

**FAST TRACKING THE FUTURE EDUCATION PROGRAM:**

# **Sydney Metro Professional Development Project Evaluation**

A research report commissioned by Sydney Metro

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# Contents

<b>Acknowledgements .....</b>	<b>2</b>	<b>The Influence of the Professional Development Program on Student Learning.....</b>	<b>32</b>
<b>Executive Summary.....</b>	<b>3</b>	Increased student engagement.....	33
The Professional Development Program.....	3	Influences on curriculum knowledge and soft skills.....	35
The Evaluation.....	3	<b>Changes to Awareness of the Sydney Metro Infrastructure Project.....</b>	<b>36</b>
Findings.....	4	<b>Summary.....</b>	<b>39</b>
Recommendations.....	4	How did the professional development program influence the implementation of inquiry-based learning?.....	40
<b>Introduction.....</b>	<b>5</b>	In what ways did the professional development program increase awareness of the impact of the Sydney Metro infrastructure project?.....	40
<b>Background.....</b>	<b>7</b>	<b>Recommendations.....</b>	<b>41</b>
Models of teacher professional development.....	8	<b>References.....</b>	<b>43</b>
Professional Development and the Impact on Teacher Practice and Knowledge.....	8	<b>Appendix.....</b>	<b>46</b>
Inquiry-Based learning: What is it?.....	9	Fast Tracking the Future Education Program: Evaluating Professional Development and Resource Development for Sydney Metro.....	47
Inquiry-Based Learning: What does it look like? .....	10	Student Survey .....	47
Inquiry-Based Learning: In the classroom and across the curriculum .....	12	Section 1: Awareness of the Sydney Metro Project.....	47
<b>The Professional Development Program.....</b>	<b>14</b>	Section 2: Learning through an Inquiry-Based approach.....	47
Program Participants.....	16	Section 3: Awareness of the impact of Sydney Metro.....	47
<b>Evaluation Design and Methods.....</b>	<b>18</b>	<b>Figures</b>	
Evaluation Participants.....	19	<b>Figure 1: Models of Inquiry-Based Learning.....</b>	<b>11</b>
Ethical Procedures.....	19	<b>Figure 2: The Inquiry Process.....</b>	<b>13</b>
Data Sources.....	19	<b>Figure 3: Survey Respondent's Prior Knowledge of Sydney Metro.....</b>	<b>37</b>
Interviews.....	19	<b>Figure 4: Survey Respondents Sharing of Knowledge of Sydney Metro.....</b>	<b>38</b>
Focus Groups.....	19	<b>Tables</b>	
Surveys.....	19	<b>Table 1: Participants in Professional Development Program.....</b>	<b>16</b>
Textual Analysis.....	20	<b>Table 2: Timeline for Implementation of Professional Development Program.....</b>	<b>16</b>
Data collection instruments.....	20	<b>Table 3: Sydney Metro Units of Work for Publication.....</b>	<b>28</b>
Data Analysis.....	20		
<b>Program Results.....</b>	<b>21</b>		
<b>The Influence of the Professional Development Program on Teacher Practice.....</b>	<b>23</b>		
Course Content.....	25		
Course Structure.....	26		
Influences on planning.....	27		
Influences on implementation.....	30		

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# Executive Summary

This report details the findings of a research evaluation conducted for Sydney Metro exploring the effectiveness of the *Fast Tracking the Future* professional development program and resource development. The program was conducted in 2018 through the Education Knowledge Network at Western Sydney University, in partnership with Sydney Metro.

## The Professional Development Program

The program of professional development designed and implemented by academics at Western Sydney University aimed to address the Sydney Metro Education Program requirements by:

- Initiating a community of practice interested in inquiry-based learning;
- Developing and promoting inquiry-based learning pedagogy;
- Supporting the design, implementation and evaluation of inquiry-based units of work based on the Sydney Metro project; and
- Developing the capacity of participating teachers to undertake action research projects for the implementation and evaluation of the designed units of work.

The professional development program was offered to primary and secondary teachers who worked at schools located within a 10 kilometre radius of the Sydney Metro City & Southwest line currently under construction. The program was delivered to each of the three cohorts of teachers across approximately two school terms. It consisted of two full-day, face to face sessions delivered at Western Sydney University Bankstown Campus, and two, after school electronic meetings using Zoom video conferencing. Teachers who participated in the program were provided with 30 hours of NSW Education Standards Authority (NESA) endorsed professional development at the Highly Accomplished level. A total of 33 teachers from 12 schools completed the program.

The program required participating teachers to apply their professional learning through the design, implementation and teacher-evaluation of inquiry-based units of work, using the Sydney Metro infrastructure project as a stimulus. The completed units of work were aligned with the NSW curriculum and were implemented in the participants' schools across a range of grade levels from Kindergarten to Year 10. The units were then submitted to Sydney Metro for editing and publication.

## The Evaluation

This evaluation was undertaken using a qualitative approach. A small amount of survey data is included to provide further insight. The following research questions were used to explore the effectiveness and impact of the professional development program:

1. *How did the professional development program influence the implementation of inquiry-based learning?*
  - What are the perceived influences of the professional development on teacher practice?
  - What are the perceived influences of the professional development on student learning?
2. *In what ways did the professional development program increase awareness of the impact of the Sydney Metro infrastructure project?*

Evaluation participants were drawn from teachers (from six schools) and students (from three schools) who took part in Courses 2 and 3. Data sources included semi-structured teacher interviews, student focus groups and a student survey upon conclusion of the professional development program and the teaching of the unit of work.



## Findings

The professional development program influenced the implementation of inquiry-based learning by providing the participating teachers with in-depth knowledge of inquiry-based teaching approaches alongside detailed information about the Sydney Metro infrastructure project. The program influenced teaching practice in the following ways:

- It provided teachers with opportunities to collaborate with colleagues from different school levels and contexts, therefore expanding their understanding of classroom practices;
- The program provided teachers with an alternative approach to teaching practice via inquiry-based learning;
- The course structure, including the combining of face-to-face and digital meetings that were spread over an extended period of time, allowed the participants to gain feedback from peers, academics, and Sydney Metro staff;
- The requirement to design and then teach a unit of work changed how teachers engaged in the planning process and enabled them to integrate various subject disciplines; and
- The implementation of the inquiry-based unit of work led to high professional engagement and increased teachers' confidence to use inquiry approaches in future.

The program influenced student learning by:

- Improving their engagement with learning as a result of the shift to a more student-centred approach via inquiry-based learning;
- Providing a real-world and relevant context for learning;
- Promoting skills such as critical thinking, problem solving, and collaboration;
- Increasing their knowledge of their local communities and transport options.

The professional development program increased the awareness of the impact of the Sydney Metro infrastructure project amongst teachers, students, and the broader community. In particular, the impact on the environment and the ways in which people move around Sydney featured heavily in the units of work and the students' responses to survey and focus group questions. The engaging nature of the program promoted discussion amongst teachers, (including those not participating directly in the professional development program), students and their families, and the broader community members who came into contact with the participants during the course of the program. The program resulted in teachers, students, and community members engaging in critical thinking, collaboration, and specific subject discipline content, skills, and knowledge to consider the impact of the Sydney Metro project on their lives and communities now and in the future.

## Recommendations

The following recommendations are provided to assist in the development of future professional development programs related to the Sydney Metro project:

- Due to the positive impact of the program on teachers, students, and the broader community, it is recommended that Sydney Metro continue to provide professional development opportunities that build capacity in teachers leading to sustained changes in practice and improved knowledge of the development of significant infrastructure projects.
- It is recommended that Sydney Metro develop some supplementary documents that align their resources with curriculum areas to increase the use of Sydney Metro resources as stimulus materials for school inquiry. This will assist teachers in using the resources in the delivery of inquiry-based units based on the Sydney Metro infrastructure program.
- To improve future iterations of the professional development program it is recommended that detailed guidelines for documentation of units of work and linking with curriculum outcomes are provided for teachers. This will aid the publishing process and increase efficiency.
- Future iterations of the professional development program should incorporate a buddy system to assist individual teachers who are not participating with others from their school. This will ensure those teachers receive ongoing feedback and support in addition to the support provided by Western Sydney academics and Sydney Metro staff.
- Further opportunities for peer review to be included in future iterations. This will ensure all units are of consistent quality and teachers and students gain the maximum benefit from their learning experiences.
- It is recommended that the provision of more teacher release (half a day per teacher) is incorporated into future professional development programs to ensure higher teacher and student participation rates in program evaluations.
- It is recommended that only paper-based surveys be used rather than online surveys to promote higher student participation and ease any issues regarding access to digital devices.



# 1

## Introduction

# Introduction

The *Fast Tracking the Future* professional development program and resource development for Sydney Metro was conducted in 2018 through the Education Knowledge Network, Western Sydney University, in partnership with Sydney Metro. This report presents an evaluation of the professional development program and its impact on the participating teachers and their students in relation to their awareness of the Sydney Metro infrastructure program in South-West Sydney, and their experiences of implementing an inquiry-based learning pedagogical approach.

This project arose in response to a call to providers of teacher professional development for the development and delivery of a program that would assist in achieving the goal of the Sydney Metro Education Program to:

....provide robust, credible learning experiences for students (K-10) within 10 km of the alignment about the Sydney Metro project; its purpose, construction and environmental and social context. The program supports Australian education goals (Melbourne Declaration) specifically Goal 2: All young Australians become successful learners, confident and creative individuals and active and informed citizens. (Sydney Metro, Service Provider Proposal, p.7)

More specifically, the aim of the Sydney Metro Education Program, as articulated in the Service Provider Proposal, was to focus on schools in Southwest Sydney with the following objectives:

1. Through the education program, leave a transformative legacy
  - The community and, in particular, future Sydney Metro users, are engaged meaningfully via an Australian and NESA curriculum linked education program during and after the Sydney Metro Project. The program will build student knowledge, skills and understanding around infrastructure change, the role of government in this process and the benefits for the communities along the alignment, and the broader Sydney and NSW public.
  - Through the Sydney Metro education program broad Transport for NSW and education priorities, such as sustainability, STEM, career pathways and workforce development, civics and citizenship and Aboriginal and Torres Strait Islander histories and cultures are embedded in student and community learning.

