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IB literature review

Curriculum integration in the International Baccalaureate Middle Years Programme: Literature review

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1. Background of the IB Middle Years Programme

The International Baccalaureate (IB) Middle Years Programme (MYP) is a curricular programme aimed at learners aged 11–16. The programme was offered in approximately 900 schools worldwide in 2012 (IB 2012b). Structurally arranged into eight subject groups, the programme is guided by three fundamental concepts or principles: communication, intercultural awareness and holistic learning.

Within the eight subject groups currently offered in the MYP, there is not only an emphasis on a learner gaining knowledge but also on “the understanding of concepts, the mastery of skills and the development of attitudes that can lead to considered and appropriate action” (Hayden and Thompson 2011: 15). These objectives are provided within five areas of interaction and are moving toward global contexts in the current review of the programme, as reported in *FAQ-MYP: The Next Chapter* (IB n.d.).

One facet of the MYP has always been interdisciplinary learning—IB World Schools offering the MYP have had a responsibility to transition from the use of transdisciplinary themes in the PYP to interdisciplinary understandings in the MYP (IB, 2008). As the MYP undergoes revision, a literature review has been conducted to investigate interdisciplinarity, multidisciplinary, and transdisciplinarity in various contexts and to explore curriculum integration as an approach that might relate to the fundamental concepts of the MYP.

2. Purpose of the review

This literature review is guided by three research questions.

1. What is the nature of interdisciplinarity, multidisciplinary, and transdisciplinarity in education? How are the interdisciplinary, multidisciplinary and transdisciplinary approaches to curriculum different from each other?
2. What is curriculum integration? How do the principles underpinning curriculum integration relate to the fundamental concepts of the MYP? To what extent could curriculum integration be suggested as an appropriate approach to interdisciplinary (or integrated) curriculum development?
3. How are the principles of curriculum integration transferred into practice in the development of secondary education?

The aim of the literature review is first to define the terms integrative, interdisciplinarity, multidisciplinary and transdisciplinarity in education as well as to identify any common ground between these approaches in the MYP. Second, the review seeks to define curriculum integration and explain why it could be considered an effective approach to the interdisciplinary curriculum development required in the MYP. This analysis will consider the development of the middle years learner as these issues are explored. Finally, the literature review will provide subject examples of curriculum integration that can be used as a guide for professionals in the classroom.

3. Strategy of the review

As a literature review is “not a summary of the various studies but rather an integration of reviewed sources around particular trends and themes” (Glesne 2006: 26), the strategy for this review has been to locate, identify and summarize relevant resources, and then consider resources for inclusion based on their ability to answer the research questions (see “References”). Sources were

located using a combination of electronic and print resources. Researchers obtained sources for the literature review from the following places.

- Books: George Mason University Libraries Catalog
- Articles: Electronic databases including Academic Search Complete, Education Research Complete, ERIC, Psychology and Behavioral Sciences Collection, EBSCOhost, JSTOR, International Education Research Database (IERD)
- Google Scholar

Using the research questions as a starting point, the review refined the search terms as emerging themes became clear. The review focused on K–12 education, and generally rejected those papers that discussed technology integration (akin to discussing integration of paper and pens into curriculum, but can assist with integration) and religious studies integration. Researchers gave preference to articles that focused on the middle years. The review also actively looked for negative examples.

4. Defining the terms

Because the literature review deals with curriculum integration, a search of the term *integrative* was conducted. Additionally, the terms *interdisciplinarity*, *multidisciplinarity* and *transdisciplinarity* were searched as they are directly related to the themes in question. Choi and Pak (2006) conducted an extensive review on the terms interdisciplinarity, multidisciplinarity and transdisciplinarity and found that they were ambiguously defined and often used interchangeably both in health and education research. Their literature review utilized a variety of sources, including several United States (US), United Kingdom (UK) and Canadian dictionaries, online dictionaries, Google and MEDLINE searches. Each term, as defined by Choi and Pak (2006), has its own specific meaning and purpose, and therefore, should not be used interchangeably. Rosenfield (1992) and Klein (1990) were two additional researchers referred to in order to construct how these terms differed from one another in education.

4.1 Integrative

The term comes from the root word *integrate* meaning “to render something whole” (Harper 2012a, para. 1). This meaning of the word dates back to the 17th century. The term was found in education, business, medicine, and engineering journals with the definition of combining disciplines or bringing multiple areas together (Beane 1991; Carr et al 1995; Barber, Borin, Cerf and Swartz 2001; Benjamin et al 2007). Despite the various uses across subjects, the term *integrative* implies the blurring of boundaries between subjects, with the intent of learners increasing knowledge by incorporating the study of multiple disciplines to solve a common problem or project. Given this, an integrative approach to curriculum rather than separate subject isolation makes sense for students (Brazee and Capelluti 1995; Nagel 1996).

4.2 Interdisciplinarity

The term *interdisciplinarity* was found in all three country’s dictionaries—the US, Canada and the UK. The dictionaries provided a definition for the prefix inter- to mean among, but otherwise provided very little differentiation between the three terms. Originally from Latin, inter- means “among, between, betwixt or in the midst of” (Harper 2012b, para. 1). In French, inter- changes to entre-. Ultimately, interdisciplinarity is defined as a term that analyses and synthesizes links between disciplines into a coherent whole (Choi and Pak 2006). Interdisciplinarity is distinguishable from multidisciplinarity and transdisciplinarity because it establishes a new level of discourse and an integration of knowledge (Choi and Pak 2006). Klein (2006) further clarifies this definition by identifying the purpose, which is to help the learner focus and blend information. Interdisciplinary thinking is also considered a complex skill that integrates disciplinary knowledge to produce an additional product that would have been unlikely through single discipline means (Miller and Boix-Mansilla 2004; Spelt, Biemans, Tobi, Luning and Mulder 2009).

4.3 Multidisciplinarity

Multidisciplinarity is defined only in the US dictionary, which may suggest that this term most likely originated in the US. However, an online dictionary search provided four results, including the term itself, but these were still very vague, using brief descriptions of the word, such as “of” and “involving several disciplines” (Choi and Pak 2006: 352). The dictionary defined the prefix multi- as meaning many and more than one. The etymology of multi- is Latin, and the prefix is derived from *multus* meaning “much, many” (Harper 2012c, para. 1). However, Klein (2006) further expanded the term multidisciplinary as approaches juxtaposed to other disciplines, adding breadth along with information and methods, while disciplinary elements remained intact. In the teaching and learning context, Rosenfield (as cited in Choi and Pak 2006) also stated that multidisciplinary teams work in parallel from their specific disciplinary bases to address common problems. Multidisciplinarity is unique from the other two terms because it draws on comprehension and information from many disciplines, yet it stays within its discipline’s boundaries (Collin 2009).

