Griffith UNIVERSITY

Early-years swimming

Adding Capital to Young Australians

Interim Report

November 2012

Robyn Jorgensen

Copyright

Thanks

Special thanks are offered to

- Mr Laurie Laurence and Mr Ross Gage who have worked with the research team to provide advice and support with the swim industry.
- Ms Patricia Funnell who has been the research assistant on this project and worked tirelessly to ensure the project has been successful.
- Associate Professor Peter Grootenboer and Dr Brooke Harris-Reeves who worked on the project in its early days.
- Swim industry members who provided financial support.

Contact

For further information, please contact

Professor Robyn Jorgensen,

Faculty of Education, Griffith University,

Ph: +61 7 37355876

Email: r.jorgensen@griffith.edu.au

For more information

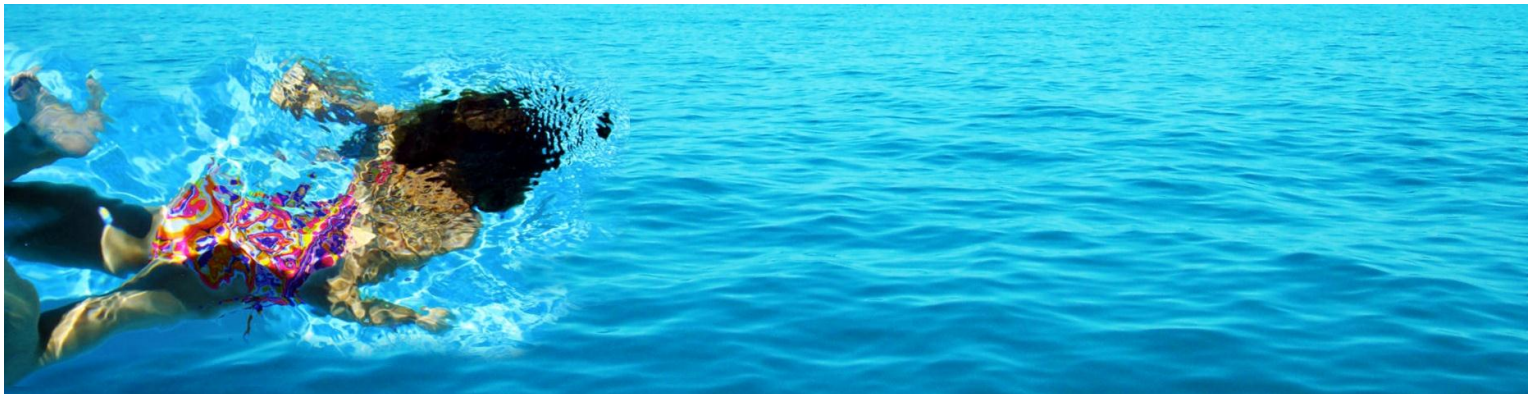
Email: earlyyearsswimming@griffith.edu.au

Web: www.griffith.edu.au/education/early-years-swimming

This report was published by Griffith Institute for Educational Research

Mt Gravatt Campus, Griffith University.

Contents



Executive Summary

Background

The Early-Years Swimming Research Project has been conducted over four years. It has centred on an examination of the possible benefits that may accrue for under-5s who participate in swimming lessons.

The importance of learning to swim at a young age cannot be disputed. With accidental drowning being the leading cause of death in under-5s, it makes good sense for all young Australians to develop water safety skills from a very early age.

Further, Australia is a nation whose national psyche is based on water activities, whether enjoying the water through personal recreation or through cheering on our elite swimmers in the pool.

Participating in swimming has rewards too for health and fitness. But unlike other physical or intellectual pursuits undertaken by children in the years prior to schooling, formal swimming lessons can commence at a much earlier age than other activities. Water familiarisation activities can start soon after birth with baby's first bath and formal lessons start in many swim centres for babies as young as four months. No other baby-centred leisure activity commences at such a young age.

As a result, the learn-to-swim industry has grown dramatically in the last thirty years.

The focus of this study is to investigate whether or not young children gain more than just swimming skills if they participate in early-years swimming.

This project has used a number of research techniques to explore the benefits, if any, participation in early-years swimming offers beyond swim skills for young children.

Research Questions

(a) What, if any, are the physical, emotional, social and intellectual benefits of learning to swim for under-5s?

(b) What factors enhance the benefits in different learn-to-swim contexts?

Within these questions, we also sought to explore:

- Are there gender or social class differences in the achievements of early-years swimmers?
- What other factors (eg. how long children have been swimming) may impact on outcomes?
- Are there factors related to pedagogy and the quality of swimming environments that need to be considered?

Approach

The study has utilised three main approaches:

1. A large-scale survey has been conducted over each of three years where parents identify, from a comprehensive list of international indicators (or milestones), the achievements of their children. Just under 7000 responses have been received over this period. Against these developmental measures, parents are reporting that their swimming children are achieving these milestones well before the normal expectations. A major limitation of this method, however, is that there is a risk of parental bias and results may represent parent over-estimation of their child's achievements, rather than their actual performance.

2. To address this possible bias, a study of 177 children, aged 3, 4 and 5 years from Queensland and New South Wales, has been undertaken. Using internationally- recognized tests, (Woodcock Johnson III for cognitive and language development; Peabody Developmental Motor Scales-2 for physical development; Strengths and Difficulties Questionnaire for Socio-Emotional behavior; and *Who am I?* for school readiness), children were independently assessed.

3. Environmental and pedagogy scans of swimming schools were undertaken in order to develop a sense of the swimming industry and what best practices are evident within that context. Sites in New South Wales, Victoria, South Australia and Queensland were visited. Using tools developed for this project, audits were taken of the school sites and how teachers were teaching swimming. This part of the project has highlighted the diversity across swim schools and the need for some measures/discussion on what constitutes quality teaching and learning.