2. A world leading education program

- Sydney Metro education program recognised as highly valued education programs by teachers on the alignment.
- Sydney Metro program is recognised nationally and internationally. (Sydney Metro, Service Provider Proposal, p. 8)

The Education Knowledge Network at Western Sydney University developed and implemented a sustained professional development program for primary and secondary teachers who worked within a 10 kilometre radius of the Sydney Metro City & Southwest line currently under construction. The program, which was delivered to three separate cohorts of teachers, included face-to-face sessions, online sessions, and the practical application of learning through the design, implementation and teacher-evaluation of inquiry-based units of work, focused on the Sydney Metro infrastructure project. The completed units of work were aligned with the NSW curriculum and were implemented in the participants' schools across a range of grade levels from Kindergarten to Year 10. The units were then submitted to Sydney Metro for editing and publication. Further detail of the program is provided in this report following a brief overview of background literature pertaining to the main elements of the program: teacher professional development and inquiry-based learning.





2

Background

# Background

## Models of teacher professional development

There are two common models of teacher professional development (PD): the traditional type of activities that involve workshops, seminars and conferences, and more contemporary type activities that incorporate study groups, networking, mentoring and meetings that occur in-situ during the process of classroom instruction or planning time (Lee, 2007). Although some suggest that the newer forms of PD are more likely to make connections to classroom teaching and may be easier to sustain over time, there are arguments that there is still a place for traditional PD or a combination of both, which may work well for teachers at various stages in their careers (Lee, 2007). The Sydney Metro PD program was designed in such a way that its delivery was both off site and in-situ, through the combination of face-to-face, and off-site, synchronous online sessions that allowed teachers to participate while in-situ.

Darling-Hammond, Wei, Andree, Richardson and Orphanos (2009) suggest changes in teacher practice and student learning respond to “intensive and sustained professional development activities, especially when they include applications of knowledge to teachers’ planning and instruction, have a great chance of influencing teaching practices and, in turn, lead to gains in student learning” (2009b, p.44). The literature also supports the argument that well-designed PD is seen to provide classroom support over a sustained period of time (Desimone, 2009; Higgins & Parsons, 2011), recognising that change is progressive and requires time and effort (Guskey, 2002). This program involved sustained professional development that aligned with suggestions made in the above literature with a focus on the development of knowledge and understanding of an inquiry approach to teaching and learning. In addition, the participating teachers were required to apply their learning to their classroom practice through the design, delivery, and evaluation of inquiry-based units of work while being supported by the facilitators of the PD.

## Professional Development and the Impact on Teacher Practice and Knowledge

Continued, tailored and effective professional learning for teachers supports student achievement and attainment (Bednar, Fiorentini, & Huang, 2011; Crowley, 2014; Nunes, 2011; Patton & Parker, 2012; Killion, 2015; Guskey, 2002); with high quality professional learning described by Guskey as a “central component in nearly every modern proposal for improving education” (Guskey, 2002, p. 381). Crowley (2014), specifically, is unequivocal in asserting that as professionals, teachers must hold a level of professional knowledge and skill; stressing further, that within a paradigm of professionalism, an inherent and fundamental obligation exists for all classroom practitioners to actively “remain up to date in such professional expertise and knowledge” (Crowley, 2014, p. 28) for the betterment of student learning.

The impact of professional learning on teachers, and the subsequent flow-on effect for students within their classrooms, whereby an “enhanced professional identity, capacity and expertise” (Robinson, 2014, p. 134) for educators occurs, is not always easy to develop and administer (Guskey, 2002; Killion, 2015; Duncan-Howell, 2010). However, the significant, positive influence authentic and personalised content-driven professional learning for teachers has on student outcomes is delineated throughout the research of Killion (2015), Guskey (2002), Patton and Parker (2012) and Duncan-Howell (2010). Implementing, and indeed shifting teacher practice to better support the implementation of inquiry-based approaches and strategies to teaching and learning was a major goal of the professional development providers, aligning with the intentions of Sydney Metro.



## Inquiry-Based learning: What is it?

Inquiry-based Learning, commonly referred to as ‘inquiry’, is a teaching approach grounded in constructivist learning theory and was conceptualised as an approach to learning nearly 100 years ago (Dewey, 1929). Constructivist learning theory, through inquiry pedagogy, regards learning as an active and contextualised process for the construction of knowledge and understanding. Differing from traditionalist approaches that hold a simple view that knowledge can be merely transmitted to learners, (Olusegun, 2015; Tam, 2000), inquiry is dynamic, enterprising and active.

While there are a range of definitions for inquiry (Colburn, 2000), inquiry-based learning and constructivism enjoy widespread support amongst educators. Both the constructivist theory and inquiry have long been advocated for as the most effective and authentic approach to teaching and learning, particularly within fields mathematics and physical sciences education (American Association for the Advancement of Science 1993; Anderson 2002; Blumenfeld, Soloway, Marx, Krajcik, Guzdial & Palincsar, 1991; Edelson, Gordon, & Pea, 1999; National Research Council (NRC) 1996; National Council of Teachers of Mathematics (NCTM) 2000; Wang, Kinzie, McGuire & Pan, 2010).

Inquiry-related practice as a stance towards teaching and learning is an approach consciously selected and applied by educators to empower their students as active agents of their learning. Inquiry promotes and supports critical and creative thinking, emboldening learners to become dynamically and intimately involved in the construction of understanding throughout the process of learning (Kuhlthau, Maniotes, Caspari 2015; Bonnstetter 1998). Perhaps most pointedly, however, Wang et. al (2010) assert that inquiry-based learning, and *learning through* inquiry, could be considered the most ‘natural’ pathway for individuals to learn about and through disciplines; permitting and indeed *inviting* learners to uncover new, deeper, first-hand understandings about subjects, their environment, and about themselves. Thus, the inquiry approach is particularly suited to students as a pathway to increase knowledge and awareness of significant infrastructure projects such as the Sydney Metro: “Inquiry equips students with abilities and competencies to address the challenges of an uncertain, changing world. Inquiry is a way of learning new skills and broadening our knowledge for understanding and creating in the midst of rapid technological change” (Kuhlthau, 2011, p2). Significant bodies of solid, grounded research reinforce that inquiry-based strategies, routines, structures and approaches to teaching and learning are both powerful and effective methods of school instruction (Dewey, 1929; Bruner, 1961; Vygotsky, 1962; Piaget, 1980; Bednar, Cunningham, Duffy, & Perry, 1992; von Glasersfeld 1995; Bonnstetter 1998; Owens, Hester & Teale, 2002; Olusegun, 2015; Kuhlthau, Maniotes, Caspari 2015).

## Inquiry-Based Learning: What does it look like?

Traditional teaching practices typically rely upon didactic, teacher-centred modes of instruction and usually include mostly singular and direct methods of teaching instruction. In the traditional approach the teacher serves as the primary source of knowledge and learning, offering only a basic, limited transfer of information. Conversely, an inquiry-based learning and teaching approach produces an integrated student-led learning experience (Fielding-Wells & Makar, 2011). In a classroom environment where the teacher is teaching through inquiry, educators thoughtfully and deliberately curate carefully constructed and interconnected learning opportunities and resources that encourage students to think, explain, challenge and extend their ideas and understandings (Murdoch, 2018). An integral element of this program was the provision of resources and opportunities directly related to the Sydney Metro infrastructure program in south-west Sydney.

Teaching and learning through inquiry innately “engages, interests and challenges students to connect their world to the curriculum” (Kuhlthau, Maniotes, Caspari, 2015, p4), triggering an act of learning that is more likely to lead towards a greater gain in the depth of understanding uncovered throughout the learning, ensuring greater knowledge retention. Inquiry by its very nature generates natural curiosity, delivering intentional, focused student questioning and wondering; setting forth a context for learning crafted by teachers that is authentic, meaningful and purposeful for learners.

Growing in commonality and prevalence, it is now a reality that teachers and schools face ever increasing, frequently diverse class populations in terms of academic ability. Importantly however, and perhaps most significantly, inquiry is known to wholly benefit all learners, “engaging all students, and not just those who have already shown that they are academically inclined” (Kuhlthau, Maniotes, Caspari, 2015, p7). This notion that inquiry is a powerful form of natural curriculum differentiation is reiterated by Colburn (2000), Rocard et. al (2007) and Camenzuli and Buhagiar (2014), all suggesting inquiry-based learning is especially effective in helping students with lower levels of self-confidence and those from disadvantaged backgrounds to engage with more positively with their learning. These insights are particularly important in this program due to the geographical spread and socio economic diversity along the Sydney Metro Southwest link, which stretches from northern Sydney (high socioeconomic), to Bankstown in the Southwest (mid to low socioeconomic). This socioeconomic range also resulted in broad diversity in terms of life experiences and academic achievement of the participating teachers’ students.



