International Electronic Journal of Elementary Education, September 2016, 9(1), 1-20.

Living Transdisciplinary Curriculum: Teachers' Experiences with the International Baccalaureate's Primary Years Programme

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Received: 15 August 2016 / Revised: 27 September 2016 / Accepted: 29 September 2016

Abstract

An integrated curriculum that is transdisciplinary in nature seems to be a good fit for 21st Century learning. There are, however, few examples of transdisciplinary curriculum at the K to 12 level. One exception is the International Baccalaureate's Primary Years Programme (PYP) which features transdisciplinary curriculum for students from ages 3 to 12 around the world. This phenomenological study explored the lived experience of 24 PYP educators to deepen understanding of what such a curriculum looks like in practice. Three main themes were identified. The first, "It's a framework" outlines participants' understandings of transdisciplinary teaching and learning and the freedom a transdisciplinary framework can bring. The second theme, "Get on board", examines participants' thoughts around what is required to successfully implement a transdisciplinary curriculum. The final theme, "Their learning journey", discusses participants' beliefs around the success of a transdisciplinary curriculum. In general, participants appreciated the transdisciplinarity of the program. Concerns revolved around implementation issues. Suggestions on how to implement transdisciplinary teaching and learning in other contexts are provided.

Keywords: Transdisciplinary, integrated curriculum, interdisciplinary curriculum, International Baccalaureate (IB), elementary.

Introduction

Educational reformers in the 21st Century note that integrated or transdisciplinary curriculum approaches address the needs of the 21st Century learner to learn the skills and worldview necessary to negotiate a complex global world (Hargreaves & Fullan, 2012; Hargreaves & Shirley, 2009). A transdisciplinary curriculum is an iteration of an integrated curriculum (Drake, 1993). A discussion of transdisciplinarity and its merits can be heard at the university level (see, Klein, 2014), however, there is little application at the other end of the educational spectrum (Richards & Shea, 2006). A notable exception to this is the International Baccalaureate (IB) Primary Years Program (PYP) for students aged 3

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ISSN:1307-9298

www.iejee.com

to 12 years. IB took the concept of transdisciplinary teaching and learning and based its entire PYP on the concept.

It is very important to understand what we are doing in terms of teaching and learning and why we are doing it. It is equally important, however, that we understand how we are doing it (Pop & Maties, 2008). The purpose of this study is to explore the lived experiences of teachers, administrators and coordinators who teach in these transdisciplinary IB programs. Since the IB PYP appears to be a good model of 21st century learning, a deeper understanding of implementing transdisciplinary curriculum as a lived experience may facilitate other educators with similar goals to move toward implementation in their own setting.

Defining Transdisciplinary

The term "transdisciplinary" first emerged during the 1970s. It was specifically referenced in an OECD conference held in France that was focused on problems experienced by instructors and researchers in postsecondary settings (Cantar & Brumar, 2011). It was defined as a, "comprehensive framework that tried to go beyond combining existing disciplinary approaches in an interdisciplinary fashion to create new frameworks, new overarching syntheses" (Cantar & Brumar, 2011, p. 637).

Wiesmann et al. (2008) argue that transdisciplinary teaching, learning and research has emerged as a response to the complex problems that exist in 21st century society. It has been found that disciplinary approaches to these complex problems are insufficient and that only by looking beyond the disciplines can the problems be understood and solutions determined. Nicolescu (1998, 2008) posits that transdisciplinary teaching and learning is not just an intellectual activity but rather must involve the entire person: mind, body and emotions. He states, "a viable education can only be an integral education of the human being." (p. 3). In the K to 12 context, transdisciplinary is often seen as at the far end of a continuum with increasing degrees of integration; it is an approach that transcends disciplinary boundaries (Drake, 2012).

The IB PYP Context

There are over 4500 IB schools around the world situated in 3 of IB's geographic regions (The Americas; Europe, Africa and the Middle East; Asia and Australia) and they are public, private and international. The PYP program is noted for its rigour and relevance. Studies show that students achieve high levels academically. For example, a study conducted in Australia found that the science proficiency level of Year 6 students enrolled in PYP schools was significantly higher than the national level (Campbell, Chittleborough, Jobling, Tytler, and Doig, 2014). Another study, conducted in Australia and Singapore, which focused on the early years PYP programme demonstrated that students' literacy skills were well-developed, their school readiness was similar or better than children enrolled in a traditional early years program, and they were developing essential learning skills faster than a comparative sample (Morrissey, Rouse, Doig, Chao & Moss, 2014). Standardized test analysis conducted in New Zealand indicated that academic achievement within PYP schools generally exceeded the academic achievement of schools with similar school populations (Kushner, Cochise, Courtney, Sinnema & Brown, 2016). Similarly, Gough, Sharpley, Vander Pal and Griffiths (2014) found the scores of students enrolled in 13 PYP schools in Victoria, Australia on a standardized national assessment of reading and numeracy were significantly higher than the Australian average in all cases, with just one exception (Year 5 numeracy scores).

Importantly, students also do well beyond the academic. For example, administrators at 13 PYP schools believed their students exhibited greater motivation and positive learner

attributes than the Australian average (Gough et al., 2014). Kushner et al. (2016) found students in the PYP schools demonstrated greater international-mindedness, inquiry skills and action than students in comparator schools. Finally, demonstrating the relevance of the PYP, a study conducted in Colombia found that 89.3% of students enjoyed being a student at their PYP school and 90% reported they were proud of their school (Lester & Lochmiller, 2015).