Results

The two stages – survey and child testing – have shown that there are considerable differences between the "normal" population (as a statistical measure) and children who participate in early-years swimming across a range of skills. These differences are related not only to physical development – as would be expected from an industry that focuses on gross motor skills – but also in areas of language and cognition. It may be argued that this is hardly surprising given that the cost of swimming lessons acts as a filter – that the children of families from middle to upper socio-economic families can afford access – so that our findings are a reflection of the social strata rather than the possibilities of swimming to add capital to young children. However, our data from the child assessments have shown that there are significant differences between the swimming cohort and the normal population, regardless of socio-economic background. While the two higher socio-economic quartiles performed better than the lower two quartiles in

our cohort, all **four SES quartiles performed significantly better than the normal population**. Similarly, we found that **there were no gender differences between the research cohort and the normal population but within the group** we found that girls performed better than boys on a number of measures. Geographically, there were no differences between children from New South Wales and Queensland. It was also found that in some areas, **children who had been attending swimming for longer periods of time scored better according to their time in swimming**.

One would anticipate that children who engage in activities that develop their physical skills would perform better on measures of this type so it is unsurprising to report that the children do well in areas that require them to use their bodies for movement (such as hopping, walking, running, or climbing stairs). What is surprising, and of interest to parents, educators, and policy makers, is that the children also score significantly better on measures that related to their visual motor skills (which includes skills such as cutting paper, colouring in and drawing lines); gross motor stationery skills (eg. standing on tiptoes, standing on one foot, imitating movement, performing sit-ups); oral expression (being able to speak and explain things, etc.); and achieving in general areas of literacy and numeracy and mathematical reasoning. It was also found that the children scored better on measures of understanding and complying with directions. Swimming children performed at levels of very high significance in relation to normal populations ($p>0.001$). Many of these skills are needed in the formal education contexts so it would appear that swimming children may be better prepared for their transitions to school. This is a considerable advantage that is well beyond the swimming skills and water safety skills advocated by the swim industry.

While the data were overall encouraging, with the children participating in early-years swimming scoring better than the normal population, there were a few measures where they underperformed. It was noted that there were areas where the children did not display advanced learning in comparison with the normal populations, most notably, in the manipulation of large objects – this test item was based on ball handling skills.

Limitations

While these results are very promising, in such an unregulated industry care needs to be taken: practices are not necessarily consistent across all swimming schools. There is considerable variation across sites and parents selecting a swim school would be well advised to choose their schools carefully. If the child is to gain in other areas of child development, then the swim environment and swim teachers/lessons need to be of a consistently high quality. As part of this project, we have conducted site visits to audit swimming school environments and to profile the pedagogies used in swimming lessons. This will be discussed later.

Summary

- Children who participate in early-years swimming appear to be achieving many milestones earlier than the normal population – across areas of physical, cognitive and language development – regardless of social background or gender.
- Many of the skills that the early-years children are scoring well on have value in schooling and other areas of learning so they are likely to be better prepared for the transition to school.
- There is considerable variation in the programs and facilities offered by swim schools. These may influence the quality of learning offered by the swim school.

Recommendations

The swim study has shown that young children who participate in early-years swimming seem to be achieving particular milestones quicker than the normal population across physical, cognitive and linguistic domains. Many of these skills are highly valuable for the transition into other learning contexts; and will be of considerable benefit for young children as they enter preschools and school. It is widely recognised that the early years lay the foundations for learning. It would appear that early-years swimming may help develop skills beyond those of swimming, and which are of considerable value in formal education. It may be of national benefit for children who traditionally do not do well at school, particularly in the early years, to participate in learn-to-swim. This may help in the transition to school but also for the obvious benefits of water safety and general well being.

- All children should participate in early-years swimming as a matter of water safety.
- Children, particularly those whose trajectory into schooling is difficult and challenging, should be provided access to swimming lessons to enhance their swimming and other skills for the transition into school.
- If subsidies are made available for children from disadvantaged families, the quality of the swim school must be ensured if the child is to enjoy maximum gain.



Background

Australia is a country mad about swimming. Most of us live within an hour's drive of a body of water, we enjoy it recreationally – with swimming, boating, fishing and diving some of our favourite pastimes. More and more of us are putting swimming pools in our backyards. There are almost one million pools at households throughout Australia (ABS: 2007) – with almost 12% of homes proudly boasting pools.

And swimming isn't just for recreation. We also enjoy the water as a form of exercise and encourage our children to take part. In 2009, over half a million children, aged 5-14 participated in swimming as an organized sport. In fact, it was the most popular sport across all children of school age, beating out dancing, soccer, Aussie Rules and netball (ABS, 2009).

Learning to swim is a large part of us enjoying the water.

Yet with all this emphasis, there have been few studies of the impacts of participating in learn-to-swim for young children. Naturally, the focus on the limited research undertaken has been on how early swimming can enhance some motor abilities such as balance and reaching (Sigmundsson & Hopkis 2010) and motor development in neonatal babies including head holding, steady sitting, and holding items (Jun, Huang & Dan, 2005). Others have looked at the impact of swimming on children suffering respiratory difficulties such as asthma (Wang, 2009 and Font-Ribera et al, 2011). There has also been some considerable research on how water activities can enhance mobility and aerobic strength for children with physical disabilities (for example, Fragala-Pinkham, et al 2008; Hutzler et al, 2008). However, there has been little research into the impact of swimming lessons on able-bodied students other than a large German study in the late 1970s (Diem, 1982) when the learn-to-swim industry was in its infancy. Not only are the conditions in Australia different from those experienced in Europe, but in the three decades ago or so since, there have been considerable advances in swimming techniques and lessons.

Two leaders from within the swim industry, Laurie Lawrence (dual International Swimming Hall of Famer, learn-to-swim expert and leading advocate in child water safety) and Ross Gage (CEO of Swim Australia and the Australian Swim Coaches and Teachers' Association), approached Professor Robyn Jorgensen at Griffith University to conduct an independent study of the benefits for young children participating in early-years swimming. Might these children be achieving at a much quicker or earlier rate the children who do not participate in swimming? There is a strong consensus in the swim industry that young swimmers who have been in the 'game' for some time, appear to be more confident, more articulate and more intelligent, than their same age peers who do not participate in swimming. As something that was purely anecdotal but of critical importance for swimmers, parents, teachers and operators, the swim industry was keen to validate – or refute – this popular observation.

