptions of the IB assessment frameworks and practices, as well as a positive role of explicit instruction in the development of critical thinking (e.g., Abrami et al., 2008; 2015; Marin & Halpern, 2011). Visser (2010), who studied IB assessment across Australia, Netherlands, Canada and USA, found that several teachers and MYP Coordinators rated assessment as the best component of the MYP. Moreover, in their study across 54 countries, Wright et al. (2016) identified that 70% of the IB coordinators considered access to a range of explicit assessment tools within the MYP as being invaluable. However, before discussing the ways in which an explicit assessment language was reported in the current study, it is useful to first contextualise it within the broader field of assessment, given the robust relationship between teaching, learning and assessment processes (Biggs & Tang, 2010).

Generally, scholars have advanced the concept of assessment from three viewpoints – assessment of learning, assessment for learning, and assessment as learning. Assessment of learning is summative, which means that it is administered close to or at the end of teaching and learning (Harlen, 2007). Assessment for learning is more formative in nature and occurs often throughout the teaching and

learning process (Black & Wiliam, 2018; Wood, 2018). Finally, assessment as learning advocates for students to be more self-directed and therefore more responsible for their own learning and assessment, often leading to them to strengthen higher-order processes, including critical thinking (Earl, 2013). A well-evidenced way to foster critical thinking is through assessment, which teachers require to determine learning needs. Scholars show that students who participate in critical thinking assessments are more equipped to distinguish between fact and opinion, with over 4,000 studies showing that effectively implemented assessment doubles students' learning speed (OECD, 2021; Popham, 2011). There is also a realisation that assessment and the provision of explicit feedback that considers individual differences improve the quality of learning outcomes. But, to maximise its effectiveness in strengthening students critical and reflective capacities (e.g., Hoseinzadeh & Shoghi, 2013; Neuenhaus et al., 2018), and given the social nature of the feedback process (Carless, 2006), the language of feedback should reflect the contextual realities of students, and in the case of the present study, teachers employed a range of personalised instructional strategies to accommodate differences in English Language ability, cultural background, and confidence with self-directed learning, especially for students who had only experienced teacher-led approaches in national curriculum contexts. In addition, teachers offered explicit feedback according to the MYP's criterion-referenced strands and descriptors, which were familiar to students. But what makes explicit instruction and feedback effective, particularly in the development of critical thinking? Part of the answer rests in the cognitive load theory, which is informed by the science of learning (Sweller, 2019).

In this context, Sweller (2019) explains that instruction (and by extension feedback) should be explicit because we have evolved to learn directly from other people via the borrowing and organising principle, as this reduces the load on working memory. Presenting information in an explicit manner that is organised to reduce load on working memory resources, especially when learning novel, complex information, such as how, when and why to be critical, is especially beneficial for students with learning difficulties or from linguistically diverse backgrounds (Chen et al., 2018; Siregar, 2021). Once the information has been exchanged and passed to long-term memory, limitations in working memory are reduced and students are able to transfer the feedback to working memory for it to be actionable. By aligning instructional experiences with this cognitive architecture, Sweller (2019) posits that the learning of skills will be enhanced. By this token, the MYP, through its clear criterion-referenced descriptors and strands that are used for project-based assessments (e.g., MYP personal project), provides its students and teachers with a shared, explicit language to engage in this borrowing and organising process, thereby strengthening the development of critical thinking. In addition, students in the present study named INS, and particularly the History unit, as being the main contributor to the development of their critical thinking. As a reminder, INS is the only unit in the MYP that explicitly mentions the term 'critical thinking' in its assessment criteria (see Figure 2). It may well be that this explicit language and, therefore, instruction in the INS unit has positively impacted students' cognitive processes in the way Sweller (2019) described above. However, challenges with assessment in IB programmes have also been identified. For example, in the Netherlands, Visser (2010) reported that 9 out of 21 teachers found it difficult to create MYP assessments. This finding aligns, in part, with some of the findings of the current study, as, although the MYP assessment criteria are well-defined and explicit, they are also sometimes viewed as inflexible and therefore time-consuming for assessment.