4.4 Transdisciplinarity

The term *transdisciplinarity* was not found in any of the three countries’ dictionaries, which suggest that this is a relatively new term in the field of education (Choi and Pak 2006). The prefix trans- also comes from Latin and is defined as across, over, beyond and through (Harper 2012d). Transdisciplinarity is a complex approach in that it involves members of various disciplines using a shared research framework uniting discipline-specific theories to address common problems (Collin 2009). It encourages disciplinary boundaries to intersect so that information can be reassembled and then recombined. This term uniquely allows for an emergence of new perspectives, while new knowledge gained from it can transcend through existing disciplines (Choi and Pak 2006). Transdisciplinarity encourages intercommunicative action among participants and contributions from its members to generate knowledge that not only addresses societal problems, but contributes to an understanding of the actual world (Lawrence and Després 2004). Another movement has been transdisciplinarity as a form of research with the purpose of crossing discipline boundaries to identify, develop, and analyse problems in research (Jantsch 1972).

4.5 Differences between the terms

Choi and Pak (2006) selected familiar everyday words like additive (increase), interactive (producing action on each other) and holistic (producing an object which is greater than the sum of its parts), in order to capture the meaning of multidisciplinary, interdisciplinarity and transdisciplinarity. To explain the differences and relationship between the terms and their application to teaching and learning, Choi and Pak (2006) stated that “multidisciplinarity is like a salad bowl, interdisciplinarity is like a melting pot, and transdisciplinarity is like a cake, in which the ingredients are no longer distinguishable, and the final product is of a different kind from the initial ingredients” (p 360). In Miller and Boix-Mansilla’s (2004) definition of interdisciplinary work, individual disciplines are considered seriously, deeply connected, and then because of the depth of the connection between disciplines, new questions emerge that, in turn, solve the original question posed. For example, a research team at a university might want to explore grant opportunities for scientific research involving undergraduates. Involved in the project might be faculty from the university’s grant office, a couple of different science departments and the university’s research review board. After considering the various perspectives and questions concerning the feasibility and ethical issues concerned with allowing undergraduates to participate in research, a decision can be reached about the original question. Each member of the team has specific expertise that makes them integral to the complexities of the question and without their perspective the problem cannot be fully considered.

References to both familiar objects and connections to everyday words are helpful in creating meaningfulness in practical terms for educators. The terms interdisciplinarity, multidisciplinary and transdisciplinarity are often ambiguously defined. Therefore, more practical terms (including those common to education) can create clearer boundaries, and educators can use and apply the terms appropriately. Collin (2009) advises educators to use common vocabulary that can be easily understood in order to facilitate successful collaboration with members from various disciplines.

5. Connections to the MYP

MYP: From principles into practice (2008), discusses the curriculum framework for the MYP and is intended to serve as a guide to explain the vision and how multiple discipline approaches should be taught. In the interdisciplinary learning section, the IB describes the term interdisciplinary as:

Students demonstrate interdisciplinary understanding of a particular topic when they can bring together concepts, methods, or forms of communication from two or more disciplines or established areas of expertise to explain a phenomenon, solve a problem, create a product, or raise a new question in ways that would have been unlikely through single disciplinary means (p 67).

This description aligns with Ramadier's (2004) definition of interdisciplinarity, which differs from multidisciplinary:

Interdisciplinarity differs from multidisciplinary in that it constructs a common model for the disciplines involved, based on a process of dialogue between disciplines. For this reason, interdisciplinarity is often implemented within the same disciplinary field and its purpose is to create synthesis. However, the second important aspect of interdisciplinarity lies in the practice of transfers, either of models or of tools (such as mathematics, and statistics) from one discipline to others (p 433).

Some parts of the guide differ in their description of approaches and terms. At certain points, the guide describes a multidisciplinary model and in other sections it describes an interdisciplinary model, for example, "Students will appreciate that subjects are not isolated but complement each other ... this must not be done to the detriment of learning within each subject. Each retains its own aims, objectives, and methodology ... teachers should encourage students to see connections" (IB 2008: 14). This description aligns with the definition of multidisciplinary as stated above. Ramadier (2004) further explains that multidisciplinary belongs to different disciplines and is considered complementary to the process of understanding while Spelt et al (2009) discuss the presentation of multiple perspectives in multidisciplinary instruction. Teaching under a multidisciplinary model also gives teachers opportunities to help students understand connections between subject disciplines (Akins and Akerson 2002). The focus on the complement of the subjects, as stated in *MYP: From principles into practice*, would also be consistent with a multidisciplinary approach.

The MYP curriculum provides a framework to encourage students to embrace and understand the connections between traditional subjects and the real world to become critical and reflective thinkers (IB 2011). Emphasis is on the fluidity of the curricular framework and the interrelatedness of the subjects (IB 2011). The common ground found between these three approaches in the MYP is their connection of multiple disciplines at varying stages on the same continuum (Choi and Pak 2006). The curriculum is structured so multiple disciplines can come together to integrate content with context since real-world problems are rarely confined to the artificial boundaries of academic disciplines. Coursework is often broader than any single discipline and needs examination within a multiple disciplinary framework. In addition, heightened demands for problem-solving have sparked greater interest in collaboration and the ability to work in multiple disciplines (Klein 2006).

The MYP curriculum recognizes the benefits of learning across multiple disciplines and aligns itself with this view. Burton (2001) noted that understanding the frameworks used to construct knowledge in various disciplines could assist in identifying similarities between disciplines and help teachers create interdisciplinary units. For example, Czerniak's (2004) unit about wetlands incorporated activities in language arts, mathematics, technology and social studies. Fogarty (1991) suggested 10 ways that educators might integrate curriculum allowing them to move from teaching single disciplines to multiple disciplines and thus provide students with a richer learning experience. The MYP provides pedagogical tools to foster the integration of content through contextual teaching and learning (the areas of interaction (AOIs) and, later, global contexts). Through this lens, MYP students should become more conscious of the significance of their

learning to real-world problems, and should come to distinguish knowledge, theories, approaches and skills as an interrelated whole (IB 2008).

Real-life problems are complex and require students to refer to their learning as a whole. The MYP curriculum provides a balanced education that will equip young people for effective participation in the modern world (IB 2011). Lam (2006) emphasizes this need because our students are already learning in globalized contexts today and have already cut across the red tape of defined disciplines. Because of this need, the interdisciplinary instruction already taking place in the MYP can be broadened so that students think in terms of conceptual themes and concepts. The distinguishing element of conceptual themes is their ability to reach out to many disciplines and cross subject-matter boundaries (Fogarty and Stoehr 2008). To demonstrate, the concept of patterns can be extended to all academic content. In mathematics, students might study geometric designs or repeating decimals. In science, classes might discuss waves, geologic compositions or genetics. History lessons might focus on the sentiment of history repeating itself or the cycle of a leader. Finally, a physical education class can also discuss the concept of patterns in sport as figure skating has required elements such as the figure eight and American football has formations for each play in the game (Fogarty and Stoehr 2008). Students participate as active players who shape and produce new knowledge while redefining new transcultural contexts of exchange.