With financial support from the swim industry, this research project was established. This is the first international study undertaken of its kind – a study which comprehensively focuses on the cognitive, physical, linguistic and social benefits of formal swimming for young children.

Water Safety as the Catalyst for Early-Years Swimming

The swim industry had once just been the recruiting area for elite swimmers but with the accidental drowning being the highest cause of death in under-5s[1], Laurie Lawrence has led a national push for young children to be involved in water safety. Recognition of the importance of young children swimming is evidenced in the support of the federal government where every new mother receives a baby package on the birth of her child which now includes a water familiarization DVD authored by Lawrence. This program alone represented a commitment by the Federal Government in 2008 of $4.2million over four years (Giles, 2008), added to the 22.2 million allocated in the Budget to water safety organisations, including Surf Life Saving Australia.

The Learn-to-Swim Industry

The interest in early-years swimming has grown with Australia now boasting 934 swim schools nationwide (RLSA and AustSwim, 2010), over 600 of which are registered with Swim Australia. Almost 80% of swim schools are privately owned and a little less than a quarter are operated by local councils. The remaining swim schools operate under a management group, through a school, are community based or a combination of these.

While largely unregulated, the industry has a number of organizations which contribute to its management, regulation and education. These include ASCTA, Swim Australia[2], AustSwim and the Royal Life Saving Society – Australia (RLSSA).

---

[1] According to National Drowning Report 2011 of Royal Life Saving Society – Australia, there were 28 drowning deaths of young children under-five years of age in 2010/11. Swimming pools remain the location with the highest number of 0-4 years drowning deaths with 12 in 2010/11.

[2] Not to be confused with Swimming Australia, the national sporting body responsible for the promotion and development of competitive swimming in Australia at all levels. Swimming Australia has almost 100,000 members and just over 1100 swimming clubs nationwide (www.swimming.org.au).



Even the Australian Taxation Office influences the participation and credentialling of teachers in the industry.

ASCTA (The Australian Swimming Coaches and Teachers Association), is the peak body for swimming and water safety teachers and swimming coaches. ASCTA (www.ascta.com) was established some forty years ago as a coaches' association but expanded to include teachers in 1996 in recognition of the growth of this sector. It is a special interest group dedicated to developing world leading practices in the education, accreditation, professional development and on-going support for swimming coaches and teachers. Swim Australia (www.swimaustralia.org.au) was launched in October 1997 as ASCTA's learn-to-swim and water safety industry development division. Its mission is to develop "learn-to-swim" in Australia to its full potential; resulting in all Australians learning swimming and water safety in an enjoyable, safe way. It registers swim schools that meet ASCTA's industry standards. It is a non-profit organization endorsed by Swimming Australia. It currently has over 600 member swim schools. Membership is voluntary.

Royal Life Saving Society – Australia (www.royallifesaving.com.au) also works tirelessly to prevent drowning and to equip all Australians with water safety skills. As a not-for profit charitable organization, it offers a variety of education programs. Every year one million Australians participate in one of RLSSA's programs. Its key programs include Keep Watch, Swim and Survive (the program aimed at children up to the age of 14), Bronze Medallion, Junior Lifeguard Club and Grey Medallion. It is also heavily involved with education, training and research.

Parents expect that their child's learn-to-swim teacher will be "qualified" though there are no compulsory swimming teaching qualifications. Most, however, will opt to undertake training offered by AustSwim (Australian Council for the Teaching of Swimming and Water Safety). AustSwim (www.austswim.com.au) was established in 1979 in response to numerous aquatics organisations identifying the need to have one organisation that could oversee the training and accreditation of swimming and water safety teachers. AustSwim is non-profit and its council comprises members of many organisations, including YMCA Australia, Royal Life Saving Society – Australia (RLSSA), Australian Leisure Facilities Alliance, Swimming Australia, Surf Life Saving Australia (SLSA) and Water Safety New Zealand. The first AustSwim courses were offered in 1980. AustSwim teacher courses are still the most widely held qualification required of learn-to-swim teachers. According to a survey of swim school managers in 2010, staff were required to have AustSwim's Teacher of Swimming and Water Safety certification (83%), followed by CPR (76%) and AustSwim's Teacher of Preschool and Infant Aquatics (58%). Other qualifications required included those from Swim Australia (32%) and ASCTA (23%)[3].

[3] Royal Life Saving Society – Australia and AustSwim conducted a comprehensive survey of swim school managers in 2010. The resulting report contains a great deal of information about swim schools and teachers and can be found at: www.royallifesaving.com.au/www/html/2808-research-reports.asp

In 2008, the Australian Taxation Office introduced new legislation whereby GST exemption was offered to those who offered courses in personal aquatic survival skills[4]. Essentially, these basic swimming skills could be used to prevent downing by letting a person survive or be safe in the water. The seven basic competencies that had to be taught in these classes were:

- sculling
- treading water
- floating
- safe entry and exit from the water
- techniques for clothed swimming survival
- use of devices to assist rescue, and
- basic swimming skills.

In order to qualify for the GST exemption, course providers (ie teachers) have to hold a training qualification from AustSwim, Surf Lifesaving Australia, Royal Lifesaving or another registered training organization (eg Swim Australia) that offers courses containing the seven competencies listed. This has been further incentive for teachers and swim schools to ensure those offering learn-to-swim programs meet at least the minimum standards.

Whilst the industry remains fairly unregulated, parents can choose to select a learn-to-swim teacher who can demonstrate qualifications from AustSwim, Swim Australia or other registered training organizations. Similarly, they can choose to select a swim school that is registered/affiliated with Swim Australia or RLSSA. However, swim schools are not required to hold membership for either organization, and not having membership is not an indicator of poor quality.