Connected learning

Finally, connected learning, which boosts cognitive capabilities (e.g., Hamza-Lup & Sopin, 2008; Kaklanis et al., 2015), was reported by teachers and students in the present study as facilitating critical thinking, primarily through references to interdisciplinary learning or cross-curricular connections. For

example, students identified that they could both connect and transfer their learning of important practices from the INS unit, including source analysis, to enable more critical analysis and synthesis across other subject areas. MYP teachers and coordinators also reported that connected learning was leveraged in a way that permitted them to better manage time on task: they recognised that critical thinking strategies learnt in INS, for example, permitted students to more quickly engage and complete tasks requiring evaluation and analysis. This finding of a positive role for cross-curriculum, connected learning is consistent with previous findings that MYP participation allows students to make deeper connections between content and, therefore, strengthen their reflective and thinking process; these findings have been observed in a range of diverse MYP contexts, including Australia, Sweden, Turkey, Spain, UK, and the UAE (Ateşkan et al., 2016; Perry et al., 2018; Sizmur & Cunningham, 2012; Stevenson et al., 2017; Valle et al., 2017; Williams, 2013). However, one of the important considerations in connecting learning to strengthen critical thinking is the importance of having access to the language of MYP instruction (i.e., English) in participating schools. This was a particular challenge for schools in Norway and a participating school in England where the composition of students enrolled in the MYP had a substantial proportion of English as an Additional Language (EAL) learners. However, in England, a solution to this was to offer critical thinking instruction in the students' first language in the initial stage until students became proficient in the English Language, which supports the importance of accommodating individual differences and diverse linguistic backgrounds to facilitate critical thinking.

Interestingly, another way that connected learning can be conceptualised is by teachers connecting their own learning experiences with their colleagues through unit planning, within and across subject areas. Given that interdisciplinary, connected learning is a core area in the MYP (Tarc, 2009), in the present study, we observed that teachers prioristised collaborative unit planning sessions across subject domains, and as emphasised by a Norwegian MYP coordinator, the IB actively encourages cross-curricular collaborations of this nature. This also presents teachers with opportunities to share resources they have found through social media (e.g., Instagram), although previous research notes that more research is needed on how teachers interrogate the evidence-based nature of online resources (Sawyer et al., 2020; Schroeder & Curcio, 2022). Moreover, Visser (2010) has previously identified that it is quite commonplace for MYP teachers and coordinators to develop curriculum and agree on teaching strategies and assessments. In support of this, Gibb (2014) found that the MYP coordinators work together with senior management to organise professional development activities for staff members in a collaborative manner. Similarly, we observed in the current study that some schools employed instructional rounds to organise data-driven professional development sessions for their colleagues, aimed at explicitly connecting critical thinking strategies across a variety of subjects. At the same time, teachers in our study reported that although there is valuable professional development through teacher collaboration, there is scope to improve access to MYP resources for teaching and assessing critical thinking. For example, several teachers and MYP coordinators suggested that it would be useful to access a bank of evidence-informed, cross-curricular critical thinking exemplars, ideally designed specifically for their own contexts. Similarly, an MYP teacher, who is also a DP teacher, recommended that it could be helpful to extend training to all MYP teachers on the Theory of Knowledge (TOK), a DP subject that is promising in facilitating critical thinking (e.g., Hopfenbeck et al., 2020).

Previous findings have indicated that, despite these professional development sessions and collaborative activities, some teachers do not always implement the MYP methodology with fidelity for several reasons, including time-related or culture-related constraints (e.g., Pendergast et al., 2014). In fact, although teachers in the current study seemed to implement the MYP principles in the manner suggested by the IB, teachers did mention that the process-oriented and "document everything"

nature of the MYP reduces students' motivation to want to use their critical thinking. This was particularly true of subjects such as Design, where there is a requirement for students to document, in written form, step by step decisions before they commence the creative process. By contrast, the expectation for students to document processes is less of a requirement in other subjects, such as Languages and Literature. It would be prudent for future research to explore this concern in greater detail and recommend practical strategies for documentation to ensure that teachers are implementing the MYP with high fidelity (Bishop et al., 2014; Durlak, 2016; Hansen et al., 2013). Nevertheless, the IB offers professional development training with the expectation that this will maintain accountability and fidelity with MYP implementation, as there will be clear standards across schools to ensure teachers are sufficiently equipped to facilitate critical thinking. But there is scope to consider how the IB might work with schools to develop additional opportunities to co-construct learning useful resources and professional development sessions in a way that is most meaningful for teachers in particular contexts.