While policymakers are busy trying to preserve a nation's competitive edge, students are already engaged in sophisticated learning across national borders outside of the classroom (Fridell and Lovelace 2008). As some have overlooked an educational responsibility of fostering in young people the vision to see the world in more complex and interdependent ways, beyond being able to compete globally, the MYP emphasizes this value. Interdisciplinary learning also leads to student success as Vars (1991) and Beane (1995) noted that students in interdisciplinary/integrative learning environments do as well or better than students who are enrolled in settings where disciplines are taught separately.

The three terms—multidisciplinarity, interdisciplinarity and transdisciplinarity—have different definitions, and therefore, different approaches to teaching and learning. The reason the PYP promotes a transdisciplinary approach is because of the nature of both the curriculum and the nature of elementary education; in elementary schools students usually have one teacher and draw on different content areas/subjects to explore themes. On the other hand, students in the MYP typically have multiple instructors with distinct disciplines. All three approaches—interdisciplinarity, multidisciplinarity and transdisciplinarity—aim to integrate disciplines for a more holistic style of learning. Although students may begin their IB experience in the PYP, which is transdisciplinary, if they continue along the IB continuum, they will move from transdisciplinary learning to interdisciplinary learning in the MYP. Both programmes (PYP and MYP), and even the Diploma Programme through theory of knowledge, encourage students to combine disciplines to broaden their learning and promote deeper understanding. The lack of flexibility in the curricular requirements and framework tends to limit teaching and learning to a multidisciplinary or, at best, an interdisciplinary approach. As aforementioned, multidisciplinarity is unique from the other terms because it draws on comprehension and information from many disciplines, yet stays within discipline boundaries (Collin 2009). Due to the style in which state and/or local standards assess students by subject, teachers are more likely to teach in a way that must retain a good part of its subject-specific identity. Teachers in the MYP work to integrate tools, methods and concepts to achieve both new understandings and student success with different classes of students. This infers that the structure of the IB curriculum frameworks allows school-specific (national and/or state) subject-specific requirements to be met while maintaining the IB mission and philosophy (IB 2008).

6. Curriculum integration

Curriculum integration has existed throughout human existence: cave drawings told stories and provided history through art; likewise ancient Chinese characters and Egyptian hieroglyphics integrated language with art. Da Vinci expressed his belief in interdisciplinary connections when he said, "Painting is poetry that is seen rather than felt," (as cited in Lock 2009). Klein (2005) traces the earliest contemporary use of the term integration to books on psychology by Herbert Spencer

and William James in 1855 and 1896 and, more directly applicable to this study, to Alexis Bertrand's 1898 theory of integrated instruction.

6.1 Definition of curriculum integration

While Gehrke said, "Every curriculum integration author seems to need to provide a new definition, slightly different from any other—perhaps to help establish good reason for doing another book or article at all" (1998: 255), Chrysostomou (2004) held that "many educators arranged all the different possible levels of integration along a continuum" (p 24). However, some researchers and scholars suggest that these can be divided into a dichotomy of two competing definitions: one maintains the integrity of disciplines and is often referred to as inter-, multi- and cross-disciplinary (Dowden 2007; Gehrke 1998); the other uses whatever subject knowledge and skills are necessary to solve a problem or investigate an inquiry, and thus is often associated with problem- and inquiry-based learning. The former definition of curriculum integration (CI) requires maintaining the integrity of the disciplines: the disciplines are the building blocks but are connected with cement, that is, integrated. Fisher and McDonald (2004) and Brewer and Brown (2009) offer examples of specific instructional units following the Herbart and Jacobs models. Its purpose is to interest or motivate students while efficiently teaching the disciplines. Teachers may collaborate to establish and implement thematic units that incorporate learning in each of the disciplines, or, particularly through curriculum mapping, use certain strategies and skills that may become the focus of multiple disciplines.

As there is a need for students to make connections across the curriculum, there is also a need to recognize that integration of curriculum has two important aspects. First, integration implies unity rather than separation. Second, real curriculum integration occurs when students confront personally meaningful questions and engage in experiences that answer those questions (Beane 1991). Although the terms curriculum integration and integration of curriculum differ in syntax, they seem to refer to the same concept and are often used interchangeably in the literature, even being switched within articles (Beane 1991; Vars 1991; Loepp 1999; O'Neill, Morris and Baxter 2000).

Whereas, the latter concept of CI on the other end of CI methodology (integrated, problem-/project-/inquiry-based), relies on experience and life to drive the curriculum: subjects are just tools. Dewey and Beane are often cited as leaders of this paradigm, which also find support in the work of Piaget and Vygotsky, to wit, constructivism—though both CI camps claim these theorists and constructivism as rationale, and thematic units may be used by both. Project-based and inquiry-based learning are often considered appropriate methods for this definition of CI (Audet and Jordan 2005; Chrysostomou 2004). Examples of this could include building a house, a robot or a garden. Audet and Jordan (2005) detail a case study method of instruction, specifically using the Apollo 13 mission to teach the concepts of precision and accuracy. The lesson integrates science, mathematics and language arts.

Beane himself clearly drew these distinctions. As Beane (1997) explains, inter-, cross- and trans-disciplinary curriculums still maintain the subjects as distinct though "content and skills from each are correlated to the theme" (p 10). Fogarty (2008) provides examples of these thematic approaches for each level. A unit on sub-Saharan Africa for middle years learners involves mathematics, art, language arts, social studies, science, music and physical education whereas in the primary years, the song *Miss Mary Mack* requires all nine intelligences and the associated content areas (Fogarty 2008). With an integrated curriculum simultaneous teaching and learning occurs across the disciplines involved such that "increased and assessable understandings" are realized (Smilan and Miraglia 2009: 40; Smilan 2004). Therefore, for this review, while Beane's definition of CI is helpful, curriculum integration and integrated curriculum are umbrella terms that refer to a continuum of methods for CI from multidisciplinary to interdisciplinary to transdisciplinary to pure integration similar to the previous continuums established by Fogarty, Drake and Jacobs. To extend the Choi and Pak food analogy, multi- is the salad bowl, inter- is the melting pot, trans- is the cake, and with full/pure integration à la Beane there is no recipe—no set list of ingredients. With the latter, you use what is available and/or what you need to create the dish that you want. However, where the word continuum implies that one end is greater than another, it is a poor descriptor. As will be discussed below, one method of CI is not necessarily better nor more effective than another. Likewise, the words pure and full when used to modify integration do not imply valuation, but rather refer to Beane's concept of non-disciplinary integration.