Different swim schools will emphasise different aspects of learn-to-swim. Some may elect to offer the “Swim-and-Survive” program from RLSSA, some adapt this program to incorporate other aspects of swimming. Almost all baby classes emphasise water familiarisation and survival skills. Beyond one year of age, however, swim schools will offer any number of a variety of approaches to learn-to-swim. Most swim schools will advocate that they invoke in children a respect for the water and aquatic survival skills. Beyond this, the primary focus of some schools will be on the development of technique in young swimmers with the ultimate aim of producing (future) competitive swimmers. Others adopt more of a “general education” approach which incorporates other aspects of learning. What is taught in learn-to-swim and how it is taught may impact on what children take away from their learn-to-swim classes to use in their everyday lives. Children may have very different learning experiences from the types of programs offered by the swim schools. Each of these schools offers new learnings – swimming and other – that may help children in contexts outside swimming.

---

[4] Details of the Australian Taxation Office’s guidelines in relation to teaching of personal aquatic skills can be found at: http://www.ato.gov.au/businesses/content.aspx?menuid=0&doc=/content/39995.htm&page=2&H2

"Adding Capital to Learners": Framing the research

In this project we have elected to use the protocol of arguing that early-years swimming may be adding capital to young learners (Jorgensen, 2012). When young children participate in learning activities – such as swimming lessons – there is an expectation from parents and teachers that there will be changes in what the children can do, or know, or feel. These changes are the outcome of engaging successfully with the learning activity. The skills, knowledge and/or dispositions acquired by the learner can be something that is 'added' to the child's repertoire. We have adopted the construct of 'adding capital' to describe this process since what has been learned can be of value to the child in the context of learner and beyond. The use of capital as a key organizer for the study is based on two key considerations:

- First, the use of the term 'development' suggests that there is something biological, almost innate as to how children learn and acquire skills. This project explored whether or not young children may learn more if they participate in early-years swimming. As such, it is not a biological progression that is causing change. Rather, it is the case that in some ways the swimming environment is potentially enhancing how, what and when children are learning.
- Second, we see that what is possibly being added to children are skills that are above and beyond the focus of the swim lessons. This 'added' learning are skills that in another context, namely schools, have particular and important value. What is learnt has value beyond the swimming context and as such can be exchanged in this new environment. For example, what we have observed is that the safety element of early-years swimming is paramount so children learn very early to listen carefully to the teacher, to process instructions and then to conform to them. This is usually not undertaken in an authoritarian manner but the teachers are keen for the children to listen and then perform the activity in an environment that ensures their safety. While these skills have value in the swim context, within the context of formal schooling, this set of skills is key for participating effectively and productively in classrooms. Thus the skill is a form of capital that can be exchanged in another context for rewards.



Research Design

This research was not conducted using the traditional experimental design where there are control groups and experimental groups. We have employed methods that allow us to compare swimming children with other populations of children who represent the 'normal' population. In this context, the research team developed two key methods for testing the research question – a large survey that relied on parent reporting which allowed a comparison of swimming children against the developmental milestones with which most parents are familiar. The second method involved a battery of internationally-recognized tests of child development. The latter were carefully selected on the basis of there being a normal population against which we could compare the results of the children in our cohorts. This latter point was critical in enabling any claims to be able to be made as to whether or not the swimming children were ahead of the normal population.

Survey

The first method was to employ a large-scale survey that has been undertaken in Australia, New Zealand and the USA. This was a simple survey based on the developmental milestones that children who develop normally are expected to attain by particular ages. The comprehensive list of milestones was later modified to incorporate those of a more contemporary nature, advocated by the Centre for Disease Control (CDC) in the United States. Parents were surveyed asking them to indicate their child's age (in months) and then to check off if their child was able to achieve the particular milestones.

Over the three years, 6900 parents completed the survey:

Year	Total Responses
2009-2010	1650
2010-2011	2330
2011-2012	2950
TOTAL	**6930**

Table 1: EYS Survey responses by year

The second year of the data forms the basis of the results reported here. The last round of the survey is still open and will be analysed at the end of 2012.

The 2010-2011 data represents 2330 children. Parents were asked to complete the one questionnaire for each child aged 5 and under. The distribution across ages and gender can be seen in the following graph (Figure 1):

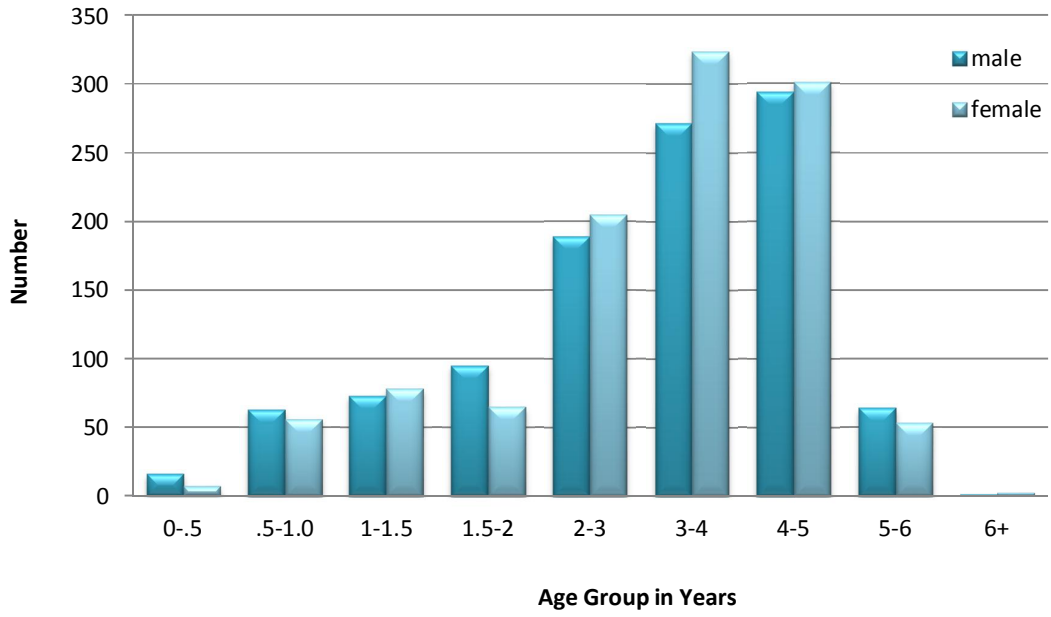


Figure 1: Participants in 2011 EYS Parent Survey by age and gender

While such a survey of this type is a handy tool for acquiring large response rates, it was also limited. In the first instance, there is the risk for parents to over-estimate their child's performance so there is the possibility of an inbuilt bias in the reports. Secondly, there is a risk that with an on-line or paper format, that the items can be misinterpreted by the reader and hence incorrect assessments of the child might be made. Being cognizant of these shortfalls, further testing was planned.