6.4 Limitations and Future Directions

While the results generally suggest an advantage in critical thinking for MYP students compared with their non-MYP peers, it is valuable to remember that MYP students, teachers and coordinators have expressed a range of concerns, and have advanced recommendations to improve the MYP experience, and by extension, to strengthen critical thinking among students. One of the key recommendations from the teachers and coordinators' views was to increase the support provided in the form of resources. In fact, several teachers expressed that the DP has a wealth of resources, but this is not the case for the MYP. Given this gap, it could be promising to conduct a study that evaluates the availability of critical thinking resources in the MYP as well as to document promising strategies that teachers are implementing in their own classroom to facilitate critical thinking. The outcome of this study could be very practical such that teachers could access these resources through an online platform (e.g., IB resource portal/My IB). Another consideration in this context could be that critical thinking, as a multi-dimensional construct, is explored in terms of critical thinking practice, which has been argued to be different to critical thinking skills (Tunjungsari & Takwin, 2021).

Although the MYP affords the opportunity to flexibly implement the curriculum, there are key processes and principles that guide implementation to ensure effectiveness and fidelity in learning outcomes. However, given that teachers in the current study have expressed that a challenge with specific subjects lies in the requirement to provide detailed documentation of processes, it would be prudent to explore if and how any adaptations to the programme have been made, especially in contexts where teachers are time/resource poor. Moreover, in the current study, we learnt that one of the schools in Norway has devised a new approach in which students collaborate with their teacher in the writing of their final report cards, as "*there's zero evidence to suggest that [the traditional model of just teachers writing to parents] helps students in any way*" (Teacher 37, MYP Coordinator and Individuals and Societies teacher, Norway). Importantly, the teachers from this school emphasised that they are currently "experimenting with this" and "in theory" this would help students with their thinking skills (Teacher 37, MYP Coordinator and Individuals & Societies teacher, Norway). Similarly, one of the schools in England noted that they are currently discussing within the context of the MYP, "*what kind of [assessment] framework can we use that is quite flexible for everyone [students] who has a different starting point [with their critical thinking achievement]*" (Teacher 41, MYP Coordinator and Science teacher, England). Indeed, although it is not unusual for programmes to vary in their implementation based on location and context, it would be useful for the IB to have detailed insight into these adaptations, including an evaluation of what, if any, positive or negative impacts these adaptations may have on the development of critical thinking skill and practice (Durlak, 2016).

As is often the case with complex, multi-country studies such as this one, there are several limitations that would ideally be addressed in future research. With respect to students' social, cultural, and economic backgrounds, we adopted two measures including the collection of data from students about the number of books in their household and from their parents about their education levels. In the context of the current sample and the large gender imbalance in the IB and non-IB sample, the use of the former indicator is of concern, as previous research has shown a gender bias in responses to questions about books at home, and specifically, females have been found to report higher number of books when other evidence suggests they are of a similar social background to their male counterparts who reported lower numbers (Engzell, 2021). In addition, we designed the current study to collect data about parental education level, as parents are more accurate in their responses compared with those provided by their children, but the response rate was too low for this variable to be included in the analyses (Engzell & Jonsson, 2015). Low response rates from parents about their educational background is not uncommon, with Engzell and Jonsson (2015) finding that in parent samples "missing data are almost entirely due to unit nonresponse: failure to respond altogether" (p. 317). Although we sought to collect data directly from parents about their level of education through a short (less than 5 minutes) questionnaire, our experience is consistent with Engzell and Jonsson (2015). Therefore, future research should attempt to have a greater gender balance in the recruitment of IB and non-IB samples and endeavour to obtain a range of socio-cultural and economic background indicators, as this factor is crucial in ensuring the propensity score matching procedure includes all relevant variables.

