Evaluating the social impact of a science centre's STEM professional learning strategies for teachers

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Science centres generally strive to increase awareness, interest, capability and participation by citizens in science, technology, engineering and mathematics (STEM). This review of Scitech's professional learning (PL) strategy was designed to analyse quantitative and qualitative feedback about the professional learning activities delivered by Scitech consultants and drew from 2014 and 2015 data. We aimed to determine the social impact of Scitech professional learning programs on participants and their students across three specified programs. Concepts used as indicators of potential social impact that informed and framed this evaluation included integrated STEM, transversal competencies, scientific literacy, numeracy and social constructivism. A mixed method data collection was adopted and included face to face interviews, documented school visits, classroom observation, review of PL resources and presentations, review of PL feedback and follow up telephone interviews. We found that teachers participating in Scitech PL perceive they are making a difference to the classroom environment for students with increased STEM confidence, exemplar activities, shared planning and deeper understanding of curriculum. A key strength of the PL initiatives was the Scitech PL model which empowered teachers as active participants who engage in two-way learning with Scitech facilitators and colleagues.

Introduction

Science centres internationally have similar visions and missions. They generally strive to increase awareness, interest, capability and participation by citizens in science, technology, engineering and mathematics (STEM). For many, the physical centre and exhibition space is just one dimension to their social enterprise. In this day and age digital communications, outreach to remote locations and teacher development and education resources are also core business elements (Questacon, 2015). Scitech, Western Australia's pre-eminent science education centre shares these priorities. Since being established in 1988 it has aimed to be a dynamic reflective organisation with a reputation for quality services and experiences that engage the public with STEM (Scitech, 2015).

Scitech's Professional Learning (PL) strategy recognises teachers as the key drivers and multipliers of innovative STEM experiences in schools. Skilled and enthusiastic teachers translate and magnify the impact of resources provided in PL workshops and in more sustained longer term action learning Hubs (Scitech, 2015). Feedback from teachers participating in workshops is actively pursued and collected through online surveys. Levels of participant satisfaction are typically high but the information collected does not help answer more difficult questions such as the sustainability of the impact and how the PL is translated into classroom practice.

The evaluation reported in this paper was motivated by a desire to understand how the Scitech PL strategy impacted teachers' engagement with STEM and the experiences and

outcomes achieved by children in their classrooms. Measuring the performance of not for profit organisations like Scitech, is often donor led (Flatau, Zaretzky, Adams, Horton & Smith, 2015), as evaluations provide evidence regarding value for the money invested. However, reviewing performance also drives improvements to programs and services. The challenge in establishing the evaluation was to identify appropriate outcomes, indicators and assessment tools to provide the required information and insights.

In this context, it should be noted that social enterprise activities such as Scitech's PL strategy are not simply linked to short term outputs, but rather to the transformation of attitudes and beliefs that lead to changed behaviour and long term social impact (Polonsky, Grau & McDonald, 2016). A risk to quality evaluation occurs when social enterprise organisations conduct measures of easily accessible outputs (e.g. the number of participants in a workshop), rather than monitoring what is most important but more difficult to measure (e.g. participants' development of scientific literacy and ability to make informed life style decisions). This evaluation resulted from recognition that we need to know more about the differences programs make and if they are having positive outcomes. Critical professional reflection of this nature ensures efforts and resources are invested in the best possible way, for the greatest social impact.

Specifically, the objectives of the evaluation were to:

- Use a logic model to capture and articulate the overall contribution of the Scitech PL strategy to STEM education.
- Assess the social impact of Scitech's PL strategy on participating teachers and their students

Framing the evaluation

Concepts that informed and framed the evaluation project included integrated STEM, transversal competencies, scientific literacy, numeracy and social constructivism. These concepts were used as indicators of potential social impact in the evaluation of the professional learning initiatives. Literature is reviewed in the following section to establish the conceptual framework for the evaluation.