Child Assessments

Child assessments were conducted in order to validate parental claims about their children's achievement. Drawing on widely-used child testing protocols, a series of tests were selected to be administered to children. It was planned that 200 children would be tested. As the tests require considerable input from the child, language skills needed to be well developed, and an attention span commensurate with the time of the test was required. To this end, children only of 3, 4 and 5 years were tested (boys and girls, from high, mid and low socio-economic backgrounds and with varying swim experience).

The battery of tests employed by the Early Years Swimming (EYS) Project was specifically selected to meet a number of criteria:

- Suitable for our purpose – to assess the physical, cognitive, linguistic and social development of children
- Age-appropriate – for assessing 3-5 year olds
- Could be utlilised in one session of 1-2 hours per child
- Mostly administered directly to the child without requiring input from a caregiver (or teacher)
- Could be administered by qualified teachers, but not requiring specialist qualifications (psychology, physiotherapy, occupational therapy, etc.)
- Standardised and norm-based: tests have been administered widely with a pool of previous respondents against which we could assess our participants.
- Provide "age-equivalent" measures.
- Are not designed for screening purposes (eg. for identification of autism) – these tend to focus on deficits and not the achievement of milestones and beyond.

A comprehensive range of instruments was selected in order to quickly and accurately determine each child's progress across a number of cognitive and language areas.

Name	Domains Assessed	Brief Description
Woodcock-Johnson III	Cognition Language	Assesses a range of cognitive areas, including: oral language, listening comprehension, maths reasoning, verbal ability, cognitive efficiency.
Peabody Developmental Motor Scales (PDMS-2)	Physical	Assesses both gross motor (stationery, locomotion and object manipulation) and fine motor (grasping, visual-motor).
Who am I?	School Readiness	Assesses child's cognitive ability in drawing a number of shapes, letters, numbers, words and self-portrait.
Strengths and Difficulties Questionnaire (SDQ)	Socio-Emotional behavioural screening	Rates 25 attributes (some positive, others negative: emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, prosocial behaviour

Table 2: Four test instruments employed for EYS child assessments

Each assessment took approximately 90 minutes to implement by trained teachers. Parents were usually present but were asked not to contribute to/influence the child's responses. Assessments were conducted on campus or within quiet rooms in swim schools.

Woodcock-Johnson III (WJIII)

The Woodcock-Johnson III (WJ-III) Tests of Achievement is a comprehensive system for measuring general intellectual ability, scholastic aptitude, oral language and achievement. It allows the assessment of a wide range of ages, reportedly 2-90 years. First developed in the United States in the late 1970s, it has been extensively tested, with a wide normative sample in 2001 of over 8000 in the United States. It has since been re-normed with an Australian sample of over 1300 in 2006-2007. Sub-tests from the WJ-III have been used in other large-scale Australian studies, for example, the Child Care Choices Study (Bowes et al, 2009).

At ages 3-5, it is difficult to assess cognitive and language skill in one brief sitting. The WJ-III allowed us to quickly and accurately gauge each child's progress. To do this, eight test items were selected from the WJ-III Tests of Achievement battery based on appropriateness for the purpose of the study (in assessing cognitive and linguistic levels), suitability for the age group and ease of implementation:

Sub-test Item	Brief Description
Item 1: Letter-Word Identification	Letter-Word Identification measures the child's word identification skills through both identifying letters by sight then progressing to pronouncing letters and words correctly. Items become increasingly difficult/less familiar.
Item 3: Story Recall	The task requires the subject to recall short, but increasingly complex stories.
Item 4: Understanding Directions	As an oral language measure, the child has to listen and follow a sequence of instructions. Items become increasingly complex linguistically as the number of tasks to perform increases.
Item 7: Spelling	Initially, the child draws on prewriting skills (drawing, tracing) and progresses to writing orally presented letters and words. For older children, the final items measure the ability to correctly spell words.
Item 9: Passage Comprehension	Initially, the child is asked to match symbols with pictures of objects. The items increase in complexity to matching a picture to a word or phrase and identifying a missing key word from a sentence.
Item 10: Applied Problems	Mathematics problems need to be solved by the child by listening to the problem and performing simple calculations, eliminating any extraneous information presented. Calculations become increasingly complex.
Item 14: Picture Vocabulary	Word knowledge and oral language development are assessed as the child is asked to name objects from illustrations. Single word responses are generally required but items become increasingly difficult as less familiar objects are presented.
Item 18: Quantitative Concepts	The child demonstrates their understanding of maths concepts, and symbols through counting and identifying numbers, shapes, and sequences. The child may also progress to items where they have to identify a missing number from a series.

Table 3: Items selected from Woodcock-Johnson III Tests of Achievement for EYS child assessments

The results from each of these sub-tests are recorded as “Age Equivalent” scores, sub-test scores can also be amalgamated to allow the formation of five “clusters”: Oral Language, Oral Expression, Brief Achievement, Brief Reading and Maths Reasoning. Each of these clusters is designed to provide a highly reliable prediction of future achievement in a minimum amount of testing time. As composites of individual tests, they are more reliable than individual test items.