These are consistent with a small, but growing, research literature that demonstrates transdisciplinary approaches to teaching and learning lead to academic outcomes that are as good as or better than traditional disciplinary approaches (For examples see Guyette, Sochaka, & Costantino, 2015; La Porte, 2016; Sillisano et al., 2010; Tan & Bibby, 2010). There is also evidence from a recent meta-analysis of 213 transdisciplinary socio-emotional learning (SEL) programs (Durlak et al., 2011) that transdisciplinary approaches to teaching and learning increase student motivation to learn, empathy, impulse control skills, self-management techniques and problem-solving skills – all important components of learning that are not always reflected in academic achievement scores.

The PYP is grounded in a strong transdisciplinary framework based on the work of Ernest Boyer (1995) and others. The framework is holistic in nature with an emphasis on the whole child and authentic and significant inquiry (International Baccalaureate Organization [IBO], 2009). The importance of the disciplines is acknowledged, but disciplines alone are not enough. Students need to learn the concepts and skills that transcend the disciplines and fall into the transdisciplinary realm. IB begins with the transdisciplinary themes (Who we are, Where we are in place and time, How we express ourselves, How the world works, How we organize ourselves and Sharing the planet) which are organized into units of inquiry. Each inquiry unit includes central ideas (enduring understandings), key concepts (e.g. form, function, causation, change, connection, perspective, responsibility and reflection), related concepts (e.g. property, structure, patterns, sequences, systems, etc.) and lines of inquiry that correspond to the central idea (IBO, 2012a)

Additionally, students acquire and apply transdisciplinary skills including thinking skills (e.g. higher order thinking skills, metacognition, and dialectical thought), social skills (e.g. respect, collaboration, conflict resolution, etc.), communication skills (reading, writing, listening, speaking, etc.), self-management skills (e.g. organization, safety, time management, healthy lifestyle, etc.) and research skills (e.g. questioning, observing, planning, collecting data, etc.)

The IB PYP program, however, does not just focus on concepts and skills it also includes attitudes, values and behaviours. Students need to demonstrate the attributes in the IB Learner Profile. These attributes are: inquirers, knowledgeable, thinkers, communicators, principled, open-minded, caring, risk takers, balanced and reflective. Through this process students learn to be internationally minded and to be able to collaboratively solve the complex problems in the interdependent world they live in (IBO, 2009, 2012a, 2012b)

The PYP consists of administrators who lead their schools and PYP Coordinators who focus on assisting classroom and specialist teachers in the transdisciplinary process. Within the PYP, teachers are identified as classroom or specialist teachers. Classroom teachers teach the core subjects and are the main designers and implementers of the transdisciplinary units. Specialist teachers are disciplinary specialists who typically focus on areas such as physical education, the arts and library.

The PYP includes mandated collaborative planning time using a specified PYP Planner that utilizes backwards design (Wiggins & McTighe, 2006). The collaborative planning typically involves the classroom teachers and PYP Coordinators. In some schools specialist teachers

also collaboratively plan and in other schools they do not. The PYP Planner encourages designers to choose their transdisciplinary theme, central idea and summative assessment task first. Second they choose their key concepts, transdisciplinary skills, IB Learner Profile attributes and teaching strategies. Summative assessment tasks are typically rich performance assessment tasks, not just traditional paper and pencil tests or essays.

Research Questions

The overarching research question for this study was: How do primary educators in IB schools translate transdisciplinary theory into practice as explored through the PYP teachers', coordinators' and administrators' lived experience. Additional questions included:

1) How did the participants in the study understand, define, plan for and approach transdisciplinarity?
2) What barriers did participants identify which hindered their ability to deliver a transdisciplinary program?
3) What supports were provided to help participants deliver a transdisciplinary program?

Method

The study utilized an empirical phenomenological research design (Creswell, 2012; Moustakas, 1994). Creswell (2012) states that the phenomenological approach is best suited for problems in which it is important to understand a collective groups' common or shared experience of a phenomenon. In this case it was important to understand the common experiences of PYP teachers with transdisciplinary teaching in order to develop or refine practices and policies and to develop a deeper understanding about the features of the phenomenon under investigation.

After securing ethics clearance, 24 IB PYP participants (teachers, coordinators or administrators) were interviewed from all 3 of IB's geographic regions and represented public, private and international school contexts. A snowball recruiting method was utilized. Every participant who agreed to participate in the study and completed a videoconference or telephone interview was asked to inform any of their friends and colleagues who currently taught in the PYP who they thought may be interested in participating in the study to directly contact the researchers for more information.

Participants were evenly distributed between IB's three geographic regions with 8 participants (33.3 % of the total sample) coming from each. Consistent with IB's demographics 13 participants worked at international schools (54.2%), 7 worked at private schools (29.2%) and 4 worked at public schools (16.6%). The majority of the participants were female (83.3%) and the mean number of years participants had been teaching was 15.4 years with the mean number of years participants had worked at IB schools being 8.0 years. In terms of their roles, 12 participants (50%) were classroom teachers, 6 participants (25%) were specialist teachers, 4 participants (16.7%) were coordinators and 2 participants (8.3%) were administrators.

Data collection consisted of in-depth interviews with participants through videoconferencing software such as Skype or over the telephone. As Moustakas (1994) recommends we used a broad, general umbrella question that was further broken down into three more directed questions and several additional probes. The interviewer addressed the probes only if the participant did not offer any information in that area.

Interviews with participants were conducted by one, or both, of the primary researchers and lasted approximately one hour in length. The interview was recorded on multiple audio recorders and then transcribed by a trained transcriber. Participants were sent the transcript of their interview so they could provide clarification around what they stated. They were also encouraged to correct any errors they believed were in the transcript with regard to what they reported in the interviews. Participants then sent their checked transcripts back to the researchers.