Finally, it is important to note that since the study was conducted within the context of the COVID-19 outbreak, there were disruptions to readily accessing IB schools within the targeted authorisation year as initially planned (authorisation no later than 2017). Moreover, while recruitment was generally successful, it was difficult to secure Grade 9 students from non-IB schools in Norway, which left us with no representation from this year level as was part of the initially intended research design. This was also partly due to one of the schools in this context having to withdraw because of emerging pandemic related constraints. Consequently, this could have contributed to the less effective matching for the Norwegian sample, and means this country was not present in the Grade 9 only analysis. Therefore, the matching procedure could be further enhanced by ensuring that all sub-groups are well represented across the different grades and countries.

6.5 Conclusion

All participating MYP schools, including teachers, coordinators and students, perceived that participating in the MYP, and particularly when the MYP is implemented with fidelity, confers an advantage in critical thinking. This perception was supported by the results of our quantitative study, which showed that MYP students held an advantage in critical thinking skills relative to their matched, non-MYP counterparts. In addition, through the qualitative component of our study, we uncovered a range of benefits of the MYP implementation for the development of teaching and assessment aimed at developing critical thinking. Across each of the three contexts – Australia, England and Norway – MYP coordinators, teachers and students reported positive developments in critical thinking because of participation in the MYP. Teachers and MYP coordinators reported that through a self-directed approach, students were given the space and time to reflect on their own thinking processes and themselves as independent thinkers and learners, and although it was a challenge for some students to drive their own learning process in this way, teachers noted that these skills become stronger as students spent more time in the MYP. Nonetheless, future research is required to address several limitations in the current report, as well as to elaborate on several suggestions raised by students, teachers and coordinators regarding their experiences of the MYP.

Overall, across the document analysis, quantitative comparisons, and qualitative interviews, this report provides encouraging evidence that the IB MYP contributes to students' critical thinking skills by embracing evidence-based, student-centred pedagogical approaches. This research serves not only as an important evaluation of the effectiveness of the MYP but provides vital insights into students' and teacher's perceptions of the role of pedagogy and classroom practices in facilitating and supporting critical thinking development. Given the increasing importance of critical thinking as a graduate attribute, as highlighted in the IB Learner Profile, it is vital that we continue to robustly evaluate how educational systems can best improve students' critical thinking through their classroom practices, and the present study generally supports the features and practices of the MYP in this respect.

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Appendices

Appendix 1: Interview schedule for Middle Years Programme teachers + MYP Coordinators

Many thanks for agreeing to participate in the interview. This will be very helpful for our research to better understand how critical thinking is taught and assessed in the Middle Years Programme. I am interested in your experience as a teacher and/or coordinator as you prepare students for their internal and external examinations. All responses and personal data will be handled with strict confidentiality and will be destroyed as soon as it is no longer needed for research purposes. Your name and that of your school will not appear in any reports. Feel free to skip questions or withdraw from the interview at any time. I would like to record the interview to facilitate data collection. Do you mind if I record our conversation?

Questions about courses in the MYP

1) What skills do you think the MYP helps students to develop?
    a. Think about the approaches to learning skills. How well do you think the MYP helps students to develop these skills, especially their thinking skills?
2) What is your understanding of critical thinking?
3) To what extent do you think the MYP helps students to develop their critical thinking?
    a. Can you give an example?
4) How do you assess critical thinking within the MYP?
    a. What type of feedback do you give students on their critical thinking?
5) How is the Individuals and Societies course delivered at your school?
6) To what extent do you think the Individuals and Societies course helps students to foster critical thinking?
    a. How do you think the Individuals and Societies course helps students to foster critical thinking?
7) How well do you think students engage with the Individuals and Societies course?
    a. Can you give an example?
8) Can you describe challenges associated with teaching, learning and assessing critical thinking in the MYP course?
9) To what extent do you think the guidance you are provided for teaching and assessing critical thinking helps you in preparing students for their internal examinations and for the MYP assessment?
    a. What other support would you require?

Questions about the MYP project and eAssessment

1) What skills do you think students develop by engaging with the personal or community project?
2) How do you find the courses that prepare students for their assessments (e.g., MYP assessment, if applicable)? Can you elaborate?
3) To what extent do you think the MYP assessments help students to develop their critical thinking

   a. Can you give an example?
4) How well do you think students engage with the MYP eAssessment?
5) Can you describe challenges associated with the MYP eAssessment?
6) To what extent do you think the guidance you are provided for teaching components involved in the MYP eAssessment helps you in preparing students for completing the MYP eAssessment? What other support would you require?