Tests of Achievement / Clusters	Brief Reading	Oral Language	Oral Expression	Maths Reasoning	Brief Achievement
Letter-Word Identification	●				●
Story Recall		●	●		
Understanding Directions		●			
Spelling					●
Passage Comprehension	●				
Applied Problems				●	●
Picture Vocabulary			●		
Quantitative Concepts				●	

Table 4: Woodcock-Johnson III Tests of Achievement clusters assessed for EYS

The WJ-III provided age equivalent scores for each item. Using such a standardised test allowed us to compare the child’s actual age with the performance on each item and each cluster with a wider population of children. It also provided us with “Z” scores for each item and cluster.

Peabody Developmental Motor Scales 2 (PDMS-2)

The PDMS-2 is composed of six subtests that measure interrelated motor abilities that develop early in life. It was designed to assess the gross and fine motor skills in children from birth to five years of age. It has been proven to be both reliable and valid and draws on a normative sample of over 2000 children in the United States. It is widely used by physiotherapists, occupational therapists, psychologists and early childhood specialists in examining the motor skills of young children. It has been used in Australia, most recently in Stagnitti et al's 2011 study of disadvantaged preschool children.

We have used five of the PDMS-2 subtests. (The sixth subtest – Reflexes – is designed for babies up to 11 months only and is not used here.)

Sub-test Item	Brief Description
Locomotion (89 items)	Measures a child's ability to move from one place to another, to transport the body from one base of support to another. The actions measured include walking, running, hopping and jumping forward.
Stationary (30 items)	Measures a child's ability to sustain control of his or her body within its centre of gravity and retain balance (eg. standing on tiptoes, standing on one foot, imitating movement, performing sit-ups).
Object Manipulation (24 items)	Measures a child's ability to manipulate balls. Examples of the actions measured include catching, throwing and kicking.
Grasping (26 items)	Measures a child's ability to use his or her hands and fingers. It begins with the ability to hold an object with one hand and progresses to actions involving the controlled use of the fingers of both hands (eg. using a pen, buttoning).
Visual-Motor Integration (72 items)	Measures a child's ability to integrate and use his or her visual perceptual skills to perform complex eye-hand coordination tasks, such as building with blocks, and copying designs.

Table 5: Components of Peabody Developmental Motor Scales 2 (PDMS-2)

Only items relevant to the age group were administered by establishing basal and ceiling levels. PDMS-2 then allowed the progression of raw scores to standardised scores, percentile ranks and age-equivalent results.

Further, the results of the five subtests are used to determine three quotients: gross motor, fine motor and total motor.

- **Gross Motor Quotient:** Measures the use of the large muscle systems. Three subtests (Locomotion, Stationary and Object Manipulation) form this composite score.
- **Fine Motor Quotient:** The Fine Motor Quotient (FMQ) measures the use of the small muscle systems and draws on the Grasping and Visual-Motor Integration subtests.
- **Total Motor Quotient:** The Total Motor Quotient (TMQ) is formed by a combination of the results of the gross and fine motor subtests. Because of this, it is the best estimate of overall motor abilities.

Who Am I?: Assessment of School Readiness

ACER's *Who Am I?* was used to determine readiness for specific learning experiences by assessing cognitive processes that underlie early literacy and numeracy skills. It assesses the child's abilities in relation to the three areas of copying shapes, producing symbols and drawing:

Areas Assessed	Items	Purpose
Copying shapes	Reproducing a circle, cross, square, triangle, diamond	Copying tasks are used to assess the ability to conceptualise a given figure and to be able to reproduce it. The accuracy of the copying is seen as evidence of the development of the understanding. Figures become increasingly more complex.
Symbols	Writing name, numbers, letters, words, sentence	An understanding of conventional notation systems (alphabets and numerals) is measured through the production of a number of symbols (numbers, letters, words).
Drawing	Self-portrait	The production of a self-portrait is used to assess the general intellectual development of the child.

Table 6: Components of ACER's Who Am I?

Developed in Australia, *Who Am I?* it has been administered to over 4000 children in 2004 as part of the major study *Growing Up in Australia* (Rothman, 2005) to assess four year-olds' readiness for school. It is quick to administer and suitable for children from varied backgrounds, including those with limited English.

Goodman's Strengths and Difficulties Questionnaire

Parents/caregivers were asked to complete Goodman's Strengths and Difficulties Questionnaire (SDQ). This is a brief behavioural screening questionnaire designed for 3-16 year olds. It asks parents to rate children on 25 attributes, some positive and others negative. These 25 items are divided between 5 scales:

(a) emotional symptoms
(b) conduct problems
(c) hyperactivity/inattention
(d) peer relationship problems
(e) pro-social behaviour