Data Analysis

Data were analyzed using the empirical phenomenology approach (Moustakas, 1994). In this approach the researcher attempts to suspend his or her own thoughts and beliefs to uncover the lived experiences of their participants. The goal is to discover any common themes that emerge across participants' lived experiences and report these themes, to the greatest extent possible, in the participants' own words.

In order to accomplish this, the researchers read over each transcript several times. Significant statements that were relevant to the phenomenon were identified. These identified statements are called the Meaning Units and could be as short as a sentence or as long as a page of the transcript. The Meaning units were then thematically organized in a situational structured description for each participant. The themes in each situational structured description were called the categories. These categories were then analyzed for common themes across participants. The reported findings below emphasize the commonality that is present in the diverse experiences of the participants interviewed in terms of their lived experiences with transdisciplinary teaching and learning.

Findings and Discussion

Three major themes emerged across the lived experiences of the 24 participants. They included: "It's a framework!", "Get on board" and "Their learning journey." Each theme is detailed below.

"It's a framework!"

All the participants identified the PYP as a unifying framework that was designed to promote transdisciplinary teaching and learning. Three main categories emerged that related to this theme and included: Freedom, personal understanding, and concept confusion

Freedom. One participant explained, "What is great about the PYP … you have this framework that you can customize however it will fit your schools needs the best." Another participant noted, "I have loved working with it. Of course it is not perfect but nothing is right now but I think this idea that it is a framework and finding these interpretations in it is interesting I think and everybody is making sense of it which is something that I enjoy." A third stated, "PYP is a framework and then you have to find your own way into it, your own interpretations almost. Of course you have to meet the standards but how you document children's learning over time is up to you as long as you do it." A fourth participant added, "We need to understand that the IB has schools all over the world and I personally appreciate the flexibility that it has." Finally, a fifth participant articulated, "It gives me the freedom as an educator to do lots of [things] with kids." Other participants noted specific ways that the PYP framework allowed their schools to integrate in written curriculum standards from various jurisdictions and detailed the curriculum mapping exercises they had engaged in to do that. One participant commented that solidifying "how to make the [PYP] and standards all work cohesively together" is something schools need to strive for.

Not all participants, however, thought the freedom the PYP framework provided was a good thing. One participant noted, "The scope and sequence I have to say is very, very vague, very wishy-washy." Another participant went further, "Anyone can choose the learning goals that they wish for their report card which to me does not make sense … I think it needs to be set in stone, a lot more standardized … I would love to have the transdisciplinary skills set out in a developmental continuum."

Personal understanding. The second category illustrates how participants interpreted the PYP framework and all the components embedded in it. A key component of the framework is teaching and learning. Participants articulated their understanding of transdisciplinary teaching and learning in a multitude of ways including:

> "So when I think about transdisciplinary learning I think what you are trying to do is … create connections between, across and maybe beyond, the disciplines … it's almost like it transcends the disciplines, it rises above it … [it] is more important than if you were just working in a disciplinary way."

Another participant stated:

> "The way I have learned to frame it … is to stop compartmentalizing disciplines … If you stop putting disciplines up as isolated, standalone disciplines and core subjects, and instead of putting 'Writer's Workshop' you put 'Large Group', instead of putting 'Reading' you put "Small Group", then you are able to take the unit of inquiry and mesh it with your daily activities."

A third participant described it:

> " I really look at it from a multi-tiered approach … I think at the most basic level is where the subjects really are working together very seamlessly as we are exploring a real life situation, real life issue … something very relevant to the real world."

A participant described, "Because I am a learner, I like concept learning. It's a difficult thing. In fact in working with my [students] right now on regions and they want to do what I call 'factoids' all the time. I started with a question, 'What makes your region unique?', and I kept coming back to that. They want to look at things as 'factoids' instead of as a concept … all places have a unique culture but they want to look at tiny bits of information that will probably not serve them well in the future and so in teaching the concepts I try really hard to talk with those and use those in my vocabulary."

The skills portion of the PYP framework IB refers to as the transdisciplinary skills or the 'approaches to learning'. One participant said, "If you look at the skills, you know, there is communication skills, social skills, there is research skills, thinking skills and self-management skills and then under each header there is a further sort of definition of what these skills imply. So, for example, under thinking skills you find remembering, analyzing, synthesizing, creating, you know, that sort of further refinement of what these skills imply." A second participant outlined, "They are skills that can be used throughout the subject areas or across subject areas throughout the day. And it's not that content doesn't matter but the content is used to teach the skills instead of the skills being used to teach the content." A third participant noted, "We also have articulation to make sure that we are covering all of those skills and we are trying to get better at teaching them explicitly rather than just saying there are communication skills involved in the unit, we try to teach those skills so that the kids know how to be positive in their communication skills in that unit."

The values and attitudes component of the PYP framework is reflected in the IB Learner Profile. This component of the framework one participant referred to as "the heart of it all and it is the heart of the whole IB continuum." The participant went on to articulate, "These are the attributes that we have and they're personal and they're academic and so we need to look at them in both of those ways and they interact with everything all the

time. At our school we tend to focus on a couple of them with each unit, ones that sort of speak to us and we link those quite strongly to the attitudes as well. Now how we assess those - we largely do a lot of reflection on them … a big part of the student portfolio relates to the learner profile." Similarly, another participant stated, "The learner profile is that learner outcome that we are aiming for. For me, everything else is a means to that end, to becoming an inquirer. You know, to becoming that internationally minded person that is represented from those, from that collection of attributes." Another participant noted, "They are probably more often sort of integrated into the teaching. So I know a lot of people use story books to sort of model what the attributes might look like and often those books will be integrated into a unit of inquiry so we will connect to whatever the unit is and so then they can look at how the characters in the book … are, you know, internationally minded or open-minded or caring, or whatever." This participant continued, saying, "Most visible are often the learner profile attributes and they are also posted all over the school."