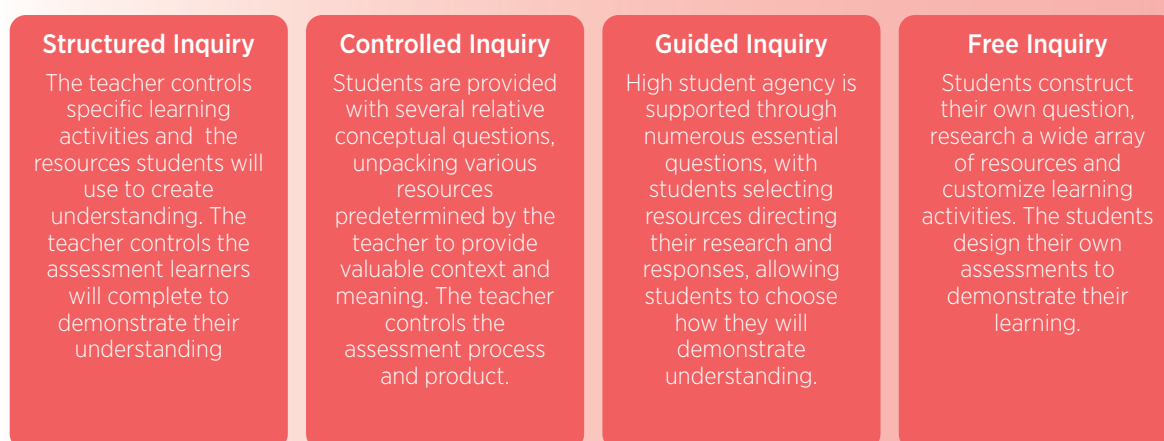


Misconceptions pertaining to inquiry-based learning do exist (Olusegun, 2015; Tam, 2000), and it is important to note that not all inquiry-based learning processes and pedagogies are the same. Different methods, approaches, interpretations, and models of inquiry-based learning co-exist. The various models employ varying degrees of increased or reduced structure and direction from the teacher to meet the needs of students and are specifically selected to cater to differing learning needs and classroom contexts. Each of these conceptualised processes and models for inquiry-based learning comprises of specific and distinct phases and stages within the inquiry process. Many of these models have emerged from and through various disciplines, such as scientific inquiry, historical inquiry or problem-based learning. The similarities, hallmarks and key indicators of inquiry practices throughout all interpretations, however, remain consistent, with all models incorporating varying degrees of student autonomy and teacher control (Maniotes, Harrington, Lambusta, & Kuhlthau, 2015).

Irrespective of the level, inquiry-based learning aims to develop students' abilities to analyse, synthesise and evaluate information, indicated through Bloom's Taxonomy as high-level thinking processes.



**Figure 1:** Models of Inquiry-Based Learning (Fichtman-Dana, 2011)



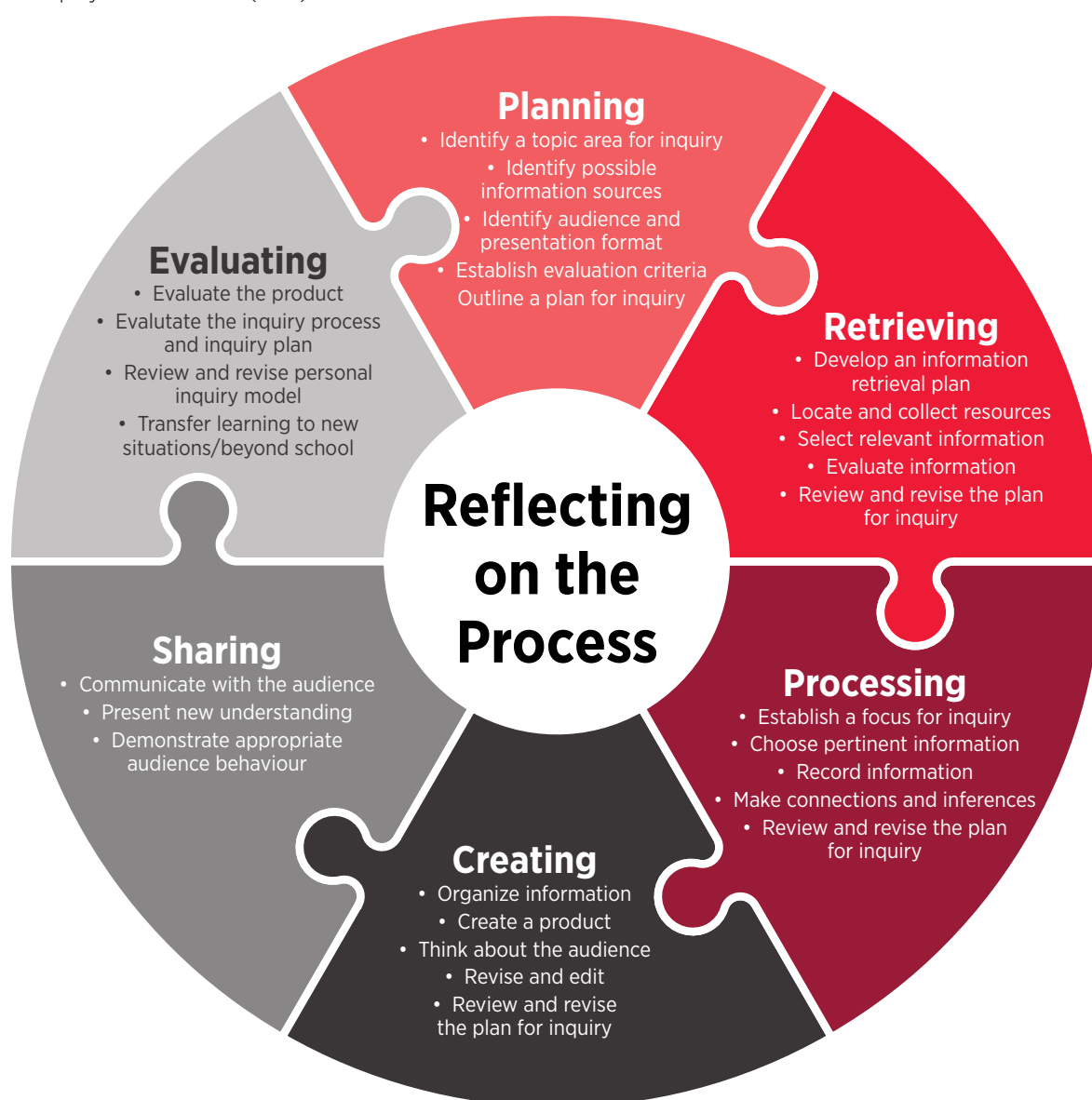


## Inquiry-Based Learning: In the classroom and across the curriculum

Inquiry is a multifaceted and multi-layered teaching approach and may include short focused lessons or larger lengthier projects. Students learning through inquiry can often be observed engaging in learning experiences that involve them making and documenting observations; posing questions; playing with problems; looking for patterns; making and testing conjectures; examining books, images, artefacts and other sources of information to see what is already known; planning investigations; reviewing what is already known; experimenting; evidence documenting; using tools to gather, analyse, and interpret data; proposing answers, explanations, predictions and formulating questions; and communicating results and findings (Maaß & Artigue 2013; Katz, 2014; Kuhlthau, Maniotes, Caspari, 2015; Maniotes et.al, 2015). These skills and capabilities nurtured and refined through inquiry-based learning “add depth and richness to student learning” (ACARA, 2019) and are also a distinct feature of the Australian Curriculum General Capabilities.

Inquiry-based classrooms are highly collaborative learning environments where multiple and diverse perspectives are sought and valued (Katz, 2014; Maniotes, et.al, 2015). Through inquiry, both teachers and students work together in learning communities and groupings that are fluid, responsive and supportive. Students not only problem solve but significantly, they gather ideas, grow curiosity and problem pose. Within an inquiry-based mathematics classroom students think deeply and critically as they hypothesise, debate, test theories, and challenge mathematical concepts. All of these thinking processes and learning experiences facilitate dynamic and robust mathematical discourse and conjecture, essential to the development of mathematical proficiency (Katz, 2014; Kuhlthau et. al, 2015) and are features of the Australian Curriculum mathematics proficiencies (ACARA, 2019).

**Figure 2:** The Inquiry Process Kühne (1995)



In an inquiry-based mathematics classroom learning is connected through, beyond and between 'big ideas' and concepts, often transcending the boundaries of subject areas with broader goals and objectives towards mathematical competencies and proficiencies the focus of the teacher. While the role of the teacher in an inquiry-based classroom can be different, the teacher remains essential (Colburn, 2000), often acting as a coach rather than the fount of knowledge or the source of truth (von Renesse & Ecke, 2015). Through inquiry, teachers can effectively activate the affective, cognitive and behavioural domains of engagement for students (Fielding-Wells & Makar, 2011). Teachers of inquiry work to serve their learners,

...orienting students towards questions and problems of interest for them that contain interesting learning potential; making constructive use of students' prior knowledge; supporting and guiding when necessary their autonomous work; managing small group and whole class discussions; encouraging the discussion of alternative viewpoints; and helping students to make connections between their ideas and relate these to important mathematical and scientific concepts and methods and the curriculum...students are not left alone in their discovery but are guided by the teacher who supports them in learning to work independently. (Maaß & Artigue 2013, p782)

The ability of an inquiry approach to promote connections within and across curriculum disciplines provides a powerful argument for the use of the approach, particularly in the context of the Sydney Metro project, where the potential for curriculum integration is significant. Similarly, the project

is rich enough to sustain inquiry in individual disciplines such as mathematics or science. Katz (2014) affirms that mathematics classrooms rich in inquiry-based pedagogies enhance and improve a student's development of the interwoven and interdependent strands for mathematical proficiency: conceptual understanding; procedural fluency; strategies competence; adaptive reasoning; productive disposition (Katz, 2014). Notably, these very strands feature heavily within the Australian Curriculum (Mathematics). The Australian Curriculum Assessment and Reporting Authority (ACARA) highlight the importance of mathematical proficiency, noting within Australian F-10 Mathematics curriculum documentation, that the development these capabilities are considered an "integral part of all mathematics content across the three content strands: number and algebra, measurement and geometry, and statistics and probability...[and, that] the proficiencies reinforce the significance of working mathematically within the content and describe how the content is explored or developed, [providing] the language to build in the developmental aspects of the learning of mathematics" (ACARA, 2019).