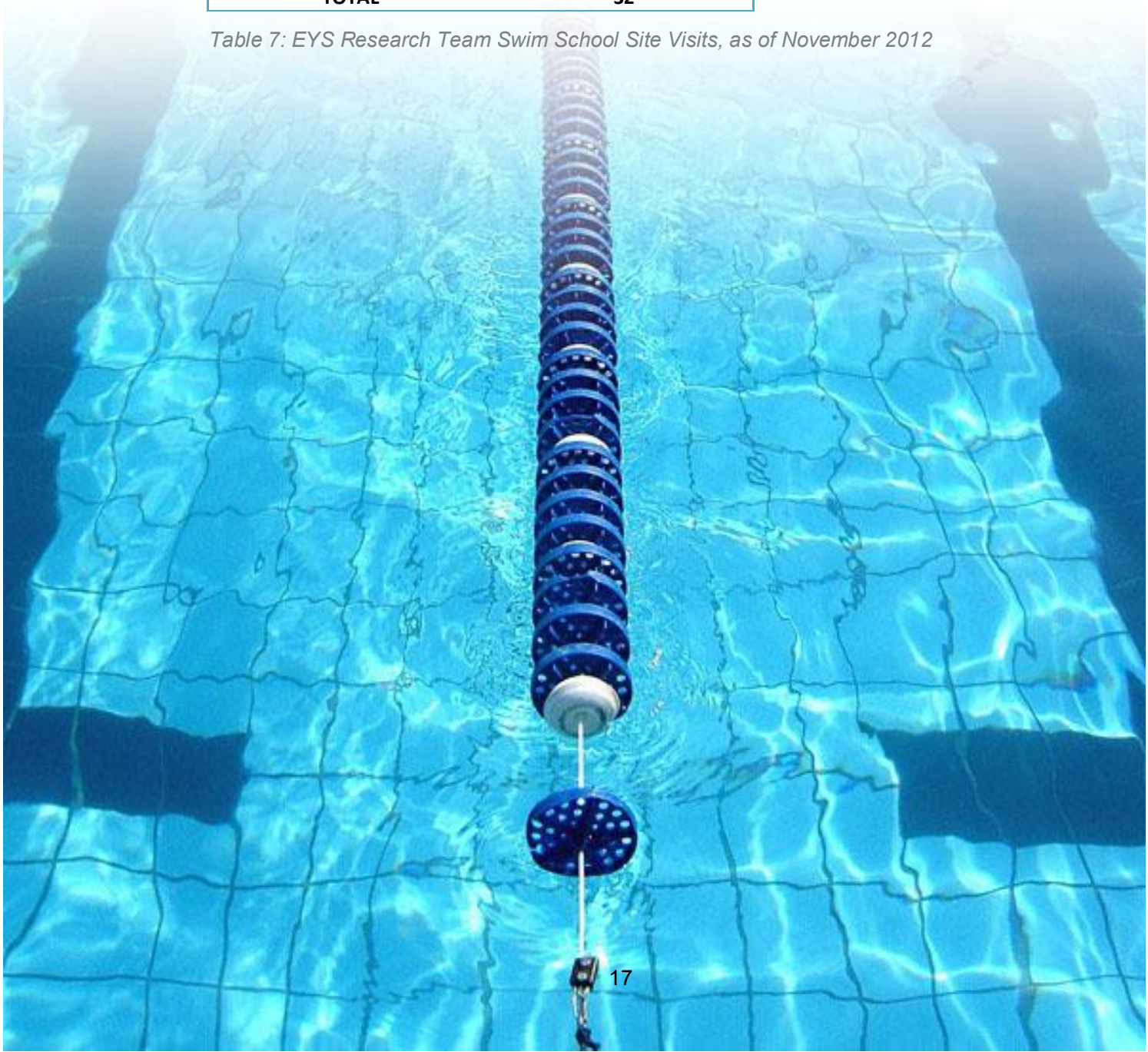
There was some difficulty identifying alternative measures for use in assessing the socio-emotional development of children in this age group. Most assessment instruments require the input of a caregiver or teacher or longer-term assessment by a mental health professional. Because of the age group of the children concerned and both budgetary and time constraints, the SDQ was identified as the most appropriate instrument, though still reliant on the input of the parent. It has been previously been tested in Australia, UK, Finland, Italy, Germany, Spain, Sweden and the US on children as young as three and normative data was available for comparative purposes.

Swim School Environmental Scan

Based on the literature on early childhood environments, a comprehensive audit tool was developed that incorporated the principles of quality early childhood education environments relevant to the swim school industry. The focus for 2010-2011 was the development, trialing/refinement of the tool and then the implementation of that tool. A total of 32 schools were visited in 2011-2.

State	No of schools (Individual sites)
QLD	7
NSW	15
VIC	7
SA	3
TOTAL	**32**

Table 7: EYS Research Team Swim School Site Visits, as of November 2012



Pedagogy Profiling

It is well recognised in education that the teacher is the most important factor in children's success in school (outside socio-economic status). With this in mind, the project also sought to profile the teaching practices in the swim industry. A tool was developed, trialled, and refined throughout 2010-2011. The tool profiles the teaching practice (not the teacher) and how the practices of the teachers may be fostering skills (adding capital) to the child – including the physical, intellectual, social and linguistic.

The final model that was developed for the profiling of early-years swimming pedagogy focused on the following five dimensions, each of which was then broken into a number of key elements. These can be seen in the table below:

Dimension	Elements	
1. Orientation	• Water familiarisation • Water survival skills	• Swim technique skills
2. Physical Capital	• Coordination • Differentiated activities • Participation/flow	• Activity progression • Corrective evaluations • Integrated communication strategies
3. Social capital	• Social support • Child engagement • Parent/caregiver engagement	• Confidence building, emotional well being • Self-regulation
4. Intellectual capital	• Literacy • Numeracy	• Other curriculum areas
5. Language Capital	• Rich Language	• Instructional discourse

Table 8: Dimensions and Elements from Swim Pedagogies Profiling

A total of 90 lessons were observed across the four states in 32 swim schools:

State	No of schools (Individual sites)	No of lessons observed
QLD	7	10
NSW	15	54
VIC	7	14
SA	3	12
TOTAL	**32**	**90**

Table 9: Dimensions and Elements from Swim Pedagogies Profiling

Initially, two observers scored each lesson independent of the other. At the conclusion of the lesson, scores were discussed and a common score negotiated. This process ensured that team members all gained a common understanding of the scoring rubric so that across the team there was consistency in scoring.

We are continuing to profile the schools and pedagogies so these will be expanded over the remainder of 2012. The data presented later in this report is based on the observations to date.

Analysing the Data

As with any large study, analysis of the various data sets requires specific techniques. These will be discussed in detail in the section below.