Concept confusion. Several participants noted that the PYP framework, and especially the concepts embedded in it like the central idea, key concepts, related concepts, transdisciplinary skills and the IB learner profile, was quite complex and confusing. As a result, the final category that emerged in the "It's a framework!" theme was concept confusion. Statements from the participants demonstrated that they often did not understand, or were confused about, the concepts in the PYP framework. For example, one participant, while asked to describe his/her understanding of related concepts stated, "I would say the related concepts that I am looking at, that I am really emphasizing with kids, are the ideas of tenacity, resilience, determination, perseverance, you know the big ideas about anything to achievement, trying to strive for personal excellence." These seem to not be concepts at all, but rather values that the participant wanted to instill in his or her students. Another participant, responding to the same question, replied, "We always have them clearly displayed … I try to use them but to be honest in some ways they are decoration on the wall."

Another participant was asked to give his/her understanding of the central idea, key concepts and related concepts and stated, "Backwards by design is often used … as a planning tool and I think that's why you start with that conceptual understanding and then …what skills can children build while they're developing these understandings." While using the current terms the participant veered from defining the conceptual understandings to focus on skills. Another participant, when asked to provide an example of a skill he/she would teach, stated "we taught children to be risk takers." This appears to not be a skill but rather an attribute from the IB Learner Profile.

Most of the participant's confusion centred around the central idea, key concepts and related concepts. Many participants were not able to provide understandings of these concepts that were congruent with the IB's conception of the terms. One participant noted, "In my experience working with teachers … the related concepts seem to be easier to access for the students than for the teachers. The key concepts as well … especially for teachers who are new to the PYP, that kind of trips them up a little bit." From participants' responses it would appear that even teachers with several years of PYP experience still struggle with the central idea, key concepts and related concepts in the PYP framework. They do not seem to completely understand what a transdisciplinary concept consists of.

"Get on Board"

The second major theme was for the PYP to function as a transdisciplinary program people needed to "get on board" as one participant put it. The participants articulated there were multiple components that needed to be in place for true transdisciplinary

teaching and learning to occur within the PYP and these components were the categories that made up this theme. They included: Educator's Philosophy and Attitude, Administration, Timetabling, Collaborative Planning, PYP Planner Issues, Lack of Experience with PYP, and Professional Development

Educator's Philosophy and Attitude. Personal philosophy and attitudes were central to the implementation of the PYP. One participant highlighted, "When I came in [the school] had been struggling for a few years because the head of the school was not on board with the PYP and he … hired a curriculum coordinator that wasn't in tune with [the program] … and so a lot of the curriculum decisions she was making and the people she was hiring [were] working against the PYP and inquiry." Another participant noted, "There are some people on my team who are not so inquiry-based and they just want to get the job done … I guess it's a difference in philosophy … it's more about having a constructivist nature, like sort of an inquiry nature, and some can't let go, they can't let go of the reins, they don't like the messiness [transdisciplinary teaching and learning] brings." Another participant noted there was "absolutely" a conflict between people who are more transdisciplinary and people who are discipline-based. The participant went on to state he/she sees "it all over … people talk about it all the time."

Other participants provided examples of how a change in philosophy helped foster more transdisciplinary teaching and learning. One participant stated, "Recently there have been a few really good hires, and there has been a new head of school and … PYP Coordinator … a lot of people rethink their practice and start teaching [in a more transdisciplinary way] … teachers teaching a little bit less prescriptive." Another participant said, "There is now a drive to hire teachers who aren't just good teachers but who also embrace the PYP. There are some transitions being made right now with the teaching staff and some teachers who have chosen to move on." Adding to this, a participant stated, "I am moving [to another school] next year … they need someone to come in and reassure them and work with them to be focusing on this inquiry-based learning and concept-based learning, which is really what the transdisciplinary framework is all about.". One participant summed it up this way, "The only thing that hinders transdisciplinary [teaching and learning] are people's attitudes."

Administration. The second category that emerged was administration. One participant noted, "Leadership is so important … I think the leader has to understand how that process [of transdisciplinary teaching and learning] works … but [there has] to be that instructional piece too, to help support the continuation." Another participant gave the example of an inspirational principal, "who has since passed away, who told us our mission. Our mission was transdisciplinary [teaching and learning] and how we were going to work as an IB school. We did not have the answers at the beginning but we tried things … and they have carried on that mission for the last seven years. It took a lot of hard work, high expectations for teachers, high expectations for students and parents … we felt like we could not let her down." A third participant stated, "Our administrative team is really strong and the main goal is for us to be a true PYP school. So in almost any way they can they support [transdisciplinary teaching and learning]. It has not always been that way at this school but I would say for the last 5 years that has really been the case. Everything is devoted to it, there's money, there's time, there's support."

Other participants noted that their administration in some ways hindered transdisciplinary teaching and learning." One teacher complained, "Labelling this as a PYP school is a farce. Administration has created an environment, through the timetable and the lack of time for collaborative planning mostly, which focuses more and more on single-subject instruction and specialist teachers. We are required to do blocks of Reader's and

Writer's Workshop and standalone math and must write this into our classroom timetable so parents know at all times what we are doing."