In summary, literature pertaining to the inquiry-based learning approach supports its use in a range of subject disciplines. The use of an inquiry based approach promotes critical thinking and provides important opportunities for the integration of subject disciplines. Further, contextualising learning through inquiry based learning allows students to acquire, clarify, and apply understandings of concepts (Edelson et. al, 1999) through active participation and a range of concrete experiences (Duran & Dökme, 2016). This research evaluation will explore the influence of IBL on the program participants' practice and their students' engagement with what is currently the largest infrastructure project in Australia.



A large, bold, white number '3' is centered within a red circle. The circle is partially cut off by the top and right edges of the frame. The background of the entire slide is a gradient of red and pink.

The Professional  
Development  
Program

# The Professional Development Program

The following program of professional development aimed to address the Sydney Metro Education Program requirements by:

- Initiating a community of practice interested in inquiry-based learning;
- Developing and promoting inquiry-based learning pedagogy;
- Supporting the design, implementation and evaluation of inquiry-based units of work based on the Sydney Metro Project; and
- Developing the capacity of participating teachers to undertake action research projects for the implementation and evaluation of the designed units of work.



The program structure was as follows:

## **Session 1: Introduction to Inquiry Based Learning and the Sydney Metro Project**

*Full day, face to face workshop at Western Sydney University, Bankstown Campus*

Participants were introduced to the pedagogy of inquiry-based learning and the action research process. They were introduced to the Sydney Metro project by a Sydney Metro representative. The workshop facilitators provided an overview of the activities and expectations of participation in the professional development program to culminate in a set of units of work to be published and disseminated. By the end of this workshop participants had begun brainstorming ideas for their units of work. Participants were set the task of drafting a unit of work in preparation for the next meeting (in approximately three weeks).

## **Session 2: Designing a Unit of Work using an Inquiry Approach – Aligning with Curriculum and Embedding Technology**

*Two-hour, after school, online session (Zoom)*

Participants shared their progress and received peer feedback on the draft units of work and began to align their activities with curriculum outcomes, General Capabilities and cross-curriculum priorities.

## **Session 3: Implementing a Unit of Work using an Inquiry Approach – Assessment Strategies and Evidence Gathering**

*Two-hour, after school, online session (Zoom)*

In this session participants shared the progress of their draft units of work. They provided each other with feedback and were set the task of completing their drafts in preparation for implementation in the following school term (refer to timeline, Table 2).

## **Session 4: Presentation, evaluation and finalisation of Units of Work**

*Full day, face to face workshop following implementation of unit, held at Western Sydney University, Bankstown campus.*

In this final workshop, participants presented their completed units, work samples (including assessments) and other evidence to their cohort of participating teachers. They were also provided with time to finalise their units and work on documenting the unit evaluation. A follow-up peer review was included in the original program planning, however this did not occur due to the heavy work commitments of the participating teachers.

Participating teachers were provided with 30 hours of NESA endorsed professional development at the Highly Accomplished level.

## Program Participants

The professional development program was delivered three times during 2018. The program attracted a range of primary and secondary teachers from the public and private school systems as indicated in Table 1. The participants included in Table 1 are those who completed the entire program, including the submission of a completed unit of work. An additional eight teachers were enrolled, however, due to a variety of reasons, were unable to complete the program. In most cases, more than one teacher from each school participated in the program. Units of work were designed and delivered by each of the participating teachers. However, not all units have been selected to be published or disseminated. In many cases, the units were designed collaboratively amongst teaching teams. Table 1 provides details of the units to be published by Sydney Metro and the NSW Department of Education.

**Table 1:** Participants in Professional Development Program

Course	School	No. of Teachers	Grades
1	Bankstown Girls High School	2	9-10
	Bankstown Primary School	1	1
	Belmore Boys High School	4	9-10
	Chullora Public School	6	K-6
2	Artarmon Public School	4	K-6
	Dulwich Hill School of Visual Arts & Design	2	9-10
	Mosman High School	1	7
	Revesby Public School	4	3-4
	Wenona School	1	7-8
3	Fort Street High School	4	7-10
	Quakers Hill East Public School	2	K-2
	Sydney Secondary College Balmain Campus	2	7-10

33

**Table 2:** Timeline for Implementation of Professional Development Program

	2017				2018						
					Term 1 30/1 – 13/4			Term 2 1/5 – 6/7		Term 3 24/7 – 28/9	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Course 1					Session 1 Intro	Session 2 Design 1	Session 3 Design 2	Unit Implementation		Session 4 Evaluation	Peer Review
Course 2								Session 1 Intro	Session 2 Design 1	Session 3 Design 2	Unit Implementation
Course 3											Session 1 Intro





2018				2019								
Term 3 24/7 – 28/9		Term 4 15/10 – 19/12										
Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
	Publication											
		Session 4 Evaluation	Peer Review			Publication						
Session 2 Design 1	Session 3 Design 2	Unit Implementation		Session 4 Evaluation	Peer Review			Publication				

# 4

## Evaluation Design and Methods

# Evaluation Design and Methods

This evaluation was undertaken using a qualitative approach. A small amount of survey data is included to provide further insight. The following research questions were used to explore the effectiveness and impact of the professional development program:

1. *How did the professional development program influence the implementation of inquiry-based learning?*
  - What are the perceived influences of the professional development on teacher practice?
  - What are the perceived influences of the professional development on student learning?
2. *In what ways did the professional development program increase awareness of the impact of the Sydney Metro infrastructure project?*

## Evaluation Participants

There were two groups of participants in the evaluation. The first group of participants were drawn from the teachers who participated in Courses 2 and 3 of the professional development program. There were three primary and three secondary schools with eight and six teacher participants respectively. The second group of participants were students of teachers who had taught the Sydney Metro inquiry units of work. There were a total of 32 primary students forming six focus groups and 12 secondary students forming two focus groups who participated. The teachers and students have been anonymised for the purpose of this report.

## Ethical Procedures

The research methods employed in this evaluation were approved by Western Sydney University's Human Research Ethics Committee (approval number: H12808) and the NSW Department of Education (SERAP number: 2018575). All prospective participants were provided with a plain language information sheet about the research. This evaluation was conducted with participants who gave informed consent to participate.

## Data Sources

Data informing this evaluation were drawn from the following sources:

### Interviews

Semi-structured interviews were conducted with the teachers who participated in Courses 2 and 3. Interviews were selected as a way to garner in-depth information about the participants' experiences in the professional development program and related classroom practices. The semi-structured interviews were carried out on completion of the unit of work either during the final professional development session or at school, following the completion for the course. Participants from the same school took part in a group interview. Where only one teacher at a school participated in the PD program, he or she took part in an individual interview.

### Focus Groups

Each participating school was invited to have students participate in focus group discussions. Three out of the eight participating schools provided signed consent forms for their students to participate. Representative groups of students from each of the participating teachers' class groups at the schools detailed in Table 4 took part in a focus group discussion on completion of the unit of work to allow the researchers to gain a deeper insight into the students' perceptions of the inquiry-based learning and their perceptions of the Sydney Metro project. Each focus group consisted of five or six students, selected by their teachers (from those who had returned signed consent forms) as being representative of the class group.

### Surveys

A simple and concise survey (Appendix 1) was designed for students using age appropriate language to assist in addressing the research Questions 1 and 2 relating to the perceived outcomes of the professional development (implementation of inquiry-based unit of work) on student learning and any changes to the students' awareness of the Sydney Metro project. Surveys were administered on completion of the unit of work.

The intention of using a survey instrument in this evaluation was to allow the researchers to gain feedback from the maximum number of student participants. However, due to the requirement for all students to return consent forms signed by carers prior to completing the survey, only a small number of surveys were completed (14). Those respondents came from the same school and were all in the same Years 7 and 8. Although only a small number of students responded to the survey we still include this data in the report.

## Textual Analysis

The completed documentation relating to the 11 units of work selected for publication by Sydney Metro (including teacher evaluations and sample student work samples) were collected and analysed to assist in responding to each of the research questions.

## Data collection instruments

The following questions and topics served as open-ended prompts for student focus groups and teacher interviews:

### Students (focus groups):

- You recently learned about the Sydney Metro project. Can you talk about what you learned?
- Can you talk about the way that you learned?
- Was it different to the way you usually learn? How?
- Can you talk about whether you think learning in this way is effective?
- Would you like to use this way of learning again? Why or why not?
- Can you talk about the things your teacher did to help you in your learning?
- What impact do you think the Sydney Metro project will have on your community and on your own lives?
- Do you have any feedback to your teacher about your learning or that way that you learned?

### Teacher Interviews:

- Can you talk about your general experience participating in the professional development program?
- Based on your experiences designing, implementing and evaluating an inquiry based unit of work, what are your current perceptions of teaching through an inquiry based approach?
- What are your perceptions about how an inquiry based approach facilitates student access to the curriculum?
- Can you talk about the benefits of such an approach for your students?
- Can you talk about whether you believe the program assisted in the development of your skills in relation to inquiry based learning?
- Were there any unanticipated benefits or outcomes to your participation in the program for you, your colleagues or your students?
- Can you talk about whether other teachers and/or stakeholders were involved in this project?
- Do you have any suggestions for future iterations of the program?

The survey instrument is included in the Appendix.