Thus, inter-, multi- and cross-disciplinary curriculums are those that connect two or more disciplines through themes, skills or other means. Whereas, integrated curriculums do not distinguish among the disciplines, but rather draw upon any and all knowledge and skills in order to solve problems and investigate questions. Interdisciplinary teaching as currently practised in the MYP would be considered a form of curriculum integration.

6.2 Interdisciplinary teaching and concept-based learning

In the MYP, interdisciplinary teaching builds on teaching done in single disciplines, and does not replace it (Boix-Mansilla 2010). Students are encouraged to question and analyse information embedded in the various subject groups. Although there is a danger of interdisciplinary units being overloaded or stressed with too many subjects forced into one learning experience (Hameyer 2007) successful CI can be done by emphasizing concepts. Erickson (2007) promotes the use of concepts as they promote knowledge at a deeper level and allow students to transfer knowledge about a subject to different disciplines. Unlike topics, which are limiting and often tied to one discipline, concepts are broader and allow for interdisciplinary teaching opportunities (Erickson, 2008). For example, a topic on fish might be better framed as a concept about habitat. Concepts organize and unify; they are timeless and abstract to allow students to think about a subject critically and in complex ways (Erickson 1998). By building a lesson plan with a one or two word concept like cultural diversity and an overall unit theme like cultural diversity in our state/nation an IB teacher can create a unit plan that integrates lessons in multiple subjects with various essential questions. Further, as the IB learner profile is expected to be integrated into IB classrooms, teachers might also embed concepts like open-mindedness and reflection into classroom discussions as well as the IB mission statement ideal of international-mindedness. As Erickson explains:

When students begin to think beyond the facts, they are able to see patterns and connections of old knowledge and new knowledge; they transfer understandings to other situations; and they systematically build conceptual depth and sophistication (1998: 41).

Students also retain knowledge longer when there is an emotional response to learning (Erickson 2007).

6.3 CI and the fundamental concepts of the MYP

Fundamental elements of the MYP including the personal project, the areas of interaction (AOIs), and later, global contexts clearly fit in with principles of curriculum integration described by Dowden (2007) as follows:

Dewey (1936) and other American progressives such as Hopkins (1941, 1954), Dressel (1958), along with Neo-Progressives such as Lounsbury and Vars (1978) and Beane (1997), all emphasized that the subject matter of the curriculum should be both personally meaningful to the learner and be of substantive value to society (p 59).

By this definition the MYP personal project exemplifies CI. The project establishes a problem/inquiry for students to explore and investigate. The exploration starts with student choice and accesses student skills and knowledge. While the product should demonstrate the culmination of student learning and incorporate some of the approaches to learning skills, distinguishing among subjects is not necessary in order to receive high marks.

The AOIs (and subsequent global contexts) can serve as a means for engendering CI, as per the personal project. Other examples of CI could include assignments that involve general inquiry into the areas, for example, compare examples of human ingenuity 1,000 years ago to today, identify and describe threats to our environment, develop a plan for community and service that addresses one of those threats, and so on. These assignments might guide students to their eventual personal project.

However, the AOs also provide for inter-multi-cross-disciplinary curricular connections. For example, teachers may collaborate to reinforce approaches to learning that are common across disciplines, or students may reflect on and/or consider the approaches to learning across disciplines. Students and teachers may explore exemplars of human ingenuity in two or more disciplines, such as the sciences, the languages and the arts. The IB's *Global engagement: Teaching and learning about rights* (IB 2012a) can also be used by MYP teachers to develop lessons that provide opportunities for interdisciplinary instruction but also curriculum integration as students can explore issues related to human rights in language and literature, economics, science, technology and many other subjects. The guide also connects community and service to the focus area of human rights.

These applications of the definitions of CI and interdisciplinary integration are pretty well explicated in the IB document *MYP: From principles into practice* (2008). In addition, the currently available IB planning procedures and templates, similar to Jacobs' work, should help schools and teachers implement both interdisciplinary and curricular integration according to the above definitions.

A recent example of approaches to learning as a method for encouraging interdisciplinary curriculum integration can be found in Bosse, Lee, Swinson and Faulconer (2010). These researchers state that CI fosters deeper understandings, critical thinking, and motivation; forges conceptual connections and makes learning relevant for students; and develops "a common core of knowledge necessary for success in the next century" (Bosse et al 2010: 262). The structure of the MYP including the design of the unit planner with significant concepts laid out provides evidence for a concept-based model of curriculum integration.

6.4 CI and interdisciplinary curriculum development

In general, from nursery school to university, and more specifically at the middle school level, CI may be an appropriate approach to curriculum development. Bosse et al (2010) cite research that "demonstrates that integrated curricula provide endless opportunities for more relevant, less fragmented, and more stimulating experiences for learners" (p 262). Carr (2007) synthesizes and summarizes the philosophies of MacIntyre and Peters, as determining that "an educated person is one who can make connected sense of things ..." (p 5). Hence, CI may provide for greater student engagement while meeting the current philosophical paradigm of educational objectives, which includes the ability to synthesize, make connections, to wit, integrative thinking (Gardner 2008; Carr 2007; Barbot, Besançon and Lubart 2011).

Teachers face accountability for spending more time on individual disciplines, that is, mathematics, reading and writing, yet are also told to integrate disciplines for meaningful experiences, develop critical and creative thinking; in other words, teachers face growing pressures to better develop higher-order thinking skills while more effectively providing instruction in the rapidly expanding domains of the lower-order thinking skills (Gehrke 1998; Fogarty and Stoehr 2008; Gardner 2008). These are not at odds—CI in the Dewey/Beane tradition can provide more time for disciplinary knowledge while inherently developing higher-order thinking skills. Moreover, given that fields of knowledge expand infinitely, why not base some of the curriculum on student preference?

In various disciplines, CI can be successful with students. Brooks and Brooks (1993) noted that deep understanding is constructed when students make new connections with prior experiences, and thematic learning is supported by brain research (Cohen 1995) as well as Beane and George's work showing that people process information through patterns rather than small fragmented bits of information (1996). Alleman and Brophy (1993) found that social studies teachers often integrate subject matter by combining it with visual arts or language arts subjects but activities may have limited educational value depending on the depth of the assignments and the overall goals of the unit, noting "attempts at integration sometimes distort the ways teachers represent or develop social studies content" (Alleman and Brophy 1993: 289). Hinde (2005) was also cautious about successful CI in social studies classrooms but provides practitioners with ideas for effective integration including making sure all activities are educationally significant and developmentally appropriate for the age of the learners involved.