Timetabling. Participants noted that how the timetable was constructed was often directly related to the underlying philosophy of the school and especially that of school administration. On occasion, however, participants stated that the timetable was the result of historical events or current events, such as building construction. One commented, "that if you are truly going to be transdisciplinary you can't tell teachers to spend X amount of minutes on each subject. That totally contradicts the bigger idea." Similarly, another participant stated, "I personally believe that we are at school to learn. We shouldn't have to be needing to do math from 9 to 10 o'clock." Another said, "Some schools …. [are] very program driven so I was told to have a block of reading instruction for 50 minutes and a block of writing instruction for 50 minutes, etc., and it was a very segmented day. I believe … the more integrated the curriculum is, the more authentic the learning experiences can be for the children and the more meaningful for them. That it makes more sense for them [to not have a strictly set timetable] because their lives are not segmented in that way." One participant who articulated that transdisciplinary teaching and learning was fully implemented, and implemented well, at his/her school stated, "We are given the time and also the freedom to design units as we like, with of course the oversight of the PYP coordinator. But unlike I know many of the public schools … we are not bound rigidly by timetables or time frames or state testing that we have to do. So just the freedom to merge subjects and deal with them in the PYP way, within the framework [promotes transdisciplinarity]".

A conflict emerged between the amount of time being scheduled to teaching classes by specialist teachers and the regular classroom teachers. One participant explained, "There is a bit of a conflict, so more and more of our daily timetable is being handed over to the single-subject [specialist] teachers … which is leaving homeroom teachers saying we do not have enough time in our daily schedule to teach all of the math, all of the language, all of our units of inquiry. We just don't have enough time." Another participant noted, "Something that really hinders [transdisciplinary teaching and learning] is the schedule because we have these specialist subjects … it would be nice to have it be a bit flowing …because good inquiry I believe really needs at least an hour." Other participants noted the timetable could also hinder transdisciplinary teaching and learning because it does not provide time for the classroom teachers and specialist teachers to collaboratively plan. Another agreed, "The classroom teachers have timetabled planning time, it's just the extra people like the librarian and other single-subject teachers who can't always get to all of those meetings." The result of this is that transdisciplinary teaching and learning is decreased.

Collaborative Planning. The majority of participants stated that collaborative planning was essential to transdisciplinary teaching and learning. As one participant said, "You can't do it without it … so you cannot, absolutely, cannot do any transdisciplinary curriculum without the team meetings." Another participant stated, "It's key, it really is. My own development and understanding of the power of collaboration really came in when I started collaborating with other people … collaborating with different people from different disciplines and the kind of expertise they have … it builds their understanding of these big ideas but also to see where the links are." Another participant made the point, "At the schools that are very well into their IB you see [collaborative planning] everywhere. For example, at my current school the specialists and the [classroom] teachers work really well together to ensure that transdisciplinary teaching is occurring.

Other participants, however, identified problems with the collaborative planning process as it currently existed. The participants identified scheduling meetings where everyone

could attend was difficult. As one participant stated, "It is something that is extremely hard to do, it is extremely hard to coordinate schedules … to be honest the biggest complaint that the staff have right now is that we are not coordinating with the specialists." Another participant noted, "We don't [collaboratively plan] as a whole school because we have specialist teaching … when my students go to Spanish that is sort of no contact time for me [and I have no collaborative planning time with the specialist teachers], so it's not actually transdisciplinary if that makes sense."

Another issue with specialist –classroom teacher collaboration was inequity. One participant explained, "What happens in the PYP is they create these units of inquiry as classroom teachers, so these units are already created, and then now [the specialist teachers are] supposed to fit into this. So suddenly we are having to fit into something that has already been created, we haven't had equal ownership in the process." Similarly, another participant commented, "I think from what I understand it's from a classroom teacher perspective it's being done, they are looking at the transdisciplinary skills but in the single subjects it's still not really being addressed." A third participant noted, "Because I am not [a classroom teacher] I am not at all of the planning meetings and … I am not there for the main parts of it." A fourth participant stated, "Okay so there is conflict between the specialists and the classroom teachers and this notion of transdisciplinarity as some of the specialists feel that their subjects, and themselves personally, are getting short shifted in the name of transdisciplinary teaching."

PYP Planner Issues. Another category, which is related to collaborative planning, is PYP Planner Issues. In general, most participants stated they liked the backwards design process the planner promoted. One participant stated, "I like the process of it. The process makes sense to me. You have a central idea that fits under the theme, then you come up with …the lines of inquiry and the teacher questions … and then in Box 1 is the summative assessment and it gives you … what's the evidence that they've reached the understanding of that central idea by the end of the unit. Then from there is Box 3 where it shows all the formative assessments." Similarly, another participant stated, "The PYP planners do a really good job of listing everything in that specific order, so we look at what the summative assessment will be for a particular unit and then go backwards." A third participant noted, "I feel it is necessary. I do feel that it is very time-consuming, especially when you are creating a new unit. I feel it makes sense in terms of the backwards design, it makes sense in terms of, you know, showing the different activities. I think some schools take it to the nth degree and really go overboard while some schools do the exact opposite and there is no use in it at all."

Some participants, however, felt there were some issues with the design of the planner itself. One participant stated, "It's a little too structured and the organization of it, like the skills and the learner profile and things like that, are a bit of an afterthought in the way the planner is organized." Another participant noted, "In the planner they kind of have it a little bit backwards because they don't even have you decide what your learner profile and your skills are until the bottom of that box 4 and because we are not supposed to do anything [to change the planner] I have actually switched the orders inside the boxes." A third participant stated, "It is backwards by design, which is great and it really gets you focusing on the things like the key concepts, but it doesn't provide enough focus on those approaches to learning [skills] and the related concepts." A fourth participant stated, "I feel like I need more space because there is not enough space there."