## Data Analysis

Data from teacher interviews and student focus groups was audio-recorded and transcribed. This data, along with the survey data, was then analysed to identify emerging themes in response to the evaluation questions. The units of work to be published by Sydney Metro were analysed to determine the model of inquiry implemented by the teachers and the topics and disciplines covered.







5

Program Results



# Program results

The foundation of this project was to increase engagement in the Sydney Metro infrastructure program through teacher professional development. The program aimed to develop the participating teachers' knowledge of inquiry-based learning as a pedagogical approach, while at the same time increasing awareness of the Sydney Metro program within and beyond school communities who would be likely to use the new transport network. In addition, the PD program would result in the development of a series of units of work that could be implemented by other teachers in NSW, further increasing awareness of the Sydney Metro program.

This section presents an analysis of the data gathered from student surveys and focus groups, teacher interviews, and the units of work to respond to the research questions:

1. *How did the professional development program influence the implementation of inquiry-based learning?*
  - What are the perceived influences of the professional development on teacher practice?
  - What are the perceived influences of the professional development on student learning?
2. *In what ways did the professional development program increase awareness of the impact of the Sydney Metro infrastructure project?*



# 6

The Influence of  
the Professional  
Development Program  
on Teacher Practice

# The Influence of the Professional Development Program on Teacher Practice

Data from the participating teachers and their students indicates the professional development program resulted in deeper understandings of the design and implementation of inquiry-based pedagogical approaches. While there were some early concerns regarding the design and implementation of the units of work, the participating teachers successfully implemented units of work, 11 of which are currently progressing to publication by Sydney Metro (Table 5). The teachers' initial concerns were related to their students' abilities to engage in the inquiry process, the challenge of fitting in an inquiry unit to an existing scope and sequence, and the challenge of adapting current teaching practice. The majority of teachers participating in the PD program had little or no prior experience teaching through an inquiry-based learning approach. For some, this challenge required a significant shift from their existing practice. The following comments illustrate the initial perceived challenges:

I know personally I need to change my planning, my thinking. Everything that I have been so comfortable in doing all needs to change, go out the window, because obviously you don't plan for the next lesson. They tell you what you're doing next lesson. That's where you get your ideas...

*(Year 1 teacher)*

I was thinking this is going to be really hard; I don't know how to fit it in with something we're doing, but then it actually ended up fitting in quite well with our geography and English units.

*(Kindergarten teacher)*

An additional concern for some teachers emerged as a result of having primary and secondary teachers participating in the course together. In some cases this led some of the primary teachers to feel a lack of confidence in the ability of their students to engage in the inquiry process when compared to the secondary students:

One of my main concerns from the beginning is that the first day we came in all the other schools were high schools, and I think one other teacher was from a Stage 3 from another primary school. I was just - everyone's ideas are these big great ideas. Their students are capable and I'm like how are we going to do this. Even today I was saying to Nathan ours look so different. It was very different and I just wasn't - I guess I didn't give the students the credit where credit was due. I didn't think we could take this concept and make it work.

*(Year 1 teacher)*

...listening to secondary teachers talking, there is such a disconnect between where our cohort of children are and their cohort of children and I don't know if there is much that's transferable. It may be beneficial to have a primary lesson and a secondary lesson.

*(Year 1 teacher)*





Interestingly, this concern was only expressed by primary teachers, and particularly those in the lower primary classrooms. Such concerns are understandable due to the vast differences in age and ability between students in lower primary and those in secondary classrooms, and were eventually addressed over the duration of the program, resulting in the units designed by early years all aligning with the Structured or Controlled models of inquiry-based learning as described by Fichtman-Dana (2011) (See Table 5). However, while the combination of primary and secondary teachers was a challenge for some, others saw this as a benefit that allowed them to gain insight into a range of teaching strategies within different school contexts:

Because we're primary based and we've got some high school or secondary teachers it's good to see what they're doing too and how intense it is because we've got up to Year 6 and then Year 7, they're doing all of this and I'm like wow.  
*(Year 3 teacher)*

## Course Content

The course content included exposure to the range of inquiry-based learning approaches as described by Fichtman-Dana (2011). In addition, the participants were exposed to current trends in the use of digital technologies to support learning, assessment strategies, and action research methodology. Most of the interviewed teachers indicated the content was helpful in their planning and implementation of the units of work:

I was still fairly new to inquiry-based learning so I learnt some good skills.  
*(Year 3 teacher)*

A continuum from closed inquiry to open inquiry [exists]...I found it beneficial in terms of for me, it was the first time I'd really written an inquiry unit. [Previously], most of the units I've written for my class were very much directed by the teacher, and I very much directed where the unit is going to go.  
*(Kindergarten teacher)*

However, one teacher did indicate that further examples of inquiry-based learning units of work would have been beneficial during the planning stages.

## Course Structure

The course structure appeared to have been influential on the teachers and their inquiry-based learning practices. The multi-session program aligned with recommendations from literature regarding effective professional development, allowing the teachers to apply the new knowledge to their planning and instruction (Darling-Hammond et. al, 2009). The spacing of the sessions and the synchronous format of the two afternoon sessions appeared to have positive benefits for the participants:

The Zoom sessions were really valuable because I gained a lot of advice from other teachers about the problems I was having planning my unit.  
*(Year 5 teacher)*

...it was rewarding, but say, because it wasn't passive, because you had to come up with a unit of work and it was more face-to-face with professionals, I felt that it was a challenge to get materials up and develop something of - that's worthy of being published. So I found that a challenge to then do that in my own time, along with the rest of my teaching practice.  
*(Year 9/10 teacher)*

...actually having that Zoom session to talk to Nathan with regards to the topic area and him giving you the presentation - he gave us a different topic at each zoom meeting. That was beneficial because you could still then have the back and forth, like, I didn't understand this topic, could you please elaborate on this? Or he asked us for an example. Just the fact that you can talk and get a response back - it's like a virtual environment equivalent of being in a tutorial or a lecture. I found that very useful.  
*(Year 9/10 teacher)*

if we hadn't had those Zoom sessions, I probably would have done a lot less work, because I didn't necessarily know what I was supposed to be achieving, because I hadn't done this type of professional development before and it was good to get that clarification and validation of our approach. So that was good.  
*(Year 9/10 teacher)*

Overall, the teachers found the course structure was highly effective. The ability to take time out of school to collaborate and plan was beneficial for the participating teachers as tasks such as unit design are usually conducted in teachers' personal time. The following quote is representative of the teachers' sentiments:

I'm glad that the combination of Western Sydney University and the Metro allowed us to even spend this time - even over several days, to design new units of work, to base - to do on this inquiry-based learning. Because we only have a certain amount of time in our lives, and actually having teachers have time out of class is actually what's one of the most important things when it comes to designing new units of work.  
*(Year 8/9 teacher)*



## Influences on planning

The PD program appears to have had a significant influence on the unit of work planning phase, when the participants were required to design their units using an element or elements of the Sydney Metro project as a stimulus. This planning phase was conducted over a sustained period, including the initial session and two follow-up synchronous online sessions. Each of the sessions included peer feedback as well as feedback from the PD facilitators and Sydney Metro staff. The benefits of the collaboration that was embedded into the program design emerged as a significant theme in the teacher interview data. The following quotes provide exemplars of the teachers' responses:

I found it helpful because I was listening to others and I was like okay their feedback, I was kind of getting an understanding. Because I maybe interpret things differently. I found that through the discussions and the assistance that was provided, I was able to understand it more as well. So, it was beneficial.

*(Year 3 teacher)*

Seeing other schools approaches to inquiry-based learning and the projects they have run, helps develop my creative thoughts in regards to inquiry-based learning.

*(Year 9/10 teacher)*

Being able to see how they were going to do their assessment and how they were going to stimulate their kids with the Sydney Metro, that allowed me to then sort of form or sort of take mine in another direction or shape the way that I did mine.

*(Kindergarten teacher)*

In addition, the opportunities for teachers to work with academics and Sydney Metro staff also appeared to have positively influenced the teachers' practices. Participants were able to benefit from expert knowledge of teaching practice alongside expert knowledge of the Sydney Metro infrastructure program. Additional, 'just in time' support was also provided from the facilitators and Sydney Metro staff when required by the participants. This combination appeared to have improved the teachers' confidence in designing and delivering their units of work. The following quotes illustrate these findings:

It was actually very engaging, so I was very interested in it, because I had nothing – like no knowledge of it. Because I was passionate about it all of a sudden, the kids were passionate because I was able to reflect that.

*(Year 6 teacher)*

I think whenever there's an opportunity for a bunch of experts to come together you always take so much more away. So that's my experience.

*(Kindergarten teacher)*

I really appreciated it being run at Western Sydney University, where you're able to directly talk to the academics involved with the program, but also the liaisons with Metro. It added some more validity to the research that they're basing the findings off and I felt like I got more information out of it compared to just seeing an online lecture or an online discussion.