Thinking back on our interview conversation, is there anything else you would like to add that you believe is of importance?

Note. Questions about the MYP eAssessment will only be relevant to schools who have opted to engage with this optional assessment.

Appendix 2: Interview schedule for Middle Years Programme students

Many thanks for agreeing to participate in the interview. This will be very helpful for our research to better understand how critical thinking is taught and assessed in the Middle Years Programme. I am interested in your experience as MYP students. All responses and personal data will be handled with strict confidentiality and will be destroyed as soon as it is no longer needed for research purposes. Your name and that of your school will not appear in any reports. Feel free to skip questions or withdraw from the interview at any time. I would like to record the interview to facilitate data collection. Do you mind if I record our conversation?

Questions about courses in the MYP

1) What skills do you think the MYP helps you develop?
    a. Think about your approaches to learning skills. How well do you think the MYP helps you to develop these skills, especially your thinking skills?
2) What is your understanding of critical thinking?
3) Think of an example in a subject of your choice where the teacher helped you to develop critical thinking.
    a. How well do you think the MYP helps you to become a critical thinker? Can you elaborate?
4) How do you find the Individuals and Societies course? Can you elaborate?
5) How well do you think the Individuals and Societies course helps you understand other subjects/courses?
    a. Can you give an example of a concept or a subject you understand better because of what you covered in the Individuals and Societies course?
    b. Can you give an example of how the Individuals and Societies course helps to develop your critical thinking?

Questions about the MYP project and eAssessment

6) What skills do you think your personal or community project helps you develop?
7) Think of an example of how your personal or community project helps you to develop critical thinking. Can you elaborate?
8) How well do you think the MYP prepares you for doing your MYP project?
    a. Can you specify what you found helpful or unhelpful?
9) How well do you think the MYP prepares you for doing your MYP eAssessment?
    a. Can you specify what you found helpful or unhelpful?
10) How do you find preparing for the MYP eAssessment? Can you elaborate?
11) How do you think preparing for the MYP eAssessment provides you with skills that support the learning of other subjects?
    a. Can you give an example of skills and specify the subjects they supported?

Thinking back on our interview conversation, is there anything else you would like to add that you believe is of importance?

Note. Questions about the MYP eAssessment will only be relevant to students who have opted to engage with this optional assessment. Consequently, and when possible, the research team will

ensure that a student who has opted to engage with the MYP assessment is included in the student group interview.

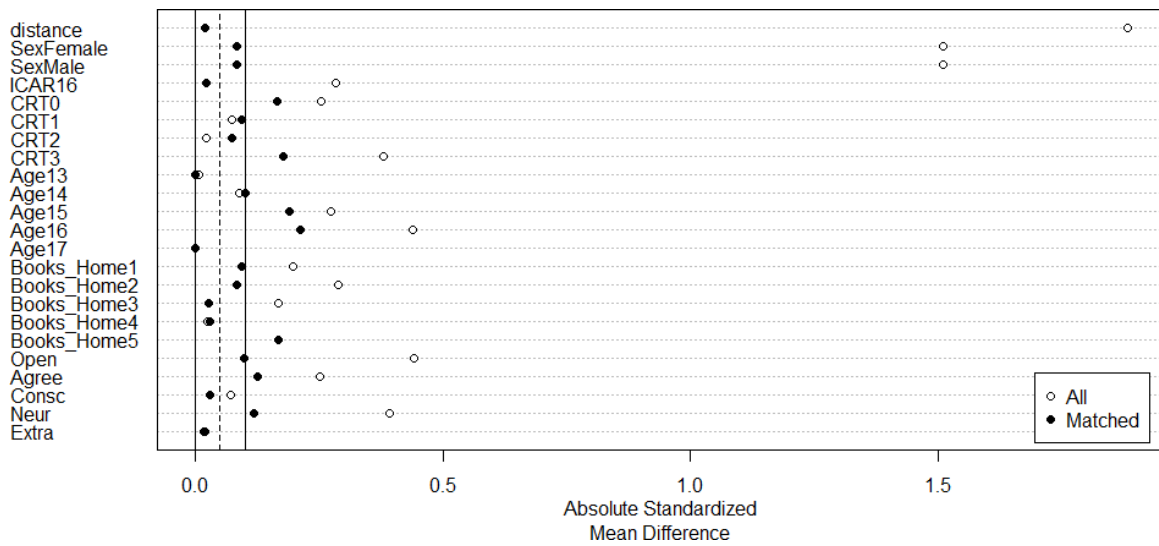## Appendix 3: Matching quality by Grade and Country