Participants also noted that the planner was more of an archival document than a living document. Most stated they did not actively use the planner while they were teaching. They used it as a guide for their planning and then they returned to it after the unit was complete to reflect on it. Many participants talked about creating their own planners that

they used more frequently while they were teaching and some participants shared these with the researchers. One participant explained, "I don't know how much they are using [the planner]. I mean they do sit down with it and they document all of their thinking around it but there is a lot of Google Docs at our school … and I think that kind of distracts them from all of the things that get placed on the planner… the expectation is that we use the planner but I think it is more a part of the culture of the team now [to use their own Google Doc planners]." Another participant noted, "I have so many things going on in my classroom, like I change things every 10 minutes because of the age of these kids and I don't have quite enough space on [the planner] so that's why I colour code my own [planner], where I plan each day." A third participant stated, "I know in our school our PYP Coordinator has devised a series of other documents that we also use but we are not allowed to scrap the PYP planner completely." A fourth participant said, "Right now it is mainly a planning tool that we mainly return to, to do our reflection afterwards and then archive it and then move on to another unit."

Lack of Experience with the PYP. As one participant stated, "[we should] recruit more teachers that maybe have a bit more experience in the PYP." Discussions involved how there were often issues with teachers who were hired who did not have any experience with the PYP that hindered transdisciplinary teaching and learning. One participant stated, "I've seen this at all the IB schools I've worked at. When teachers are brought … into the PYP who have no experience with it, they quickly get overwhelmed and often then become negative forces in the school. They often … then start doing their own thing which is to teach standalone units." Another participant noted, "The [negative] attitude comes from lack of understanding, lack of experience, unwillingness to change, and fear of change. It's not always easy to share what you are doing with someone, a lot of teachers close the door and do their own thing." A third participant stated, "The PYP is complex. There are a lot of parts to it so for a new teacher to come in that was trained in a different way, they really struggle. There is a lot of stress and frustration. One way to fix that would be to only hire teachers with PYP experience or set up a good training program for new teachers interested in teaching in the PYP that they had to take before they would be hired."

Professional Development. The participants discussed that professional development could be an important way to foster transdisciplinary teaching and learning in the PYP but they had several concerns over how, and what, was being presented as professional development. One participant stated, "I think professional development is huge but there aren't a lot of great models for how to teach in a transdisciplinary way." Another participant commented, "[IB] workshops are becoming a little bit dogmatic … they are just so broad because they have so many different kinds of schools that are now starting to use their program and they have to cater to so many people and their workshops are reflecting that. So the depth is gone because the kinds of people going to workshops are fairly different. And then when it comes to the in-school workshops they didn't really cater to our specific needs whatsoever. We did a workshop on inquiry and we feel that our school is no further along as a result of that workshop, which is really disappointing." When asked about professional development learning on transdisciplinary teaching and learning, a third participant answered, "Transdisciplinary teaching and learning, I am not so sure I would actually say there is much [PD in that area]."

Other participants discussed the "train the trainer" model that IB appeared to be using for some of its professional development. One participant described, "They have a curriculum to be taught but the person who is delivering it always has their own spin on exactly what it is. And all of those ears in that room they hear what they think the person is saying and they say what they think they heard. The information is then passed down between so many ears and mouths that we are not getting the same message at all … [Additionally]

they send some people to different courses every year but there is no consistent way at our school for sharing knowledge acquired at these workshops … so it is possible that a grade two teacher goes and because I do not teach grade two I never hear anything at all about what this person learned." Another participant talked about how there were issues with bringing experts in to the schools as well saying, "We thought we were doing a good job [with transdisciplinary teaching and learning] and [the expert] met with the whole team, PE, Music, Art, Library and we said hey this is what we are doing and she said, whoa, whoa, whoa, hang on a minute, you are not really doing the right thing here and then we didn't have an opportunity to have a second meeting with her so we never found out how to make it right."

Several participants also discussed some ideas of how to make professional development more effective. One participant suggested, "More modelling of what it looks like when you have all the pieces in place, you know, you've got the concepts, related concepts, your talk about the learner profile and your attitudes, and what does it look like when somebody is making all that happen in a meaningful way. You know what does it look like when kids are doing it … it doesn't have to be in-person modelling but you could have videos, you can have people giving tours of classrooms by Skype, of other places like that to see what it looks like when its working really well." Another participant suggested, "And there would be Job-Alikes across the city … where different schools … would offer to do a session … where you just kind of share what you are doing in your field. So it might have to do with a particular transdisciplinary theme, people might just get together to kind of share their ideas about that."

"Their Learning Journey"

Despite some of the issues the participants discussed which made implementing transdisciplinary teaching and learning in the PYP a challenge, they all stated the PYP benefited students and aided them in their learning journey. In this theme two categories emerged from the participant's responses: Rich Performance Assessment Tasks (RPATs) and Student-directed Learning.

Rich Performance Assessment Tasks (RPATs). RPATs were one of the most important aspects of the PYP; they contributed both to the program's relevance for students and its accountability to local, IB and national standards. The participants described significant learning tasks their students had accomplished such as a grade 2 class going out into the rainforest for 5 days to learn about natural resources. Many of the participants described these tasks as their best experiences in the PYP, and provided them as exemplars of transdisciplinary teaching and learning. Participants described them in the following ways:

> "The kindergarteners were studying about celebrations … under the theme 'How we express ourselves' they were learning that people celebrate for different reasons and that individual celebrations are different around the world and that there is always a purpose. And so as they went to each of the specialists throughout their unit and they planned as a whole kindergarten by voting on which part they would like to create for their own celebrations. So week-by-week they sort of built on it, they picked what colours they would need for a celebration and the purpose of their celebration and what would be included in their celebration. They planned out the whole thing with the guidance of the teachers and then they had their celebration night … All created by the kids and guided by the teachers."