Despite Alleman and Brophy's reservations about CI in social studies, Lapp and Flood (1994) found that CI was possible using a thematic approach in an example where public school students

learning cultural diversity created an Asian museum incorporating lessons in language arts, mathematics, visual arts and geography. Over three months, the students planned and executed the museum, participating in writing, speaking, reading, listening and viewing activities. Further, the students were invested in their learning and engaged throughout the project.

Schmidt et al (1985) studied curriculum integration in six elementary language arts classrooms, finding that the teachers generally believed that CI helped use time more efficiently in instruction. Unfortunately, the limitations of this study were the small sample size (only six teachers) and that each teacher used CI to varying degrees with one teacher using CI for up to six hours of instruction in an academic year at the low end and another using CI for approximately 116 hours of instruction in that same year.

In science and mathematics, research about CI is more positive. Peters, Schubeck and Hopkins (1995) carried out action research in elementary and middle school classrooms in Alaska. Using CI, teachers reported high student engagement with thematic and concept-based units. Greene (1991) also reported increased student interest but achievement was also affected as student scores in California on the National Assessment of Educational Progress (NAEP) improved after participating in year-long thematic units. Despite these positive outcomes, Mason (1996) identified several potential problems for using CI in mathematics and science, including the fact that “mathematics is sequential, and adding mathematics concepts here and there in the curriculum could confuse students if they do not have prerequisite knowledge and skills” (p 426).

Examples of disciplinary-based integration can, of course involve any of the disciplines. In their 1996 article titled “The Jazz and Poetry Connection” Hutchinson and Suhor (1996) describe how students gain an understanding of the difficult concepts of mood and tone by integrating instruction in music and poetry. Another common activity is responding to visual arts with language arts. For instance, students may analyse famous works of art in their art class and then write poetry in response to those works of art (Isenberg and McCreddie 2008). In another example in Isenberg and McCreddie’s evaluation, students learned about water distribution as part of a science curriculum, and then painted watercolours demonstrating their understanding of at least four water sources (2008). The difference with superficial integration—simply tacking one discipline onto another - may be determined by the multiple objectives that are established and assessed thereof. Teachers need to consider what concepts and skills they want students to learn from the disciplines involved and how they will assess that learning.

Given the above examples, hierarchies of CI may establish faulty valuations of CI, disciplinary, multi-, inter- and cross-disciplinary curriculums. In other words, while some connection appears desirable, whether the connections are achieved through the interdisciplinary or integration models may not be important for student achievement. Both models help students learn.

6.5 What research says about why CI works better with middle school learners specifically

Bosse et al (2010) cites brain research and theory to suggest that students learn better through patterns, connections and thematic teaching than fragmented pieces. Other educators and scholars turn to the work of Vygotsky, constructivism, Gardner’s theory of multiple intelligences and Rauscher’s work on music and the brain to support integrated approaches (Chrysostomou 2004; Fogarty and Stoehr 2008, Gehrke 1998). Caine and Caine (1991) cite research showing that the brain learns best when it works to solve problems or accomplish a specific task instead of memorizing small bits of separate facts. Interdisciplinary teaching and curriculum integration encourages such problem-solving. Further, Resnick and Klopfer (1989) stated that people learn more successfully if they are asked to think in more complex ways and are given multiple ways to look at a problem. Again, interdisciplinary approaches and an integrated curriculum can address these. Although brain size during this period remains relatively the same, there is significant internal development in specific areas of the brain, particularly the pre-frontal cortex and this impacts learners’ abilities to plan, reason, sustain attention and make decisions (Blakemore and Choudhury 2006).

Dowden (2007) states “that early adolescents have a developmental need to achieve a degree of agency in curriculum implementation and thus engage meaningfully in real-life activities” (p 60). Students start to prefer active over passive learning experiences and place value on interactions with peers during class. Research and reports by Brazee (1997), Kielsmeier (2000) and Schine (1997) lead Dowden to conclude that the trend in service learning in the US meets this need while students get to experience being good citizens (2007). In addition, students begin to understand deeper concepts and can process the world around them better. It is for this reason that teachers should use a variety of approaches and materials that are appropriate for the range of learners in their classroom (Stout 2011). Furthermore, Dewey (1900), and recent research by Arnold (1997), the National Middle School Association (2003), and Stevenson (2002) support the notion that “adolescents learn by actively and creatively ‘doing’ projects” (Dowden 2007: 61). It is for this reason that CI provides educators with a way of not only making learning relevant for middle school learners but providing a curriculum platform for which problem-based learning (PBL) can occur and students are more likely to be successful in front of their peers.

Despite this, many researchers and scholars believe the widely accepted Jacobs (1989) multidisciplinary model is not appropriate for middle school learners because it does not address the needs of adolescent learners and excludes the possibility for student agency in lesson plans (Dowden 2007; Vars 2000; Brazee and Capelluti 1995). To wit, when teachers select a theme, concept or thread for the purposes of integrating disciplines, student choice is limited. Whereas when students select—with guidance—a project, topic, or problem, such as the MYP’s personal project, they may be more motivated to apply whatever disciplinary knowledge is necessary to address the project, topic or problem.

6.6 Challenges and implications

First, it is not a question whether or not students learn better from a discipline-based model or interdisciplinary-based model or even CI: whether educators subscribe to the Jacobs or Beane models, disciplinary knowledge and skills will get taught in a more motivating and efficient manner with interdisciplinary teaching and CI.

Second, the Jacobs and Beane models of CI are not necessarily at odds: one may be seen as a precursor/baby step towards the next and or part of a continuum from distinct disciplinary to problem-based learning (PBL) as described in Jacobs (1989) and Fogarty and Stoehr (2008).

Regardless of the definition and model, the theoretical rationales for pursuing and implementing CI include: students will be more motivated to learn, educational objectives will be more efficiently and effectively achieved, and diverse learners will be reached. Moreover, CI aligns with holistic epistemology (Hare 2010), which, in turn, aligns with IB philosophy.

However, valid concerns exist regarding adoption of one model or another. Dewey would literally have practitioners build a house with students in order to meet his expectations for experiential learning, integrated curriculum and other aspects of his philosophy (see Hickman 2000, for a brief description of Dewey’s actual attempt at this). Hence, the Dewey/Beane model may expect too much of most teachers: most educators cannot build a house, never mind ensure that students acquire all the appropriate knowledge and skills necessary at each level while building that house. This model engenders potential for gaps in learning.

George’s (1996) enumeration of problems and the occasional lament over potential loss of disciplinary knowledge notwithstanding, the negative critiques exist largely within the CI paradigm. Researchers and scholars argue over what is authentic CI, terminology and methods, yet very few argue against it. Why? Probably because practitioners do not implement it; it is possible that the lack of implementation of CI and interdisciplinary teaching has made critique of it unnecessary. As Gehrke (1998) acknowledged, “Evidence of integrated curricula in use rather than in advocacy is relatively depressing—if one supports curriculum integration” (p 253).