Figure A3.1. Results of the full matching procedure for the Grade 9 sub-sample showing the differences in the covariates between the IB and non-IB groups before and after matching
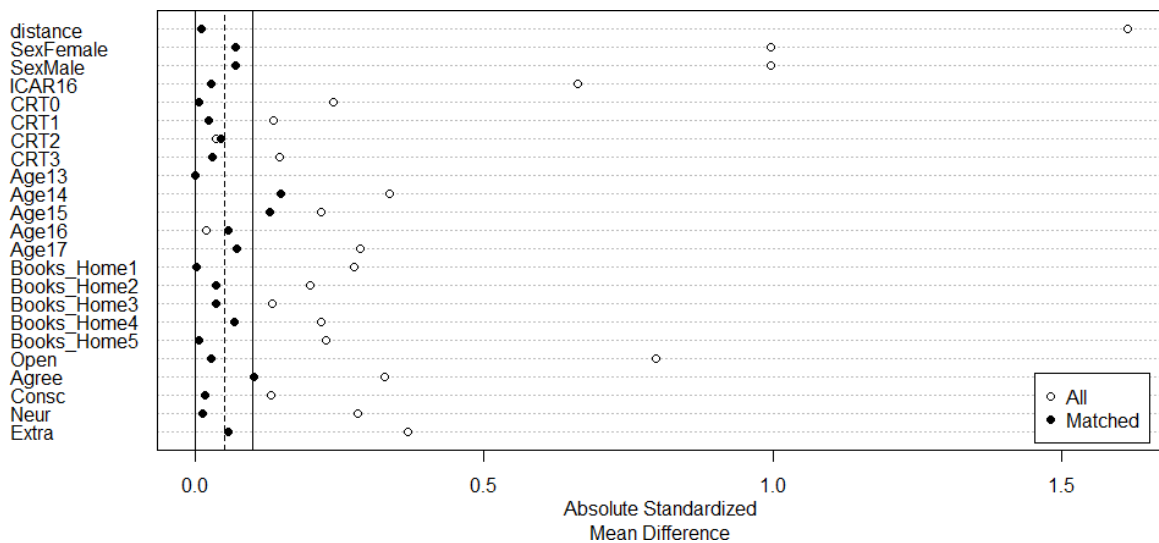