> "Last year, when I taught in the kindergarten classroom, doing a five senses unit we were able to … go out into the community, visiting pet stores, visiting the library and the fire station, inviting community members in and seeing the excitement on the children's faces when they were able to have community members come in and share their knowledge … my best teaching probably related to that unit was working with my co-teacher and digging really

> deeply into the five senses, authentic experiences like drawing blindfolded and smelling different smells and practising sign language. It was a great unit."
>
> "So we were doing a unit on water conservation and the environment and it was a grade four class and they lacked interest, they lacked desire, they just wouldn't engage in it at all. So with the permission of [the administrator] I set about turning one of the courtyards into an experimental area and we called it 'The last bucket of water [in the country]'. The students basically had to decide how they were going to preserve it … The students were able to access research data that they perhaps would not have ever known was available to them and as a result of that we actually won a government award … There were several hiccups that I created along the way where the weather started to warm up and I may have helped evaporation along a little bit and they had to figure out what would happen now … there was an overnight pollution episode that occurred and they had to figure out how to clean the water without losing the water. It was transdisciplinary … we were measuring water, we were using fractions and things like that. We used literacy because we were reading about things that we could do to protect our water, we were writing letters to government departments asking for guidance and information. We were conducting science experiments on dirty water to see how we could clean it. You know we did some social studies and some geography because we were figuring out countries that didn't have problems with water from a volume point of view so it was about the [problem] in every aspect of their learning."
>
> "The children were exploring public spaces and how they serve the diverse needs of the community. So at the end of the unit the children were asked to create a public space with recyclable materials and then kind of explain what type of public space they have created and how people would use it. This is a great one. That seems to be quite an authentic task to assess children's understanding of that big idea."
>
> "We have a lot of trouble with stray animals in [our country] so they were interested in this idea so they started to explore everything and it was very difficult for them to narrow down what they wanted to explore. So first we got them down to a couple of different concepts, where they decided they wanted to look at how rescuing stray animals [in their country] works and what the history of that is, which we can call change, and how people have been helping stray animals and what our responsibility is as people. And so they started and came to the conclusion through education that people [in their country] don't really have pets, they have like dogs for guarding but they don't have pets so it's very easy for them to just put a dog out on the street because they don't see them the same way Western people do. We have a lot of Western kids at our school, or more westernized I suppose, so they find this quite upsetting. So they decided through action and education they could improve the lives of stray animals in [their country] … That gave them the focus to carry on and move forward with their work [their solution to the problem]".
>
> "We also have a school store that third graders have to apply to run and we link it to IB, they have to tell what IB attitude would help them with this job or why they should be the one, or how they can show leadership by working at the school store. It's like an application, like a real job application. We have been able to have 30 of our 100 students do that this year."

Student-directed Learning. Many participants talked about student-directed learning being the epitome of transdisciplinary teaching and learning and a goal they were striving to do more of in the classroom. One coordinator stated, "There were some units that I really did feel were more transdisciplinary … we would put students in charge during the time and so they had some leadership roles within it. But then as teachers watched the inquiry really unfold, responded to questions and planned little mini-lessons and such to help [students] move forward in their thinking and then turned it back over to them and continued to watch and assess how things were going. So I really loved the amount of student direction within that unit and really for once I felt like that guide on the side, the presence of really moving them through their learning journey". Another participant replied, when asked what would improve the PYP at his/her school, "getting more of a student-centred approach to learning going here and really seeing that materialize."

Responding to the same question another participant stated, "I think the attitude of the school will be to embrace children for being children and young learners and minds, not minds to be opened up and shoved information in, but people who can develop understanding on their own with opportunities to grow and be creative."

Several participants discussed trying to bring in student-directed learning through genius hour, or passion projects, where students are allowed to direct their own learning. Genius Hour is a teacher-created phenomenon based on a practice at Google where employees get a certain % of paid work time to work on inquiries of their own interest. In schools, students are given a set amount of time – for example, every Friday afternoon - to generate their own questions and conduct their own inquiries based on their personal interests and not the set curriculum. One participant stated, "What is happening a lot more is that … we have something, some people call it 20% time, genius hour, passion project, we have a lot of that starting to happen in the school as well because we do find we are struggling to find the time for really deep inquiry in our units because of all these time restrictions and that we want students to have real time like this … student-led inquiry is exciting for kids and that is where you are teaching those skills and the knowledge is coming more from the kids. So a lot in the upper [primary] grades they devote some time to genius hour every week." Another participant stated, "We also know how important it is for kids to guide their own learning and take steps to build their own questions and learn more and take next steps. So last year a quick story would be the specialists got together and talked about how we could let the kids plan their own unit and that turned into planning their own activity night. So now we do activity nights that complement our units."

Other participants agreed, stating, "one of the biggest things that IB is trying to do is to let kids take ownership over their learning and being able to plan their learning and extend it on their own." As evidence for this statement they made reference to the final exhibition, which is an excellent example of an RPAT. One participant explained it by saying, "When students do an exhibition, when they start the process of exhibition, and it's the closure to the PYP, it's almost like they are kind of going through a unit planning process itself. They don't literally do that but a lot of times they sort of do that in small groups. A group of students will take a topic, maybe a branch of what we are studying and they develop their own lines of inquiry, they develop their own action piece, they develop what their central idea is going to be, what they are going to study. So they really are, they really develop their own unit. It's like a project that they develop and it really is a demonstration of their learning."

Similarly, another participant stated, "It's the closure to the PYP program and when we had our exhibition it was exciting to see the students, how they took on the learning themselves and they put together their whole projects, their experiences, and they really went through a whole unit planning process in their little groups and when they were sharing their knowledge and sharing how they connected with the community to do research about topics, kind of a branch off of what we were studying and it just led to other levels of learning. I think it was really exciting to see that we had the exhibition in a couple of different museums and the students and the community came out to watch them and to just watch the students talk about their learning. I think that was really exciting."