This lack of implementation may come in part from the pressures of national standards and assessments organized by disciplines (Gehrke 1998). Teacher resistance and the relative difficulties of effectively implementing CI may contribute to the lack of implementation (Martin-

Kniep, Feige and Soodak 1995; Venville, Wallace, Renne and Malone 2002). As Venville et al (2002) suggest:

In our own work we found that examples of integration are piecemeal and idiosyncratic. They seem to rely on local champions harnessing local resources to address local issues. Few of the examples of integration we observed were sustained over time. Why is integration so difficult? We suggest that integration challenges what Tylagk and Tobin (1994) call 'the grammar of schooling' (Venville et al, 2002: 53).

Hence, given the strong rationale and weak implementation, the balanced approach the IB has taken in the MYP is well considered. That is, maintaining distinct disciplines while encouraging interdisciplinary curriculums in integrated projects develops students' integrative thinking ability and disposition while avoiding gaps in disciplinary knowledge and skills.

The point for both the IB and IB teachers is: connecting subjects enhances learning in those subjects and engenders higher-order thinking skills. These connections should not be forced nor superficial, but, rather natural and/or necessary.

7. Implications for the MYP and IB teachers

What Gardner said about the IB as a whole, that it is forward thinking, could be said of the IB's approach to CI. The PYP exhibition, personal project in the MYP and the new interdisciplinary extended essay in the IB Diploma Programme seem to provide from CI towards the Beane end of the continuum and at developmentally appropriate ages (that is, increasing distinct disciplinarity, decreasing CI in the IB Diploma Programme years). Although Dewey predates the IB, the sentiment it conveys as it reflects IB philosophy is clear:

... this means to make each one of our schools an embryonic community life, active with types of occupations that reflect the life of the larger society and permeated throughout with the spirit of art, history and science. When the school introduces and trains each child of society into membership within such a little community, saturating him with the spirit of service, and providing him with the instruments of effective self-direction, we shall have the deepest and best guaranty of a larger society which is worthy, lovely and harmonious (Dewey 1900:29).

As much of the above suggests, based on synthesis and evaluation of the literature, the IB currently does a lot right when it comes to curriculum design. An example of an integrated unit in Sunal et al (2000) was titled "Constancy and Change". The question for the IB and IB teachers particularly in the context of the MYP is what should be kept constant in the programme and what should be changed? Where could the IB go from here to take the next steps toward more effective curriculum integration? Thorough definitions of relevant terms are explained previously to distinguish their applicability to and in the classroom. Curriculum integration as an approach to developing programmes for interdisciplinary, multidisciplinary, and even transdisciplinary teaching and learning can be promoted in the four following ways: (a) via the flexibility of the MYP curriculum framework, areas of interaction and, later, global contexts; (b) through the three fundamental concepts of the MYP; (c) through teacher collaboration and planning; and (d) through teachers' professional development.

7.1 Flexibility of curriculum planning and development

Every IB World School offering the MYP must ensure that its stated curricular requirements for each subject are aligned. The MYP requires schools to teach a broad and balanced choice of subjects each year of the programme with the intention to provide appropriate direction and advice to schools to ensure commonality among the IB World Schools offering the MYP. The IB World Schools offering the MYP are required to structure their curriculum to allow their students to achieve the aims and objectives of each subject group, which are confirmed by the IB at the end of

the programme. The flexibility of the MYP is designed to allow students to benefit in different ways from the programme's integrative approach to teaching and learning (IB 2009b). The MYP discusses both multidisciplinary and interdisciplinary models of teaching and learning throughout their guides. This flexibility is essential because of the necessity to meet the needs of multiple schools with varying requirements. Because of differences in how the MYP is implemented in schools in different parts of the IB world, it is important to remember that sometimes programmes are not always contained in a single building and students may spend part of their MYP in one environment and another part in another environment. The MYP gives teachers choice to design their units to be subject-based or interdisciplinary in nature, which allows educators to address what is necessary for learning outcomes in the way they feel is most appropriate (IB 2008). Although this flexibility is permissible, the IB encourages disciplines to intersect as much as possible with teaching and learning because it promotes a deeper understanding for students and true collaboration among teachers. Developing interdisciplinary units of work can draw together elements of different subject areas to support a more extensive exploration of subject content (IB 2008). These units are to be planned by teams of teachers, working in collaboration, guided by the common planning document published by the IB. Use of the MYP planner, the conceptual framework to come in 2014, and other resources can help teachers and students discover these curricular connections more thoroughly and effectively.

7.2 Collaborative planning among teachers

One suggestion might be to reorganize the curricular framework into two circles that naturally go together, and are unnaturally disintegrated: those being humanities (languages, history and arts) and mathematics and science. This reorganization could lead to collaboration between those teachers who teach subjects that naturally connect. In considering reorganization, while the areas of interaction (AOIs) may prove constants for the life of our species (and some, that is, environment, perhaps beyond human existence), is their articulation as a core facet of the MYP beneficial to student outcomes? For the Beane/Dewey model of CI, teachers need to know the skills and knowledge that the national and local standards in all subject areas require. They then need to be able to guide students to those standards through their inquiries, as they solve problems and work on projects. Thus, Dowden (2007) warns "implementing integrative curricula is not a 'soft option' and is likely to present teachers with unexpected challenges," and, moreover, that each CI must be unique and developed in the context of the site (p 61). Vertical planning is necessary in order to ensure the progression of learning each year the programme is in place (IB 2009b). Horizontal planning is equally important and encourages dialogue among teachers in a particular grade level. This structure also encourages students to be lifelong learners and makes connections across content areas. These approaches are best applied to teaching and learning through teacher collaboration and collective planning. However, it does not have to be difficult for teachers to make interdisciplinary connections. It may be as simple as a quick conversation while passing in the hallway; if teachers ask each other what the upcoming skills, approaches to learning or time period content focus is, they may find overlap. Another possible route could be to provide cross-curricular planning time for subject teachers. Although cross-curricular planning time is required in the MYP, subject teachers are sometimes split between multiple buildings and administrators often need to find creative ways to get them together. Teacher workdays and student holidays can be used for interdisciplinary planning and the creation of CI projects and units. The MYP is designed to teach students to become independent learners who can recognize relationships between school subjects and the world. Successful teaching of the MYP requires commitment to its fundamental principles on the part of the whole school and a high degree of communication and collaboration between teachers.