What is social impact?

While definitions of social impact are regularly contested, social impact is described as 'the effect of an activity on the social fabric of the community and well-being of individuals and families', by Social Enterprise UK (2015). This group further clarified that we measure social impact to better manage and communicate the social value specified work creates in a clear, consistent way. Social impact is also described as 'systematic social improvement that involves looking for the underlying issues beneath a problem and addressing that underlying problem' (Social Enterprise, 2015). This implies that social impact is not about finding a temporary fix but instead using a consistent approach to training and services to bring about improvement. Furthermore, the Social Enterprise UK group note that anything social implies people are involved and improvement involves

making a change for the better. Social impact involves actions leading to sustained improvement in the lives of groups of people and it is generally understood as "making a difference".

Similarly, social impact is defined as 'the net effect of an activity on a community and the well-being of individuals and families' (Centre for Social Impact, n.d.). Thus evidence of improvement in understandings of STEM competencies, scientific literacy, numeracy or the Western Australian Curriculum (SCSA, 2016) among participants attending Scitech PL was considered social impact.

STEM: Science, technology, engineering and mathematics

"Science, technology, engineering and mathematics (maths) are distinct and complementary approaches to knowledge and practice that have been proven to produce a benefit to society" according to Australia's former chief Scientist, Professor Ian Chubb in his report for the Australian Government describing a strategic approach to STEM (Office of the Chief Scientist, 2013, p.24). In the report, the scope of STEM is summarised with one category of science, the natural and physical sciences. Chubb described technology as satisfying real-world needs through the provision of goods and services and growing in importance as information and communication technologies develop. He commented that engineering and technology are critical factors in the long-term economic growth of modern industrial societies. In addition, Chubb described maths as aiming to understand the world by performing symbolic reasoning and computation on abstract structures and contributing to biology, medicine, social sciences, climate and many additional disciplines. Other researchers, for example Hackling, Murcia, West and Anderson (2014) described education in STEM as a powerful and productive driving force for economic growth, and Prinsley and Johnston (2015) stated "a strong economy in the twenty-first century prospers through science, technology, engineering and mathematics (STEM)" (p1).

Furthermore, Australia's *National Innovation and Science Agenda Report* (Australian Government, 2015) acknowledged the need to support and improve STEM education in schools. The initiatives announced to achieve this shift included planning for a national STEM School Education Strategy, expanding opportunities for women in STEM, a digital technologies element added to the Australian Curriculum and STEM partnerships to bring scientists and ICT professionals into the classroom. Both Prinsley et al. (2015) and Hackling et al. (2013) expressed the view that the STEM education pipeline begins in our primary schools. Two steps recommended immediately by Prinsley et al. (2015) were to raise the prestige and preparedness of STEM teachers and transform STEM education in primary schools. Scitech PL programs support this view with a focus on raising STEM awareness and knowledge.

STEM literacies: Social construction of scientific literacy and numeracy

Integrated STEM pedagogies include scientific inquiry, engineering design principles, mathematical thinking and reasoning, information media and technology literacies, and

cognitive (critical thinking and problem solving), intrapersonal and interpersonal skills and abilities (Australian Government, 2015; SCSA, 2016). These skills are largely transversal and weave through and across the individual disciplines captured in STEM (UNESCO, 2015).

A holistic and integrated approach to STEM is arguably enabled through problem or project based learning. However, STEM learning opportunities are also evident in teaching resources such as *Primary Connections* which is an integrated curriculum resource based on social constructivist principles (Australian Academy of Science, n.d.). The sequenced activities provide rich provocation for evolving the basic unit to include rich STEM learning opportunities. In practice teachers can modify and extend the *Primary Connections* units to integrate the STEM curriculum areas and in so doing generate demands for transversal skills development. The *Primary Connections* resources were designed to support children's development of scientific literacy which was defined as "the use of everyday literacies to learn about science concepts and processes-including the development of the literacies of science-contributes to students' developing scientific literacy as they learn about, communicate and represent science understanding" (Australian Academy of Science, n.d.).