*(Year 8/9 teacher)*

**Table 3:** Sydney Metro Units of Work for Publication

	Unit Name	Grade	Duration	Discipline
1	What's it Made of?	ES1	2 weeks	Science & Technology English Geography
2	Sydney Metro and Me	ES1	8 weeks	Geography
3	Do we Need a Train at Chullora?	ES1	8-10 weeks	Geography Science & Technology English
4	How are you Feeling?	ES1 (support unit)	Flexible	PDHPE English Science & Technology
5	How can Transport Connect us to Places?	Stage 1	4 weeks	History English Mathematics
6	Sustainability and Sydney Metro	Stage 2	10 weeks	Geography Visual Arts
7	Sydney Metro – Creating a Website	Stage 2	8-10 weeks	Geography History Science & Technology
8	How Does the Sydney Metro Meet the Needs of Society?	Stage 3	10 weeks	Geography History Science & Technology English
9	Sydney Metro: A 3D Design Focused Inquiry	Stage 3	7 weeks	Geography Science & Technology
10	If Landscape is a reflection of us as individuals, what are others seeing?	Stage 4	10 weeks	Geography Science Mathematics
11	The Sydney Metro Rail Project	Stage 5	10-12 lessons	Mathematics

Level of Inquiry	Key Inquiry Questions	Sydney Metro Resources Used
Structured	<p>What are some of the observable properties of materials?</p> <p>What materials make certain objects?</p> <p>How do the properties of materials affect their use?</p>	<ul style="list-style-type: none"> <li>Images of Sydney Metro trains</li> <li>Video: <a href="https://www.youtube.com/watch?v=XyQ2JP8L7Kc">https://www.youtube.com/watch?v=XyQ2JP8L7Kc</a></li> </ul>
Controlled	<p>What places do I know?</p> <p>What makes a place special?</p>	<ul style="list-style-type: none"> <li>Sydney Metro introduction video (DVD)</li> <li>Video: <a href="https://www.youtube.com/watch?v=2CmvQRSKg8s">https://www.youtube.com/watch?v=2CmvQRSKg8s</a></li> <li>Video: <a href="https://www.youtube.com/watch?v=i-FtJc1YdWA">https://www.youtube.com/watch?v=i-FtJc1YdWA</a></li> </ul>
Controlled	How does the community meet the needs of people?	<ul style="list-style-type: none"> <li>Sydney Metro models, banners, and other resources (provided by Sydney Metro)</li> <li>Video: <a href="https://www.youtube.com/watch?v=XyQ2JP8L7Kc">https://www.youtube.com/watch?v=XyQ2JP8L7Kc</a></li> </ul>
Structured	How does the community meet the needs of people?	<ul style="list-style-type: none"> <li>Sydney Metro models, banners, and other resources (provided by Sydney Metro)</li> </ul>
Structured	How can Transport Connect us to Places?	
Guided	How can we as architects design a sustainable train station of the future?	<ul style="list-style-type: none"> <li>Sydney Metro introduction video (DVD)</li> <li><a href="http://www.sydneymetro.info/">www.sydneymetro.info/</a></li> </ul>
Structured	How have trains changed over time?	<ul style="list-style-type: none"> <li>Sydney Metro models, banners, and other resources (provided by Sydney Metro)</li> <li>Sydney Metro website</li> </ul>
Guided	<p>What are trains and what are they made from?</p> <p>How do trains work?</p> <p>Why were trains invented?</p>	<ul style="list-style-type: none"> <li>Sydney Metro models, banners, and other resources (provided by Sydney Metro)</li> </ul>
Free	Inquiry questions determined by individual student interests	<ul style="list-style-type: none"> <li>School visit by member of Sydney Metro team</li> </ul>
Guided	<p>Why are urban landscapes not all the same?</p> <p>How do urban landscapes reflect those that live within them?</p> <p>To what extent do our social structures reflect the way we plan our urban infrastructure?</p>	<ul style="list-style-type: none"> <li>Seven Network World's Best Metro: <i>Go Deep Under Sydney</i> 1 hour news special, 2016.</li> <li><a href="http://www.sydneymetro.info">www.sydneymetro.info</a></li> <li>Chatswood to Sydenham Environmental Impact Statement, Sydney Metro</li> </ul>
Controlled	What impact do you think the Sydney Metro Project will have on the people you know?	<ul style="list-style-type: none"> <li><a href="http://www.sydneymetro.info/">www.sydneymetro.info/</a></li> <li>DVD: World's Best Metro – Go Deep Under Sydney</li> </ul>

## Influences on implementation

The details of the units of work, as listed in Table 5, provide a brief overview of the content covered, the subject disciplines addressed, and the Sydney Metro resources accessed within the units of work. The unit documents have been analysed to determine the model of inquiry-based learning implemented, and there were examples of each of the models as described by Fichtman-Dana (2011), with an almost even spread between *Structured* (36.4%), *Controlled* (27.3%), and *Guided* inquiry (27.3%), and one example of *Free* inquiry. It is not clear whether this spread of models was influenced by the professional development program, however, the PD program did not prescribe the model to be implemented and the teachers were free to design units that met the needs of their students and their school contexts. The majority of units (82%) also featured an interdisciplinary approach, which was encouraged but not prescribed. Those units that listed single disciplines (Units 2 and 11) did require students to apply skills and knowledge from a range of disciplines, however, the units were strongly focused on the disciplines listed and assessment within the units was focused on those single discipline outcomes.

Table 5 also details the number of Sydney Metro resources embedded into the units of work. It is interesting to note that in several of the units a minimal number of resources were accessed, and in Unit 5, no resources were accessed. This may imply that the resources that were used were of such a high quality no further stimulus or informative material was required. However, future professional development programs may need to include more time for teachers to investigate the range of resources available and ways in which they might enhance teaching and learning.

The data from teacher interviews illustrates high levels of teacher engagement; professional reflection and collegiality were developed between the teachers involved in this project and those delivering the longitudinal professional learning. Furthermore, the results of this project indicate that through ongoing professional development and professional reflection, the participating teachers developed a deeper understanding of inquiry-based pedagogies, enhanced their pedagogical repertoire of inquiry practices, strategies, structures and routines, and further built confidence in their ability to teach and assess through inquiry:

I found that with my students when I started using an inquiry approach before, I've been worried that the kids won't learn the outcomes that I need them to because I'm not teaching them explicitly those things. But what I found is that by using the inquiry approach, they use the same amount, the same concepts and skills, but they have ownership over that learning. So it's a lot more careful planning about how much to give them, when to give them that knowledge, but then it is very much more acting as a facilitator – more of a facilitator role than a teacher role in that it's not planning when to feed this information, it's being very specific about how much to give and when to give it. But you achieve the same outcome with greater ownership from the kids.  
(Year 6 teacher)



Teachers participating in the PD program clearly highlighted the positive long-term impact of the application of the inquiry-based pedagogies employed as the vehicle for learning throughout the project:

Inquiry-based learning, it really teaches our students how to be after they finish their education; what they're going to take with them in their workplace because they're going to be learning the content for whatever profession they choose or wherever they go. With inquiry-based learning they can take those learned skills anywhere.

*(Year 3 teacher)*

Inquiry gives them (students) the power to question, it's all about asking the questions and not accepting anything at face value. Inquiry, I think is really the core of all learning. It is finding the question to start with, and using an approach to find out more, taking a large question, teasing it out and working out where to go, how to solve a question.

*(Year 7/8 teacher)*

While the benefits of inquiry pedagogy were consistently highlighted, it is evident and was consistently reiterated by the participating teachers that further commitment to professional development opportunities to develop pedagogical habits and practices for inquiry is needed:

It's very different than what we currently do at our school. I think that it's going to take a lot of trial and error with it as well. I think we need to – I know personally – I need to change my planning, my thinking...it takes a lot of planning, a lot more teacher planning ahead. I definitely do think it will be hard to get into, but I definitely think that it's worth it.

*(Year 1 teacher)*

Further, the support of school leadership is critical for professional learning to have a sustained effect. This is particularly evident in schools that follow traditional approaches to teaching and learning that do not support integrated, interdisciplinary approaches to learning that are a feature of inquiry-based learning. In addition, a whole-school approach to inquiry-based learning would improve the sustainability of the professional development program:

I did it for this unit but what does that look like when you're doing that all the time. I can see how it worked as a one-off but – I know definitely lots of schools do it but without a whole school approach that's where we're having a lot of trouble.

*(Year 1 teacher)*

Finally, the provision of additional time by school leadership to allow teachers to plan for the teaching of the units of work would have been beneficial. While the decisions to provide additional time would have been school-based (and at a cost to the individual schools), an expectation of this could be communicated to schools in future iterations of the program



I hadn't done that much with an inquiry based learning before this program. So I've learnt a lot. I feel like it's hard to measure, but yes, I feel like now that I have created and delivered an inquiry-based unit, I feel like I'm ready to do it again and I feel like I definitely will. I can see the benefits in terms of student engagement; I don't see any reason why I wouldn't be doing this again and maybe in a few different learning areas

*(Teacher, Years 7/8)*

# 7

The Influence of  
the Professional  
Development Program  
on Student Learning

# The Influence of the Professional Development Program on Student Learning

Research strongly suggests that participative, interactive and coadunative professional learning engagements, delivered using comprehensive andragogical strategies and “collaborative, interactional techniques, rather than a lecture” (Coolahan, 2002, p. 27) style approach, significantly enhances the experience for participants, which subsequently, greatly improves the likelihood of transformational professional learning, with high flow on effects to student learning (Fraser, Kennedy, Reid, & McKinney, 2007; Killion, 2015; Robinson, 2014).

Throughout the Sydney Metro Project teachers engaged in ongoing, collaborative professional development. The Sydney Metro Project professional learning component was specifically structured to support and increase student learning outcomes. The project was intentionally framed to include embedded, ongoing professional learning that built on the current knowledge and skill of the participants. In addition, the targeted form of professional teacher developed employed throughout the project further orientated participating teachers with direct connections and links to the needs of their students, ensuring high engagement and high levels of relevance. As opposed to a transmissive and passive learning experience, participating teachers were afforded a direct collaborative “role in setting the agenda and [were] actively engaged in an experiential process” (Fraser, Kennedy, Reid, & McKinney, 2007, p. 154), all of which benefited the overall efficacy of the professional learning, and the project as a whole.