Figure A3.2. Results of the full matching procedure for the Grade 10 sub-sample showing the differences in the covariates between the IB and non-IB groups before and after matching
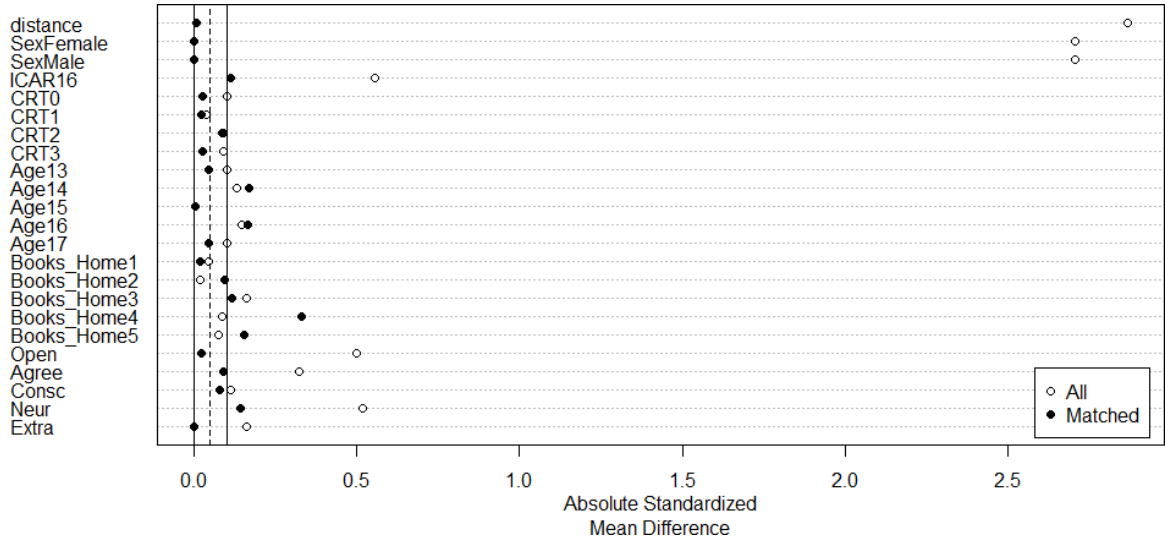
Figure A3.3. Results of the full matching procedure for the Australian sub-sample showing the differences in the covariates between the IB and non-IB groups before and after matching
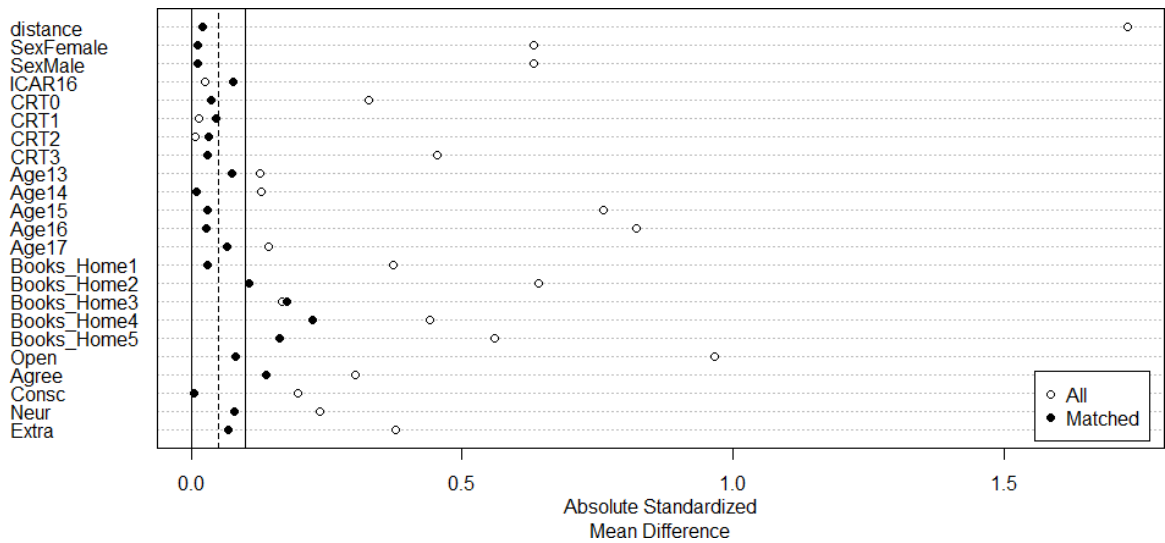

Figure A3.4. Results of the full matching procedure for the English sub-sample showing the differences in the covariates between the IB and non-IB groups before and after matching
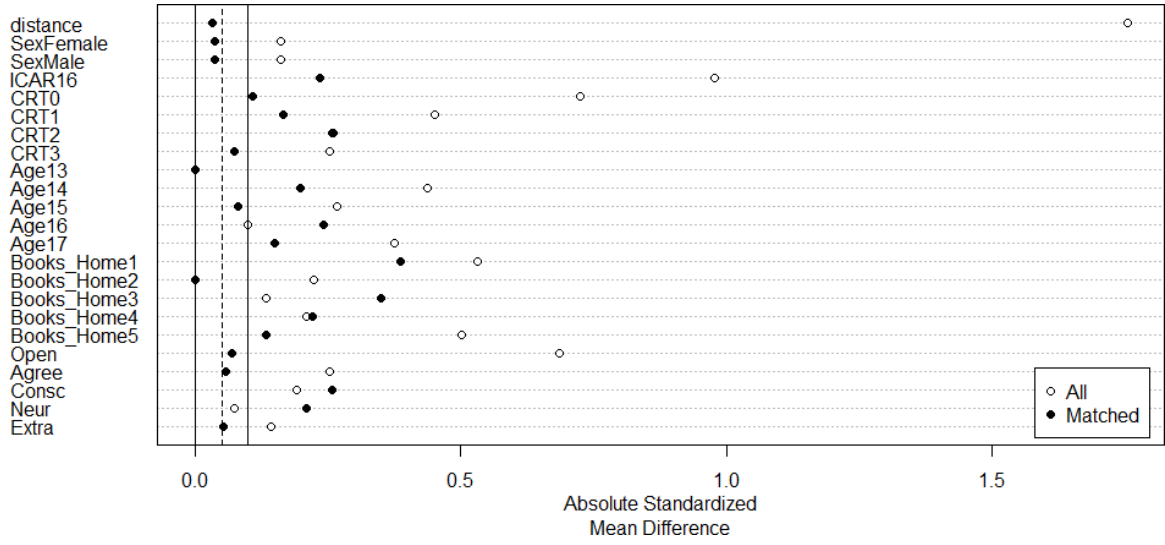
Figure A3.5. Results of the full matching procedure for the Norwegian sub-sample showing the differences in the covariates between the IB and non-IB groups before and after matching