Similarly, scientific literacy was described in the Western Australian Curriculum (SCSA, 2016) as the ability to use scientific knowledge, understanding, and inquiry skills to identify questions, acquire new knowledge, explain science phenomena, solve problems and draw evidence based conclusions in making sense of the world, and to recognise how understandings of the nature, development, use and influence of science help us make responsible decisions and shape our interpretations of information. We know scientific literacy is essential in our rapidly changing world and that scientifically literate students are better prepared to manage dynamic STEM knowledge into the future. Arguably, initiatives that successfully target scientific literacy as an outcome are having social impact.

This logic can be extended to the development of children's numeracy. Numeracy is an integral part of daily life and is reflected in questions such as how many, does it fit, which way and is it likely to happen. Numeracy extends far beyond simply counting and completing sums. It also contributes to a child's ability to inquire, problem solve and make informed decisions (Australian Curriculum, 2017). It provides an essential foundation for investigating in science, understanding, using and creating new technologies and engineering new things and solving problems.

Pedagogy and STEM capabilities

Our assertion is that teachers' professional learning initiatives should align with the State Curriculum for science and mathematics and incorporate overarching priorities associated with STEM. The pedagogical approach should recognise that learning is an active process in which learners try to make sense of their experiences. They construct understandings about their world, and develop knowledge and ideas that make sense to them by linking new information to their existing understanding. New information is then incorporated in meaningful ways for them (Skamp & Preston, 2017). For the classroom STEM teacher

this requires the selection of activities that build upon and respect learners' prior experiences, then developing teaching programs that enable learners to link information learned through active experience to their previous knowledge. In turn, teachers foster the development of transversal skills including subject specific language and communication skills as they provide opportunities for students to conduct extended inquiry projects or solve problems where they 'learn how' rather than 'learn that'. Social constructive perspectives recognise the importance of the social context where language and culture shape the way new information is learned. Teachers provide opportunities, support active student engagement and scaffold the learning.

Purpose

The purpose of this evaluation project was to provide an analysis of quantitative and qualitative feedback about the professional learning activities delivered by Scitech consultants. The evaluation, which drew from 2014 and 2015 data, aimed to determine the social impact of Scitech professional learning programs on participants and their students across three specified programs: the *STEM Hubs Program*, supported by Exxon-Fluor, the *Primary Teacher Support Program*, supported by Chevron, and the *Maths Enrichment Program*, supported by Alcoa. The review was designed to capture and articulate the overall contribution of the professional learning programs in the school community and in particular to illustrate what social impact can look like in Australian science education.

Evaluation methods

A mixed method data collection was adopted and included face to face interviews, documented school visits, classroom observation, review of PL resources and presentations, review of PL feedback and follow up telephone interviews. Site visits were conducted to representative schools participating in the three externally sponsored PL programs. These visits provided understanding of the context, content and delivery of the Scitech PL programs which informed the collection and analysis of the evaluation data. Professional Learning feedback was provided in *Excel* format by Scitech and PL resources were shared for review.

Mapping PL initiatives

A logic model was useful in making explicit the context, inputs, outputs and outcomes of the PL initiatives. Scitech as an organisation has a vision, mission and priorities which guide where they elect to offer PL into the community. In the given context, strategic decisions were made about how to use resources (people and materials) and what and where to invest them in order to meet their goals for social impact. Outputs were quantified in terms of who attended, what was done and levels of participant satisfaction. However, the outcomes of the PL were far more complex and less easily quantified as they related to change or difference, both short term and long term, brought about as a result of the PL program activities. It was however, recognised that outcomes could be affected by factors beyond the scope and control of the PL program. Measuring and clearly documenting outcomes required awareness and as much control as possible of

these external factors. With these issues in mind, a social impact framework (incorporating scientific literacy, numeracy, STEM competencies, social constructivism, and WA Curriculum alignment) shaped the design of the broad evaluation project and informed the development of semi-structured interviews with participants including school leaders, teachers, students and professional learning consultants. The mapping of Scitech's PL initiatives is captured in a logic model (Figure 1).