## Increased student engagement

The most significant theme relating to the influence of the professional development program on student learning was that of increased engagement. While engagement is difficult to quantify, changes in students’ responses to teaching and learning, their commitment to learning, and their attitudes are observable and lay the foundations for increases in student achievement. That is, students who are engaged are more likely to achieve academic success (Attard, 2013). Substantial evidence of increased student engagement was found in all teacher interviews, indicating the contextual nature of the learning (Sydney Metro), and its relevance to students’ lives were beneficial. The following quotes provide are representative of the participants’ sentiments:

I had two parents in my class who worked for the Sydney Metro so those students were able to bring even more information. So it was a topic of interest to the students, it was relevant and that made it so much more engaging for them, because they wanted to know more. They were really curious and they were talking about it all the time. Not just when we were doing the project. They would just tell or ask other teachers about it.

*(Year 1 teacher)*

Once they understood the background of it then, yeah, they just went with it. They loved it. And making those connections so they know that this is going to happen. Every time – like we listened to BTN, or like the news, they were like, oh yeah, I heard about this. Even understanding biodiversity or solar panels and all that. They’re like, oh now I understand it. Like renewable energy and like all of that.

*(Year 3 teacher)*

Seeing them (the students) take their knowledge and then apply it to then their own project and have the conversation saying 'oh, I'm like a Metro train designer' or 'I'm like a train station designer', and, oh, the guy at the train station told us we have to put in signal lights for the train drivers' meant I knew the learning successful. It was the way that they were talking about their projects.  
(Year 6 teacher)

The data provided evidence that students were engaged as a result of both the topic (Sydney Metro), as well as the process of inquiry-based learning:

The students who had previously, in this year, I'd been concerned about in terms of – one of them in terms of their behaviour, and two of them just – they'd been under-achieving in comparison to the other class. They gave their presentation today, and it was an exemplar. I told them I didn't want to speak about it too much, because I'd burst into tears, afterwards. Yeah. It was just – it was so fantastic to see that shift to absolute engagement with the task, because they'd been given a choice to pursue something that they're really passionate in. A group that I was concerned about actually ended up being the strongest group.  
(Year 7 teacher)

I like the fact the kids took ownership of their own learning and it kind of forced them to do learning. Like they had to implement the strategies we taught them. They had to implement the knowledge that they were taught earlier. Then – and I liked the fact that I just had to stand back and I could watch them, observe them and see where they go with it. Then listening to the content and listening to their language and what they're saying and what they've understood and then implementing it in to their projects and then teaching me why they've done it.  
(Year 3 teacher)

Significantly, student survey and interview data also illustrated substantial levels of student engagement and participation. Students consistently self-described highly productive learning dispositions and positive attitudes towards an inquiry-based approach to learning; expressing consummately high levels of engagement across the cognitive, affective and operative domains (Attard, 2014).

It was different how we usually learn, because we usually won't learn how to do teamwork. We usually learn math and stuff, but that time... we learnt how to work together and agree on ideas and fight for other ideas.  
(Year 3 student)

We took control over what we needed to do and how to do it instead of being told what and how to do it.  
(Year 7 student)

I liked how we drove our own learning and had to make the decision of what qualitative and quantitative research. I enjoyed having a broad topic as it kept all of our presentations diverse.  
(Year 7 student)

I liked the fact that we kind of taught ourselves in a way. I felt free with the way we did this project as we got to choose what software we used.  
(Year 7 student)

I liked the freedom of choosing what we learn.  
(Year 7 student)

I was surprised how much work we had to put in too design, prepare and create. It so open and the more work I put in and the more research I did the more I would learn.  
(Student, Year 7)

» Well, I really enjoyed the topic. I liked designing our metro. Like, giving ideas to design it. I liked the process of – if a Mosman metro would work with the community, if the route that we chose would benefit or if it would just make Mosman too crowded or something. So, I really enjoyed the project.  
(Year 7 student)



## Influences on curriculum knowledge and soft skills

The increases in student engagement as a result of participation in the inquiry-based units of work had a strong influence on the students' access to curriculum content from a broad range of discipline areas. The complexity of the infrastructure project and its impact on the environment and the community meant it was easy for teachers to align elements of the Sydney Metro project with the various curriculum requirements. The real and relevant context of the Sydney Metro project and its proximity to the students' lives, coupled with the regular media attention attracted by Sydney Metro appeared to make learning more meaningful for students:

I found that kids are better able to reach curriculum goals in a sense that they understand concepts more thoroughly because they have implemented them in a real scenario whereas, they might already be able to do those skills in a test, but they've got a better depth of knowledge about things in the curriculum because of the way that they've learnt them.  
*(Kindergarten teacher)*

In addition to addressing curriculum content, a bigger influence of the PD program on student learning was the opportunity for students to address the General Capabilities that are articulated in the Australian Curriculum (ACARA, 2019). The General Capabilities are: Literacy; Numeracy, Information and Communication Technology; Critical and Creative Thinking, Personal and Social Capabilities, Ethical Understanding; and Intercultural Understanding. Critical thinking featured from Kindergarten to secondary classrooms in the teacher interviews as a benefit of the implementation of the units of work:

It was great to bring out their ability to actually critically think about something or to come up with questions or come up with something to push their thinking deeper about well, in this case, the Sydney Metro, but it could be applied to anything.  
*(Year 3 teacher)*

At the start of the unit, we did a lot of wondering and we did see, think, wonder on the Sydney Metro; so we looked at images and videos from the Sydney Metro and they had to come up with the statement sort of something that they could see, something that they thought about the images and something they wondered about the images which is something they hadn't done before. But it was great to bring out their ability to actually critically think about something or to come up with questions or come up with something to push their thinking deeper about well, in this case, the Sydney Metro, but it could be applied to anything.  
*(Kindergarten teacher)*

The General Capability of Personal and Social Capabilities was heavily referred to in the data, with skills such as collaboration and problem solving emerging as themes in the data. This was evidence in the perspectives of teachers and students:

I think this way is effective. In groups there's more perspectives of our learning goal and we can get more ideas and like Tahlia said, if we don't know what sustainability means we can ask our group people and there's a lot of people to ask.  
*(Year 3 student)*

I think that this topic, it more taught us how to work collaboratively and how to talk to the public and communicate with others and take into account other's ideas and try and mix them with your own and your group's and work together, and how to be a leader, and when to step down and not be a leader. Just stuff like that.  
*(Year 7 student)*

In summary, it appears that the professional development program positively influenced the students' learning experiences because the inquiry process was student-centred. Within the majority of units listed in Table 5, there were elements of choice for students. The teachers became facilitators rather than purveyors of knowledge and therefore the learning had more meaning for students:

I think there's a real opportunity within inquiry-based learning to make students more self-reflective learners, but also I think what's really important is building resilience, from a welfare perspective, but also a learning perspective. Because I think students are really challenged. One of the students were commenting that there – this was a task that was so beyond an individual that it could only be done within a group. It was only by really allocating roles, designating jobs, that they'd be able to come up with a successful project, interviewing people in the community, et cetera.  
*(Year 7 teacher)*

# 8

Changes to Awareness  
of the Sydney Metro  
Infrastructure Project

# Changes to Awareness of the Sydney Metro Infrastructure Project

Prior to the commencement of the project 88% of students responding to the survey reported moderate or limited knowledge of the Sydney Metro infrastructure program. More than 25% indicated they held no knowledge at all prior to the learning experience, signifying an overall low general awareness of the project and its potential civic impact amongst the surveyed cohort (Figure 3). As the respondents of the survey were in Year 7 and 8, it would be reasonable to assume that the majority of primary aged students who participated in the inquiry-based units had not been aware of the Sydney Metro project prior to this experience.

It appears from the survey data that the teaching and learning program greatly enhanced the knowledge base and awareness of the Sydney Metro infrastructure Project. Notably, following the teaching program, 66% of responding students highlighted the potential of the Sydney Metro to reduce traffic congestion and lower traffic-related pollution. It is likely that the model of inquiry implemented with this cohort was focused on this particular theme (See Figure 5, Unit 11).

I think it will improve travel in Sydney, this includes lowering car congestion and many more traffic related issues.  
*(Year 8 student)*

I think it would definitely clear congestion in many areas and it will be something I look forward to using.  
*(Year 7 student)*

It will definitely reduce traffic congestion, could save us time, and will help to reduce pollution.  
*(Year 8 student)*



We had 15 parents come in to help; so the parents were highly engaged in the project as well. I had sent home pictures of the designs and materials and things, so the parents were well aware of what the kids were doing throughout the project and were very keen to come in and have a look and help out with the building phase.  
*(Kindergarten teacher)*

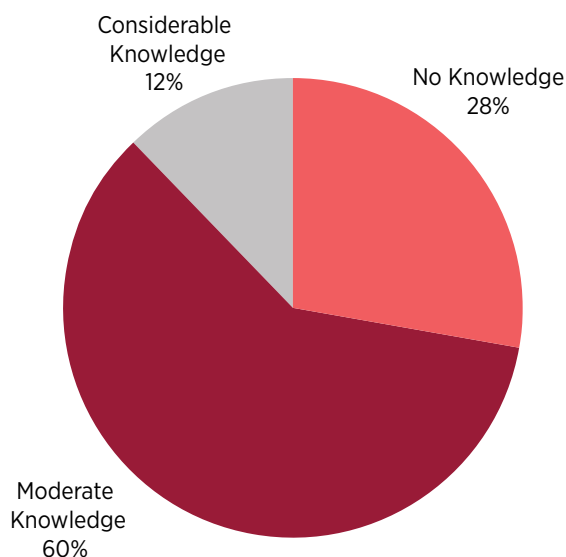
Interview data also indicated that the participating teachers' knowledge of the Sydney Metro project was greatly increased as a result of the professional development program, and this was enhanced by the input from Sydney Metro staff:

I didn't have that much interest in Sydney Metro at the beginning, didn't really know that much about it and then when – I can't remember his name – that guy came and spoke, I realised what an all-encompassing, massive operation it was and how many different aspects it could be viewed through. So that was really valuable, yeah.  
*(Kindergarten teacher)*

What I found good about the professional development was listening to Sydney Metro and getting really excited about all the different elements and aspects around sustainability, and hearing the people talk about what they were doing... I'm an English teacher. For me, I think it was interesting, but also needed to consider how I could implement something like that into a classroom when that wasn't necessarily - so that's why it didn't work with humanities.  
*(Year 7/8 teacher)*

**Figure 3:** Survey Respondent's Prior Knowledge of Sydney Metro

## Knowledge of the Sydney Metro Project prior to learning



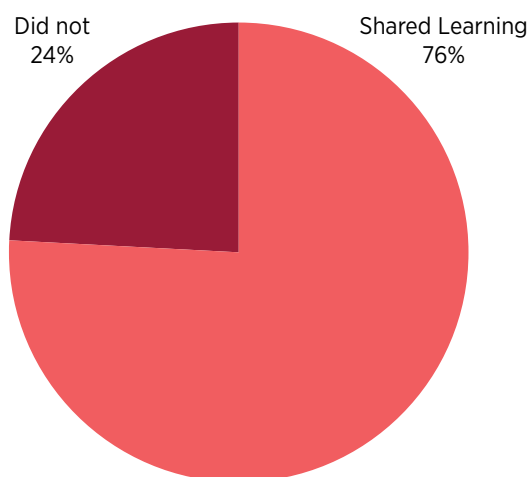
Data from student focus groups supported survey findings and provided further information with regard to students' perceptions of the impact of the Sydney Metro project. Many students spoke about how the new system would be accessed by themselves and their families in the future. The older students also discussed the benefits of having the Sydney Metro system to cope with the increasing population of Sydney:

Because Sydney's population is growing so quickly, and everyone needs to be in the city because that's where the majority – I would say the majority of jobs are. I know we're house hunting right now, and it's very hard to get it close to the city. So, Sydney metro would really help if it could us to the city very quickly. I think that it needs to spread out to rural areas. So, it would help getting to your job on time and it will also expand Sydney as a city and then you can – more people can also come in and would also do [unclear] because you can live in further areas around the city without having to worry about living close to get to the city and job on time, as well as the traffic congestion.  
(Year 7 student)

It will help my family, because sometimes we usually go to – on the train to go to the city, and probably when we use the new train, then it would be faster...  
(Year 3 student)

**Figure 4:** Survey Respondents Sharing of Knowledge of Sydney Metro

### Shared learning of the Sydney Metro Project



The data indicates that the teaching and learning initiative provided additional knowledge base building across the broader community, including parents and peers, with over two-thirds of survey respondents reporting they further disseminated the knowledge gained throughout Sydney Metro lesson sequences (Figure 5).

This data was also supported by qualitative evidence gathered in teacher interviews. The following quotes illustrate how the students' engagement with the inquiry-based approach, focusing on a relevant and interesting context, spread to engagement of the wider community:

One of the benefits I think of it was when we had our showcase. We had the stage three kids come in. We had parents come in, we had grandparents come in, we had other teachers. They were set up in the hall. They had their PowerPoints printed off so people could see what they'd done on their PowerPoints. You could hear the language. It was beautiful to hear.  
(Year 3 Teacher)

I think the community involvement was something that I wasn't expecting. We had a lot of parents come to our fair and they were actually asking students questions. I had parents coming up to me in the playground, a couple they'd be like, oh when do you need the recyclable material by? So, they became involved. I think that was the thing I didn't anticipate as much, the parents taking pleasure in joining their kids. The ones that were able to. Because I'm sure there are parents that would have loved to have been involved but can't. But that support we got from them – from the rest of the people around us. Even other execs came. They were invited and they came out as well. So that probably, for me – and the joy the kids had in showcasing. They were so happy about it.  
(Year 3 teacher)

They were obviously having those conversations at home. The questions that – well, the question and answer session we would have at the end of each of the presentations, it was quite clear that they had gone off and spoken about designs, about materials et cetera, with people within their families who were experts, maybe had an engineering background. Thinking, I can go and talk to this person, because they know about this stuff.  
(Year 7/8 teacher)





# 9

## Summary

# Summary

This research evaluation of the *Fast Tracking the Future Education Program* professional development and resources development for Sydney Metro posed the following questions:

1. *How did the professional development program influence the implementation of inquiry-based learning?*
  - What are the perceived influences of the professional development on teacher practice?
  - What are the perceived influences of the professional development on student learning?
2. *In what ways did the professional development program increase awareness of the impact of the Sydney Metro infrastructure project?*

The following summarise the findings presented in the previous sections to respond to the research questions.

## How did the professional development program influence the implementation of inquiry-based learning?

The professional development program influenced the implementation of inquiry-based learning by providing the participating teachers with in-depth knowledge of inquiry-based teaching approaches alongside detailed information about the Sydney Metro infrastructure project. The program influenced teaching practice in the following ways:

- It provided teachers with opportunities to collaborate with colleagues from different school levels and contexts, therefore expanding their understanding of classroom practices;
- The program provided teachers with an alternative approach to teaching practice via inquiry-based learning;
- The course structure, including the combining of face-to-face and digital meetings that were spread over an extended period of time, allowed the participants to gain feedback from peers, academics, and Sydney Metro staff;
- The requirement to design and then teach a unit of work changed how teachers engaged in the planning process and enabled them to integrate various subject disciplines; and
- The implementation of the inquiry-based unit of work led to high professional engagement and increased teachers' confidence to use inquiry approaches in future.

The program influenced student learning by:

- Improving their engagement with learning as a result of the shift to a more student-centred approach via inquiry-based learning;
- Providing a real-world and relevant context for learning;
- Promoting skills such as critical thinking, problem solving, and collaboration;
- Increasing their knowledge of their local communities and transport options.

## In what ways did the professional development program increase awareness of the impact of the Sydney Metro infrastructure project?

The professional development program increased the awareness of the impact of the Sydney Metro infrastructure project amongst teachers, students, and the broader community. In particular, the impact on the environment and the ways in which people move around Sydney featured heavily in the units of work and the students' responses to survey and focus group questions. The engaging nature of the program promoted discussion amongst teachers, (including those not participating directly in the professional development program), students and their families, and the broader community members who came into contact with the participants during the course of the program. The program resulted in teachers, students, and community members engaging in critical thinking, collaboration, and specific subject discipline content, skills, and knowledge to consider the impact of the Sydney Metro project on their lives and communities now and in the future.



# 10

## Recommendations

# Recommendations

The following recommendations are provided to assist in the development of future professional development programs related to the Sydney Metro project:

- Due to the positive impact of the program on teachers, students, and the broader community, it is recommended that Sydney Metro (Transport for NSW) continue to provide professional development opportunities that build capacity in teachers leading to sustained changes in practice and improved knowledge of the development of significant infrastructure projects.
- It is recommended that Sydney Metro develop some supplementary documents that align their resources with curriculum areas to increase the use of Sydney Metro resources as stimulus materials for school inquiry. This will assist teachers in using the resources in the delivery of inquiry-based units based on the Sydney Metro infrastructure program.
- To improve future iterations of the professional development program it is recommended that detailed guidelines for documentation of units of work and linking with curriculum outcomes are provided for teachers. This will aid the publishing process and increase efficiency.
- Future iterations of the professional development program should incorporate a buddy system to assist individual teachers who are not participating with others from their school. This will ensure those teachers receive ongoing feedback and support in addition to the support provided by Western Sydney academics and Sydney Metro staff.
- Further opportunities for peer review to be included in future iterations. This will ensure all units are of consistent quality and teachers and students gain the maximum benefit from their learning experiences.
- It is recommended that the provision of more teacher release (half a day per teacher) is incorporated into future professional development programs to ensure higher teacher and student participation rates in program evaluations.
- It is recommended that only paper-based surveys be used rather than online surveys to promote higher student participation and ease any issues regarding access to digital devices.



# 11

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# 12

## Appendix

# Fast Tracking the Future Education Program: Evaluating Professional Development and Resource Development for Sydney Metro

## Student Survey

*(made available online and in print)*

**Age:**

**Grade:**

**Gender:**

### Section 1: Awareness of the Sydney Metro Project

The following questions are about what you knew about Sydney Metro Rail Project before you began your learning about the project:

1. How much did you know about the Sydney Metro project before learning about it at school?
  - A) Had not heard of it
  - B) Had heard of it but didn't really know what it was about
  - C) I knew a lot about the Sydney Metro Rail Project
2. Did you talk about the Sydney Metro Rail Project with people outside school when you were learning about it?
  - A) Yes
  - B) No
3. Who did you talk to about the Sydney Metro Project?

### Section 2: Learning through an Inquiry-Based approach

The following questions are about the way you learned about the Sydney Metro Project:

4. What did you like most about the way you learned?
5. Name four things you learned about the Sydney Metro project that are important to you?
6. Do you think the things you learned will be useful in other areas? How?
7. What surprised you about your learning?
8. Would you like to learn in this way more often?
9. If you had to change anything about the way you learned about the Sydney Metro project, what would you change and why?

### Section 3: Awareness of the impact of Sydney Metro

The following questions explore your understanding of how the Sydney Metro will affect the community:

10. What effect do you think the Sydney Metro rail line will have on your life now and in the future?
11. How do you think the Sydney Metro project will affect your community?
12. Do you have any feedback for your teacher in regard to your work on the Sydney Metro project?



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