A third participant outlined, "I am fairly involved with the final exhibition … I do a lot of work with the whole class, so with 80 kids, and for this they have to explore the different key concepts that the IB uses and it's hard for them to choose this because they do not have to do this at any other time in their lives [up to this point]. So we really explore what those concepts are and they break them down and they have to make their own central idea, which is kind of the big idea that they want people to take away from their project … student-led inquiry is the biggest piece of [transdisciplinary teaching and learning], where

they really understand what they are trying to explore." A fourth participant questioned, "I don't understand why IB does not just make the PYP a series of exhibitions in each grade. Everyone, teachers, parents, the kids themselves, all value it the most, so why not base the entire program on student-directed learning?"

Conclusion

As demonstrated by the themes above, all of our participants appreciated the potential of transdisciplinary teaching and learning. For the most part their comments about their experiences were positive. The more critical comments some participants made were not directed toward transdisciplinary teaching and learning itself, but rather toward poor implementation of the PYP. There are several conclusions which can be drawn from the participants' experiences which may assist other educators who wish to implement transdisciplinary teaching and learning into their own practice.

A majority of participants understood transdisciplinary teaching and learning, especially as outlined in the PYP documents (IBO, 2009; 2012a; 2012b), to be a framework with which they could work and which was flexible and transportable to different contexts and cultures as transdisciplinary teaching and learning is not culture-bound. Such a framework seems particularly important in today's society where global knowledge is required to solve the world's complex problems, drive innovation, and expand the global economy. This level of flexibility is also helpful because a variety of subject specific scope and sequence documents may be integrated into the transdisciplinary framework. Scope and sequence documents might come from national or state education mandates or have been locally developed by school administrators and curriculum specialists. The transdisciplinary framework itself, however, needs to clear, concise and easy for educators to understand and use. The Know, Do, Be Model (Drake, 2007, 2012; Drake, Reid and Kolohon, 2014), for example, is an elegant framework which promotes transdisciplinary teaching and learning.

The transdisciplinary framework seems to be most helpful when it includes a curriculum planning tool to be used in every school; that tool focuses on backwards design principles and leads to rich performance assessment tasks (as opposed to traditional paper and pencil tasks, tests and exams) (Dobozy & Dalziel, 2016). A planner needs to be easy to understand and can be used on a daily basis, not just as an archival document (Dobozy & Dalziel, 2016).

As highlighted by the participants, time to collaboratively plan is essential when implementing transdisciplinary teaching and learning. All the educators involved in curriculum planning and implementation need scheduled time to meet with each other and come up with the outline of the transdisciplinary units. This included generalist, classroom teachers, single-subject specialist teachers and any curriculum coordinators or specialists who are involved. It was important that this collaborative planning time was scheduled throughout the school year and not just at the beginning of the year or term. Participants described transdisciplinary teaching and learning as being very fluid so frequent collaborative planning sessions are necessary so everything remains running smoothly. This is consistent with several studies that have found collaborative planning is not only beneficial for transdisciplinary curriculum development but also increases teacher efficacy and teachers' sense of empowerment (Linnell, Zidenberg-Cherr, Briggs, Scherr, Brian, Hillhouse, & Smith, 2016; Miller, 2013; Tan & Nashon, 2015)

In addition to collaborative planning time, large blocks of time during the school day need to be devoted to transdisciplinary teaching and learning (as opposed to an hour for reading and an hour for math) (Miller, 2013; Nompula, 2012). When blocks are only loosely structured, more student-directed learning may occur. During these times students

will likely be actively engaged in their own, or teacher-led, inquiry projects. Participants described how strict timetabling makes it very difficult to implement transdisciplinary teaching and learning because it is very difficult to determine how long each inquiry activity will last.

Another element that seems required for successful implementation is that everyone 'buy in' to the program. Supportive administrators who devoted time, resources, scheduled collaborative planning time and flexible classroom schedules led to effective implementation. Successful teachers believed that the program promote student teaching and learning and they tended to be comfortable with the messiness that inquiry-based, transdisciplinary teaching and learning brings. Several studies have recognized the need for school administrators to develop strategies that increase teacher motivation and confidence in the changes administrators are hoping to effect, no matter what the new initiatives involve (Epstein & Willhite, 2015; Marsh, 2015). Other researchers have found that teacher efficacy is a key component of successful curriculum development and implementation (La Porte, 2016; Nurlu, 2015)

The transdisciplinary program did not just happen. A solid professional development was in place to give formal training on how to implement transdisciplinary teaching and learning (Burton, 2012). This would be recommended to insure educators are on the same track (Scripp & Paradis, 2014, Thomas, Hassaram, Rieth, Raghaven, Kinzer & Mulloy, 2012). But, if this approach is as effective for the 21st Century as it seems to be, then it should be implemented more widely. Faculties of Education need to include transdisciplinary teaching and learning methods into their curriculum. Teacher candidates need to be given the opportunity to engage in this type of education during their practice teaching blocks and should be provided with opportunities to see transdisciplinary teaching and learning being modelled (Corlu, Capraro, & Corlu, 2015; Dowden, 2014; Thomas et al., 2012).

We hope that by considering the lessons learned from this study, more educators will feel comfortable implementing transdisciplinary programs. Such programs that are both accountable to local and national mandates and still relevant to students while preparing them for the complexity of the 21st century world will greatly benefit the next generation.

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Acknowledgements

This research was supported by a grant from the International Baccalaureate Organization.

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