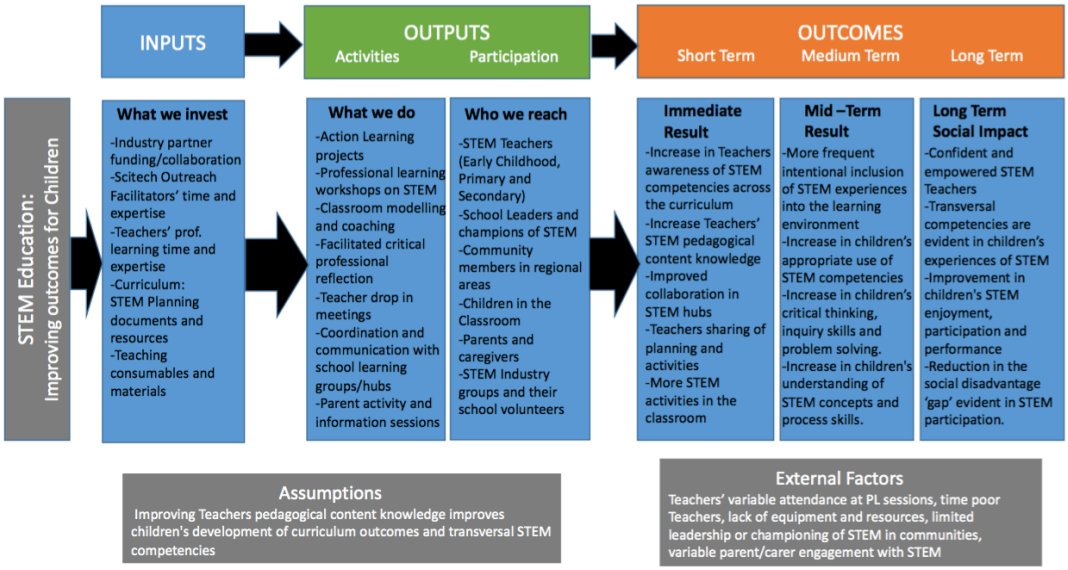

Figure 1: Scitech's logic model

Scitech's professional learning approach

Scitech is supported by the Western Australian Department of Education and the Office of Science to provide professional development to teachers of STEM, with the goal of improving the quality of teaching and learning in the classroom. Primary school teachers receive the majority of professional development delivered by Scitech, while the secondary school sector is viewed as an area of investment and growth. Programs are delivered at Scitech, in the classroom, and at school hubs across the state. The majority of programs are delivered through workshops and classroom modelling across the metropolitan area and the Pilbara.

Professional learning at Scitech is primarily based on an 'intensive' approach, usually exposing teachers to a sustained year-long program. Once-off activities based on the needs of teachers and school leaders are also delivered, though this makes up a smaller portion of the work with teachers. In supporting its mission Scitech recognises that teachers are a key driver of change. The 'multiplier effect' means that skilled and effective teachers are able to deliver innovative STEM teaching to West Australian primary school students. Figure 2 illustrates Scitech's intensive approach to professional learning.