7.3 Connections with fundamental concepts of the MYP framework

Interdisciplinarity, multidisciplinary and transdisciplinarity can be applied to teaching and learning through the MYP's fundamental concepts: holistic learning, intercultural awareness and communication (IB 2009b). Holistic learning is a natural application of these three terms in that it represents the idea that all knowledge is interrelated and that the curriculum should promote the development of the whole person (Hare 2010). As the MYP places significant emphasis on the importance of holistic learning, this type of education represents a "journey for both students and teacher and one in which both parties will grow and critically examine perhaps strongly held values and beliefs" (Hare 2010: 7). The relationship between teacher and student changes and holistic

learning deepens the learning process. The MYP evolves to a concept-based curriculum (International Baccalaureate, n.d.); the idea that holistic knowledge is interrelated and the curriculum should contribute to the development of the whole person (IB 2008) fits in well with the idea of curriculum integration (CI).

Intercultural awareness is applicable to the three terms because it encourages the development of international-mindedness by exploring other cultures, a key feature of international education. In addition to the personal project, this might be promoted through a collaborative project that may replace (though use) the AOIs and facilitate the move to global contexts. In 1998, Harvard University biologist Edward Wilson suggested that global concerns such as ethnic conflict, arms escalation, overpopulation, abortion, environment and endemic poverty could only be addressed by integrating disciplinary knowledge. He argued students and educators need “fluency across the boundaries ... to provide a clear view of the world as it really is” (Wilson 1998, as cited in Venville et al 2002: 75-76). This suggests CI may be a method to a mission that matches the IB’s—to create a better world. Within the MYP, teachers can create a broad variety of interdisciplinary units and instructional design will vary depending on purpose, objectives, selections of disciplines, and grade levels (Boix-Mansilla 2010). Teaching beyond single disciplines (and using interdisciplinary instruction and CI) also lends itself to asking students different types of questions and encouraging meaningful personal inquiry (Gardner and Boix-Mansilla 1994). Perhaps existing IB resources such as global engage and the online curriculum centre subject forums can facilitate teachers making connections with other classrooms and other IB teachers throughout the world.

To exemplify the above points, in a possible project students would first select a global problem, such as population growth, climate instability, hunger, poverty, energy supply, potable water supply, war, violence/oppression, disease, racism or sexism, as possible topics. Students would be grouped at the local school site according to the selected problem and language B instruction. The local student group would then connect with at least two international groups working on the same problem: one language A and one language B. Groups would study the problem and develop a potential solution. This is a project that could spiral through all three levels: PYP, MYP and DP. Moreover, it could be tied to the IB Diploma Programme community, action, service (CAS) requirements and obviously uses/applies to many AOIs, for example, human ingenuity and the environment. Perhaps this project might tie to the future e-assessment that would have an interdisciplinary component. Additionally, there are many examples of CI projects and units (game design for STEM, coffee house presentations for humanities, and so on) and both researchers and practitioners continue to compile and disseminate those to other teachers, coordinators and schools.

Communication suggests that schools should encourage open and effective dialogue, including but not limited to, defined disciplines (Collin 2009). When well instructed, students encounter disciplines in different ways—interdisciplinarily, multidisciplinarily and transdisciplinarily. Discipline boundaries are tentative and students at different levels will combine disciplines in different ways (Gardner and Boix-Mansilla 1994). Newell (2010) maintains that complex topics require approaches that are both interdisciplinary and integrative. An integrative approach presents students with diverse perspectives and encourages them to make connections that they might not be able to make with a single discipline-based approach.

The IB learner profile as the driving force behind all IB programmes is a deeply held philosophy about the nature of international education. This philosophy is reflected in the IB mission statement and translated into a set of learning outcomes for the 21st century. The ten qualities of the IB learner profile represent the essence of the programmes and describe the type of student who will cultivate international-mindedness. The following 10 characteristics describe what the IB learner strives to be: inquirers, thinkers, communicators, risk-takers, knowledgeable, principled, open-minded, caring, balanced, and reflective (IB 2009a: 2). Multiple discipline approaches provide an opportunity for these ten characteristics to develop.

7.4 Teachers’ professional development

A third suggestion is to design professional development and teacher education courses that prepare teachers for CI. Fortunately, the IB has a myriad of opportunities for teacher professional development. The global workshop architecture provides a framework for IB workshops and

training. Within the global workshop architecture, category 2 and 3 workshops could provide teachers with skills and resources regarding CI. In category 2 workshops, participants might engage in more detailed study of a discipline, evaluate resources, or could pursue something like CI. Category 3 workshops are “concept-specific and can be any topic related to IB-practice” which would also be suitable for professional development in CI (Daly 2012: 168). Workshops are delivered in online and face-to-face formats. In addition, teachers can pursue professional development options through the IB educator certificates (formerly IB teacher awards), a concept that recognizes further commitment by IB teachers and administrators and allows them to pursue professional development opportunities while also obtaining a higher education credential.

On the other hand, teacher education can also limit implementation of CI. According to Roebuck and Warden (1998) many pre-service teachers do not experience methods classes with teams of faculty and are not taught to teach an integrated curriculum. Also, secondary teachers are typically licensed in a single discipline and this also may also limit the knowledge to carry through CI in the classroom. For an interdisciplinary model or an integrated model to work, teachers need to share the same students at the same time. These opportunities in larger public school settings are harder to arrange due to scheduling and the availability of teachers to plan units. Park (2008) also found that teacher’s roles in implementing CI are important. For CI to be properly implemented and sustained, teachers need to be thoroughly familiar with the curriculum they are trying to integrate. One challenge of professional development is that theory is often hard to put into practice.

Besides the global workshop architecture and the IB educator certificates, IB teachers can connect with other teachers and coordinators through the online curriculum centre, the IB virtual community, and global engage. These three resources can be used to obtain not only discipline-specific support, but get ideas, connect with classrooms throughout the world, and work collaboratively on projects. These sites support the MYP philosophy of interdisciplinary teaching and learning and students can engage with other IB students from all over the world. Finally, Boix-Mansilla said:

Ultimately, interdisciplinary teaching in the MYP builds on a serious commitment to teachers’ capacity to grow as thinkers, citizens, and professionals. For many teachers, this is perhaps the most personally meaningful motivation to teach across disciplinary lines (2010: 25).

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Selected annotated references

Audet, R. and Jordan, L (eds). 2005. *Integrating inquiry across the curriculum*. Thousand Oaks, CA, USA. Corwin Press.

The authors provide methods and exemplars of inquiry by subject as well as for CI. The book also discusses use of inquiry with diverse populations.

Barbot, B, Besançon, M and Lubart, T. 2011. "Assessing creativity in the classroom". *The Open Education Journal*, 4, (Suppl 1:M5). Pp 58–66.

This article describes prior attempts to assess creativity, then focuses on a new instrument, developed by the authors, which distinguishes between integrative and divergent thinking. This may be interesting to IB and IB teachers, as the instrument psychometrically measures integrative thinking ability and comes with pre- and post-test capabilities to measure growth in integrative thinking ability.