Appendix 4: Coding guide for MYP coordinators/teacher and student interviews

Themes & Codes	Description
Principled Action	**This refers to the active (authentic) opportunities that are implemented to ensure that students actively engage in and use their critical thinking.**
Ethos of thinking	Opportunities to strengthen thinking in relation to: • oneself (metacognitive awareness and reflection on choices/decisions); • others (critical spirit about the lived experiences about others, including being intellectually curious, flexible, open-minded, and autonomous); • the world and general life experiences (being critical about events across the world and one's own lived experiences).
Interdisciplinary learning	Any mention of specific combinations of subjects that facilitate critical thinking; this also involves application of ideas to different/multiple contexts
Concept-driven and contextualized curriculum	Any mention of specific concepts (or reference to concepts) to foster deep learning experiences within personal and global contexts
Distinct features of academic subjects	Any mention of specific components/features of subjects that facilitate critical thinking; if a concept is mentioned without specifying a subject, this is viewed as general and is coded under a relevant area in the understanding the nature of language section/assessment and accountability section
Action as an outcome	Any mention of inquiry-based, self-directed approaches in which students engage in authentic projects connected with real-world learning and outcomes
Understanding the Nature of Language	**This refers to explicit instruction focused on the critical development of five language skill areas: listening, speaking, reading, writing, and presenting, including understanding different languages to be able to engage in these skills within varied linguistic contexts**

Critical listening	Instruction in and opportunities to engage in careful, systematic thinking and reasoning to see whether a speaker's message makes sense.
Critical speaking	Instruction in and opportunities to avoid/reduce ambiguous statements in speaking, as well as avoid personal biases when orally communicating viewpoints. An active/interactive critical audience (e.g., peers) is not necessary and therefore this is distinguished from critical presenting (see below)
Critical reading	Instruction in and opportunities to both understand and evaluate text-based information; to identify underlying/unstated messages and ideologies in different sources of information
Critical writing	Instruction in and opportunities to analyse and evaluate information, usually from multiple sources, to critically develop a written argument; can also include the development of written plans in a critical way
Critical presenting	Instruction in and opportunities to present and practice presenting a project plan, including its value, or project details/product design to an active/interactive critical audience who will provide feedback
Multi-lingualism	Opportunities to learn different languages (and by extension cultures) to facilitate access to various worldviews, gain cross-cultural awareness and understanding, and nurture perspective taking and open-mindedness
Assessment and Accountability	**This theme includes the assessment of critical thinking as well as accountability measures implemented to secure the quality assessment of critical thinking**
Explicit assessment language	This refers to shared assessment language between teachers and students (e.g., types of assessment, rubrics/criteria, explicit feedback about critical thinking)
Assessment fidelity	This refers to use of pragmatic-oriented assessment policy to ensure assessment fidelity
Assessment readiness	This refers to any opportunities to address challenges to the teaching/learning/assessment of critical thinking (for teachers and coordinators) OR opportunities to prepare to critically engage in completing assessments (for students)
Background knowledge	Formative or summative assessment opportunities to expand understanding/meaning of concepts in an area of learning (e.g., opportunities for scaffolding and building pre-existing knowledge)