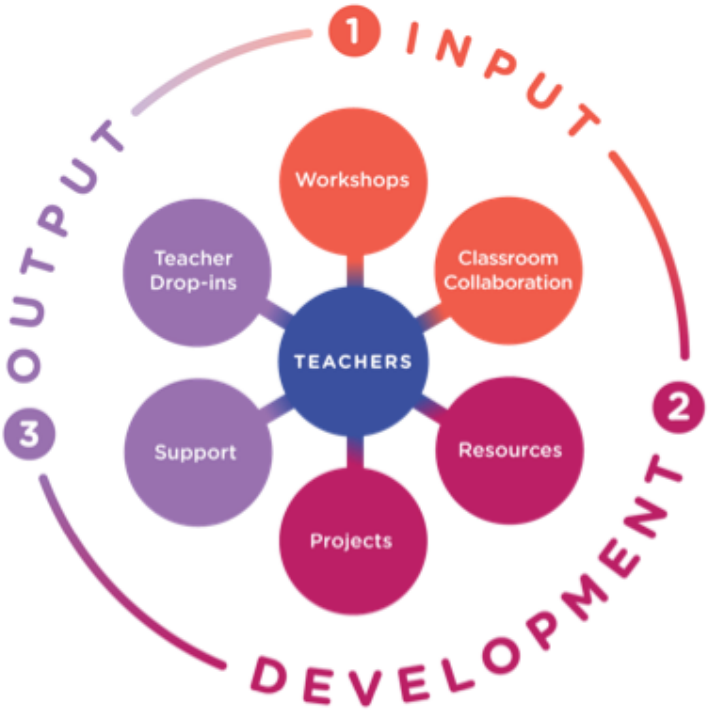

Figure 2: Scitech's professional learning approach

The main professional learning approach used is developmental in nature. It is based on inputs made by Scitech PL facilitators. These include workshops and classroom modelling and are aimed at introducing and demonstrating new, or enhancing current, content, pedagogy and technology. This is followed with development and support which include consults and planning sessions at school, resource provision, and collaborative classroom teaching with the teacher. This stage then extends to what is termed outputs, which includes action learning through teacher tasks, such as assignments, networking sessions, sharing of best practice sessions with groups of teachers and teacher drop-ins.

Scitech's professional learning programs aim to improve STEM teaching in primary and secondary schools. This, in turn, is expected to positively impact on teacher (and student) interest, awareness and capacity and confidence in STEM and contribute to developing a scientifically literate culture within schools and the wider community.

Case studies of selected professional learning programs

Three PL programs were selected from the ten delivered by Scitech consultants, who are well qualified science teachers, as the focus of the evaluation. These were the *STEM Hubs Program*, the *Primary Teacher Support Program* and the *Maths Enrichment Program*. These programs were designed to cater to the needs of primary school teachers and their students, with some links to the early childhood and secondary years.

The *STEM Hubs Program* was designed to enhance the scientific and technological literacy skills and capacity of students and their teachers through a series of intensive, hands on sessions tailored to the specific needs of each participating school community. Teachers were provided with resources, practical support and PL experiences to enhance their capabilities to enrich STEM learning for their students. Four aims were articulated in the *STEM Hubs Program*: increasing teachers' confidence and enjoyment of teaching STEM; increasing teachers' understanding and skills in effectively planning, teaching and assessing STEM in accordance with mandated curriculum; enabling teachers to disseminate their STEM knowledge and skills throughout their school and; enabling teachers to deliver rigorous, hands on and engaging STEM programs to their students. The PL program was delivered through a series of classroom modelling workshops, teacher projects and teacher drop-in sessions, individual consultations, and a concluding celebration.

The *Primary Teacher Support Program* was designed to strengthen the science education capacity in the Pilbara region, and to enhance the confidence of primary school teachers in teaching science, by delivering engaging and inclusive science programs to their students. The four aims articulated for this program were: increasing primary teachers' confidence with the science curriculum; increasing teachers' understanding and skills teaching science; encouraging teachers to collaborate throughout their school and community; and strengthening the science education capacity of the area. The PL program was delivered through a series of workshops, teacher drop-in sessions, classroom modelling, individual consultation sessions, capacity building training and a concluding celebration.