The 1996 issue number 1 of *Middle School Journal* (MSJ), volume 28 contains the following related to CI:

Beane, J. 1996. "On the Shoulders of Giants! The Case for Curriculum Integration". Pp 6–11.

Beane, J and George, PS. 1996. "Final Comments from Professors George and Beane". Pp 24–25.

Erb, T. 1996. "Following the Bandwagon of Curriculum Integration: Beautiful Music or Deep Ruts?" P 2.

This issue of MSJ focused on CI. Beane provides his reasoning, whereas George delineates a number of potential pitfalls and problems with CI, as well as pointing out the lack of evidence supporting Beane's claims. In addition to the abovementioned articles, practitioners should find the published responses from teachers informative.

Boix-Mansilla, V. 2010. *MYP guide to interdisciplinary teaching and learning*. Cardiff, Wales. International Baccalaureate Organization.

This guide defines interdisciplinary learning as it applies to the MYP and provides teachers with ways that they might approach interdisciplinary instruction in MYP schools. Suggestions are given for topics and designing interdisciplinary units. There is also a chapter on the MYP personal project and supporting interdisciplinary research.

Bosse, MJ, Lee, TD, Swinson, M and Faulconer, J. 2010. "The NCTM process standards and the five "Es" of science: Connecting math and science". *School Science and Mathematics*, 110(5). Pp 262–276.

Using national mathematics and science standards, the researchers find correlation among the learning processes and, thus, provide a rationale for integrating mathematics and science education.

Choi, BCK and Pak, AWP. 2006. "Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education, and policy: 1. Definitions, objectives, and evidence of effectiveness". *Clinical and Investigative Medicine. Médecine Clinique Et Experimentale*, 29(6). Pp 351–364.

The terms multidisciplinarity, interdisciplinarity and transdisciplinarity are increasingly used in education literature, but are ambiguously defined and interchangeably used. This article discusses the definitions and objectives of each term.

Chrysostomou, S. 2004. "Interdisciplinary approaches in the new curriculum in Greece: A focus on music education". *Arts Education Policy Review*, 105(5). Pp 23–29.

After acknowledging the contemporary popularity of the concept of CI, the author traces CI to Plato's "harmonic unity" of knowledge, through Rousseau's life experience concept to Dewey. She goes on to suggest that integrating career education and general education can be motivating and result in better life outcomes thanks to motivation, actualization, and authentic assignments. This could inform and/or support IB's relatively new IBCC.

Collin, A. 2009. "Multidisciplinary, interdisciplinary, and transdisciplinary collaboration: Implication for vocational psychology". *International Journal of Educational Vocational Guidance*, 9. Pp 101–110. doi: 10.1007/s10775-009-9155-2.

The literature on interdisciplinarity identifies several forms of collaboration: multidisciplinary, transdisciplinary, and interdisciplinary (as bridge building or integration). To assist vocational psychology translate its interdisciplinary discourse into action, this paper uses that literature to identify the benefits, challenges and conditions for success. It indicates that the form of collaboration needed must be decided, and the cognitive, social, organizational and institutional aspects of the collaborating disciplines considered. It highlights the significance of interpersonal relationships when establishing and maintaining collaboration.

Erickson, HL. 2007. *Concept-based curriculum and instruction for the thinking classroom*. Thousand Oaks, CA, USA. Corwin Press.

Provides a good introduction to concept-based instruction with information for elementary through to secondary school teachers. Discusses the structure of knowledge and teaching concepts in light of standard-based instruction. Resources contain graphic organizers and lesson planners to assist teachers.

Erickson, HL. 1998. *Concept-based curriculum and instruction: Teaching beyond the facts*. Thousand Oaks, CA, USA. Corwin Press, Inc.

Discussion of concept-based teaching with much attention to interpreting and alignment of standards. This book discusses the difference between multidisciplinary and interdisciplinary units. Teachers will find this book especially helpful for concepts as there are charts providing examples clearly laid out by subject.

Erickson, HL. 2008. *Stirring the head, heart, and soul: Redefining curriculum, instruction and concept-based learning*. Thousand Oaks, CA, USA. Corwin Press.

This book provides teachers with ideas to transition to a concept-based method of instruction and how to design interdisciplinary, integrated curriculum. Many examples for practitioners to use as models and adapt to classrooms.

Fisher, D and McDonald, N. 2004. "Stormy weather: Leading purposeful curriculum integration with and through the arts". *Teaching Artist Journal*, 2(4). Pp 240–248.

After briefly discussing the need for arts integration with other subjects, based on Jacobs' model the authors provide an example with a multidisciplinary unit on weather. Meeting educational objectives efficiently is their rationale.

Fogarty, R and Stoehr, J. 2008. *Integrating curricula with multiple intelligences: Teams, themes and threads* (second edition). Thousand Oaks, CA, USA. Corwin Press.

This book briefly discusses the theories behind CI, and impressively aligns CI with multiple intelligence theory, as acknowledged by Gardner himself in the foreword. Fogarty and Stoehr provide pragmatic guidance for teacher collaboration in order to integrate curriculums. In addition, specific unit plans, suggested topics and themes and methods for developing CI are included for the elementary, middle and high school levels. This is a readable, pragmatic book for practitioners by one of the paradigm establishing neo-progressive CI theorists (see Fogarty 1991/1993).

Hayden, M and Thompson, J. 2011. "The Middle Years Programme". In Hayden, M and Thompson, J (eds), *Taking the MYP Forward*. Pp 13–18. Glasgow, Scotland. John Catt Educational Ltd.

This book (just published in 2011) provides a good background of the MYP including history, interdisciplinary learning, the role of the MYP coordinator and international-mindedness in the MYP. Provides some consideration of the MYP in the future and presents a portrait of an MYP school in Dubai.

Martin-Kniep, GO, Feige, DM and Soodak, LC. 1995. "Curriculum integration: An expanded view of an abused idea". *Journal of Curriculum and Supervision*, 10(3). Pp 227–249.

These authors differentiate between "bad" and "good" integration, the latter being significant, cohesive and relevant. The article provides examples and identifies issues of implementation. In this piece, student motivation and the ability to effectively meet educational objectives support the use of CI.

Vars, GF and Beane, JA. June 2000. Integrative curriculum in a standards-based world. *ERIC Digest*, 1-2. Retrieved 3 February 2012, from <http://ceep.crc.uiuc.edu/%5C/eecearchive/digests/2000/vars00.pdf>

This article sums up research suggesting that students in integrated programmes do as well or better on standards-based assessments. The authors suggest general ways for teachers to deal with standards—such as getting students involved, back-mapping and the like. While the focus is on elementary education, much of this seems applicable to other levels, and could also inform attempts to vertically integrate programmes.