The *Maths Enrichment Program* was designed to enhance the learning experiences of students in Year 4 and Year 5 through the provision of authentic mathematical experiences chosen to relate to the children's own life, while also linked to the WA Mathematics Curriculum (SCSA, 2016). Teachers were provided with innovative approaches to enrichment techniques during PL workshop sessions, classroom modelling and consultation sessions, with assistance to develop a personal scenario to cater for the student diversity within their classroom. Parents were encouraged to become involved in family maths activity sessions and participate in a parent session that provided ideas for parents to use at home with their children to further nurture their interest in maths. This program offered a hands-on approach to maths among students and encouraged them to apply their knowledge while learning collaboratively with others. To conclude the program a Family Maths Night and graduation ceremony were organised to ensure student and school participation was acknowledged.

Results

Professional learning feedback

For comparison purposes, feedback data from participants attending Scitech PL during 2014 and 2015 was provided for the evaluation study. The data provided was in semester summaries and used a 5 point Likert scale that ranged from strongly agree to strongly disagree. Percentage agreement (strongly agree and agree) are summarised below in Table

1. Numbers for Semester 2, 2015 represent responses for PL delivered by two of the PL consultants rather than the entire team as was the situation for the 2014.

Table 1: Percentage agreement of categorised responses to professional learning feedback

Question category	% Agreement			
	S1 2014 n = 700	S2 2014 n = 360+	S1 2015 n=350+	S2 2015 n = 100
Enjoyment, inspiration and creativity	88	94	85	93
Attitudes and values	81	84	80	88
Knowledge and understanding	89	90	83	92
Skills	78	80	83	83
Activity, behaviour and progression	86	86	76	99

There was consistently high agreement across the five categories with the majority of responses at 80% or above agreement. Each question category comprised of two or three questions, for example, questions related to attitudes and values included: 'My confidence to deliver STEM subjects has improved'; 'This session made me feel more positive towards STEM subjects'; and 'My view on the importance of teaching STEM subjects has improved'. Typical written feedback provided at the conclusion of PL sessions during 2014 and Semester 1 2015 included:

- A superb, engaging session where all students were able to learn and achieve, fantastic, thank you;
- A fabulous session - enjoyed your enthusiasm and knowledge. Will definitely help me plan science lessons;
- What an organised enthusiastic and well informed presenter, wonderful; and
- Fantastic session! Lots of realistic info and ideas!

It should be noted that participant feedback was formative and generated reflection and actions. A noticeable drop in agreement was evident in response to questions related to "activity, behaviour and progression" for S1 2015 and this was addressed for S2 2015. Three questions were removed and replaced with questions directly related to presenter knowledge, organisation and engagement. Two questions asking whether respondents would now spend more time delivering STEM education in their classroom, and whether experiences from the PL session would be used to reinforce their own teaching, were also removed from the questionnaire.

The most recent feedback was collected during S2 2015 and resulted in above 90% of respondents indicating they enjoyed, were inspired by, learnt something new from the PL experience and would recommend the session to colleagues. Impressively, 100% of respondents indicated they agreed that presenters' were knowledgeable about the topic, were organised and managed resources well, and also delivered engaging and high quality presentations. Importantly, 90% of these respondents indicated their confidence and attitude towards teaching STEM subjects has improved as a result of attending the sessions and 80% indicated that their view on the importance of teaching STEM subjects

had improved. Respondents offered elements such as hands on activities (25%), using apps and technology (20.8%), using the investigation planner (13.9%), using resources and the links to them (13.9%) and the Western Australian Curriculum (11.1%) as the most useful aspects delivered during PL sessions.

- An outstanding presentation from (the presenter) who led teachers through an informative and engaging presentation. I loved the new applications shown and how we all managed to make a book creator.
- You did a great job engaging the teachers. We generated lots of ideas for our students.

Responses to the question 'What will you do differently as a result of attending this PL?' included: use planners (backwards and investigation) (26.6%); incorporate new apps and more frequent use of technology in the classroom (20.3%); introduce more science activities and investigations into lessons (18.7%); create opportunities to link science and literacy in the classroom (9.4%); and strengthen links between science and numeracy (7.8%). Written comments included:

- [I will] plan investigations more appropriately for students, look into student achievement standards as a guide for what to aim for from students.
- I now have a larger bank of ICT information to draw on and a few ideas for engaging my students to try out.'

The range of responses above suggest the participating teachers found the presenters delivered PL appropriate to the them (the target audience), that the presenters are meeting teachers PL needs and the information received is empowering for them, and additionally, responding teachers propose to take action to apply their new knowledge in their own classrooms.

The professional learning programs

As the major focus of the evaluation centred on Scitech professional learning programs delivered through three programs, a case study approach for this part of the evaluation was undertaken. Site visits were made to one participating school from each program so a metropolitan primary school represents the *STEM Hub Program* as Case 1, a Pilbara primary school represents the *Primary Teacher Support Program* as Case 2 and an outer suburban primary school represents the *Maths Enrichment Program* as Case 3.

Sixteen participants were interviewed for the three case studies. Those interviewed for Case 1 comprised of five females with two in leadership roles and three classroom teachers. Those interviewed to develop Case 2 totalled eight, comprising of seven female and one male staff with two in leadership roles, a science specialist and five classroom teachers. Participants involved for Case 3 totalled three females with one a school leader and two others classroom teachers. Data collected from participants via semi-structured interviews focused on social impact are summarised for each case in Table 2.

Table 2: Summary of responses to questions seeking impact of PL attended by participants across the three cases

Case	Topics shared with colleagues	% of participants who discussed with others
1	Presentation quality	60
	Year level content	20
	Planning	20
2	Relevance to own class	29
	Specific topics	29
	STEM	29
	No sharing	15
3	Maths Family Activities	67
	Corridor conversations	33
Case	Benefit to classroom children	% of participants who took new learning to class
1	General benefits to students in school	40
	Specific benefits to students in teachers own classes	40
	Unsure	20
2	Specific benefits to students in teachers' own classes	57
	Unsure	43
Case	Recommended for future action	% responding in these categories
1	Focus presentations on specific target audience	80
	Experienced presenters to model good practice	20
2	Increase supply of resources to teachers	57
	Strengthen communication	29
	Reduce staff changes at Scitech	14
3	Increase supply of resources to teachers	67
	Strengthen communication	33

From Table 2 it can be seen that each of the case study schools responded to questions asking them about topics they will share with colleagues, any benefits the students will access as a result of the PL delivered to their teachers and any recommendations for future improvement. Typical responses are provided below.

Sharing information with colleagues

- I held an information session about coding to operate robots and teachers used them afterwards.
- The Investigation planners are very useful and we worked together on those for our classes.
- Resourcing for STEM is an issue in the Pilbara so the presence of Scitech helps compensate.

Benefitting students in classes

- PL is helping me turn my own knowledge into a child friendly approach.
- I saw the PL consultants' ideas would work for me.

- I've taken up some of the energy and positivity from the consultant so I'm not just providing worksheets any more.

Suggesting improvements
- Refine the focus by grouping participants into teacher year groups or level of technological expertise.
- Seamless networking with Scitech is still a work in progress.

In addition to building positive relationships between Scitech presenters and PL participants, families were welcomed to become involved in activities offered to Case 3. For example, families were invited to visit Scitech on funded excursions and to parent workshops. Typical feedback was:

- X ran a parents' workshop describing warm up activities with children for parents to use.
- This received fantastic feedback from kids and parents, and kids saw their parents interested.
- Scitech paid for the professional development so there was no need to grovel.
- The opportunity for the kids to visit Scitech with their parents was just like Christmas.

Follow up telephone interviews were conducted with participants who were nominated by Scitech several weeks after attending the PL sessions. The following comments illustrate participants' responses to questions about sharing PL experience with colleagues and their subsequent classroom actions.

- Absolutely would recommend to others, liked hearing how to run open investigations because it enables students to increase ownership.
- I shared PL information in the school newsletter.
- I'm now using apps to make real world connections.
- I think the program is under-utilised and teachers could make more of the opportunities.

Across the case studies the majority of the aims for the three PL programs were achieved with teachers and PL presenters in agreement that the programs are meeting the STEM needs of participating teachers and new knowledge gained from PL is being transferred into classrooms and shared with colleagues. One participant succinctly commented:

- The STEM focus helps others see the importance of science and many here have come a long way due to the involvement of Scitech.
- We took a simple concept and jazzed it up then saw the children's faces light up.

Discussion

Scitech professional learning (intensive approach) programs in this study were well received with 90% of participants recommending attendance at Scitech PL to colleagues.

More specifically during S2 2015, over 90% of teachers agreed their attitude and confidence to teach STEM had improved after attending Scitech PL. Participants found the programs relevant and indicated their intention to apply their new knowledge into classroom practice. Consistently positive feedback for Scitech resources was conveyed by participants who recognised strong links to the Curriculum, a strong focus on STEM and scientific literacy, with a clear social constructivist approach to PL planning and delivery. These achievements align closely with Scitech stated goals for PL (Scitech, 2015).

In the main the aims of the *STEM Hubs* program were met. Some teachers acknowledged there was greater capacity for teachers to transfer rigorous and engaging STEM initiatives to students, that is, scope for increased impact. Teacher comments included:

- Our history of Scitech PL is sensational with excellent planning sessions facilitated and targeted to those present.
- Teachers are now looking for ways to integrate science, ICT and maths in class.

Similarly, most of the aims of the *Pilbara Primary Teacher Support* program were met. Teachers recognise strong communication is vital between Scitech and school administrators and there is further scope for increasing PL uptake in some schools.

All aims of the *Maths Enrichment* program were met with teachers describing their improved confidence and abilities in teaching maths, their students demonstrating more enjoyment and engagement with maths and parents joining their children to appreciate the role of maths in everyday life. Comments included:

- My eyes have now been opened to different strategies to teach Maths and enthuse students.
- My students now act, draw and table their answers to problems and are not just writing them.

This evaluation was undertaken knowing that evidence is vital to document any difference programs make and whether they are having positive outcomes (Social Enterprise UK, 2015). Across this evaluation study there is strong evidence that teachers participating in 'intensive approach' Scitech PL perceive they are making a difference to the classroom environment for students, with increased STEM activity and a deeper understanding of the WA Curriculum. Such impact is possible due to the selection of activities that build upon and develop participant prior knowledge so that new information is incorporated in meaningful ways for them (Skamp & Preston, 2017), while also guiding them to 'learn how' rather than 'learn that'. Scitech's Professional Learning Strategy (Scitech 2015) is designed to transform attitudes and values that lead to long term changes in behaviour and this evaluation indicates that such transformations are underway.

Conclusion

Overall, the outcomes of this evaluation study indicated that teachers participating in Scitech PL perceive they are making a difference (social impact) to the classroom

environment for students with increased STEM confidence, exemplar activities, shared planning and deeper understanding of the WA Curriculum. A key theme emerging for Scitech and the participating teachers was the need for enhanced communication and collaboration. This was noted as a shared responsibility and required collective effort. Significant strengths of the PL initiatives include the consistently high feedback received for Scitech presenters due to their knowledge, enthusiasm and professionalism, and the Scitech PL model which empowered teachers as active participants who engage in two-way learning with Scitech facilitators and colleagues. The participants made a commitment to their school communities and colleagues by sharing ideas and learning. This point is expressed in one participant's comment:

- X offered fantastic ideas to link to real life and make interesting for staff and students.

While many teachers are comfortable consumers of technology there is scope to introduce creative aspects to their skills in this area. Scitech is strongly positioned to support teachers (and their students) as they transition from being users of technology to creative users of technology.

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