Survey

The survey that is foundational to this research has been created around widely-recognised developmental milestones. The instrument was refined using the work of the Centre for Disease Control's (CDC) (2012) milestones. These more contemporary measures were used to reflect recent changes in environmental factors contributing to changes in development. The CDC milestones are organised chronologically for 2 months, 4 months, 6 months, 9 months, 1 year, 18 months, 2 years, 3 years, 4 years and 5 years. Each chronological group is then divided into a number of key areas – social and emotional; language/communication; cognitive (learning, thinking, problem solving); and movement/physical development. These milestones can be seen in Table 10:

Age	Cognitive Milestones
2 years	• Finds things even when hidden under two or three covers • Begins to sort shapes and colors • Completes sentences and rhymes in familiar books • Plays simple make-believe games • Builds towers of 4 or more blocks • Might use one hand more than the other • Follows two-step instructions such as "Pick up your shoes and put them in the closet." • Names items in a picture book such as a cat, bird or dog
3 years	• Can work toys with buttons, levers, and moving parts • Plays make-believe with dolls, animals, and people • Does puzzles with 3 or 4 pieces • Understands what "two" means • Copies a circle with pencil or crayon • Turns book pages one at a time • Builds towers of more than 6 blocks • Screws and unscrews jar lids or turns door handle
4 years	• Names some colors and some numbers • Understands the idea of counting • Starts to understand time • Remembers parts of a story • Understands the idea of "same" and "different" • Draws a person with 2 to 4 body parts • Uses scissors • Starts to copy some capital letters • Plays board or card games • Tells you what he thinks is going to happen next in a book

5 years	• Counts 10 or more things • Can draw a person with at least 6 body parts • Can print some letters or numbers • Copies a triangle and other geometric shapes • Knows about things used every day, like money and food

Table 10: Adapted CDC Cognitive milestones for children two years and older

The focus of these milestones is to promote awareness among parents as to their child's development so that if the child is not achieving such milestones by nominated ages there is a need to 'act early'. As such, milestones are presented as diagnostic tools for child development and hence were useful in providing a benchmark to describe the age that children usually achieve particular behaviours. Using internationally recognised criteria as the basis for the survey, it was possible to see if participating in early-years swimming may progress learning in key areas of children's growth.

Initially developed as a pencil-and-paper survey where the parents would check off if their child was able to achieve the nominated behaviour, the 2011 iteration also went into an on-line format. Parents were able to scan those sections that their child could achieve and then move into the sections where they were beginning to achieve some things and not others. All developmental milestones were listed which made for a very extensive list. Items were listed according to generally expected sequence of achievement so that it was clear that there was a progression, but it was unclear to respondents as to the age at which children would be achieving such milestones. Allowing parents to commence at a point where the child was clearly at that level enabled the parent to engage more fully with the survey. This was in response to important feedback from the first iteration where parents felt that the survey was too long if they had to read and complete from the start, particularly for those parents with older children. Parents had to check off those milestones that their child was achieving.

Data were also collected as to the age of the child, the duration and extent of their swimming experience, along with other activities they were undertaking.

Eliminating non-discriminatory items

As this was a long survey with a large response rate, it is reasonable to expect that there was some need to prepare data for analysis. To do this we adopted a number of processes in order to ensure that the data was of a suitable form from which relations could be established between milestones in early swimming and capitals. Some milestones needed to be removed from the data set as they were clearly non-discriminatory so a systematic approach to cleaning the data was developed before the data were analysed.

The objective of the analysis was to consider possible and probable effects of the active participation of young children in swimming against a range of aspects of child development. Basic information essential for such consideration was the age of child and also an assessment of their performance on relevant milestones. Thus the

first step was the elimination of cases where this basic information was either not available or not usable. In some cases data were missing – either in the child's demographics or in survey responses. These responses were eliminated from the data set. In other cases, parents may have incorrectly entered data making the information void. For example, with regard to the child's age, date of birth was requested; however, some parents entered the current year rather than the year of their child's birth. There were also cases where there were clear inaccuracies apparent when considered against milestones. For example a child of 2 months rated as "holding their bottle" and "coming to a sitting position" was considered unrealistic and such cases were excluded. Finally, where clear outliers were identified, box-plots were used to make decisions on their inclusion or exclusion from the analysis.

Making sense of the data

The approach to the analysis of survey responses was sequential, with an initial descriptive perspective followed by an assessment of responses as possible components of scales reflecting development in "Motor", "Socio-Emotional", "Cognitive" and "Language" domains. To undertake this second stage a more detailed assessment using Rasch modelling, discussed below, was undertaken to identify items that could be included on a unidimensional scale. The focus of the discussion in this paper is on the initial descriptive stage.

The survey presented parents with a series of milestones based around four domains – cognitive (30 items), motor (65 items), language (42 items) and social/emotional (36 items) – on which they were asked to indicate whether or not their child had achieved that milestone. These included relatively familiar statements of child achievement, with the core responses accessed from CDC items. Given that these were provided to parents for their response without formal supervision there was also some risk of misinterpretation.

Age was calculated by determining the difference between the child's date of birth and the date of completion of the survey, measured in months. For the initial assessment, ages were classified into groups – by 6 month up to 2 years, then yearly for those above two years. Thus, as well as individual variation within children (i.e. the natural range in the achievement of milestones) there also is, within age groups, a level of variation for those that are at the lower or upper level of each age range. While such variation will occur within groups, this process also allows a consideration of the general level of achievement of individual milestones, particularly in comparison to the expected age identified by the CDC.

Rasch Modelling

While there are quite high levels of expected variation in the achievement of the milestones assessed, there were also challenges as some items were clearly non-discriminatory. For example, items that typically were achieved by children of all ages (eg early milestones such as "brings hands within range of eyes and mouth" or "imitates some movements and facial expressions") did not provide any discrimination. The use of Rasch modelling was to facilitate the identification of items appropriate for inclusion in scales assessing each of the four aspects of the milestone areas.

WINSTEPS (Linacre, 2012) software was used to undertake this analysis. For each item, fit statistics were calculated (i.e. infit value, with this transformed as a standardised t value). Additionally statistics was analysed indicating the level of difficulty of each item, thus suggesting the relative sequence of development of the milestones included. Using this approach the data could be more clearly reported within the limitations of the model.

Each test item that was accepted in the final analysis was mapped for each age group and plotted against the CDC milestones. Refer to Figure 2 for an illustration of the process through which motor skills were mapped against the milestone "Climbs well" as assessed by parents. In this milestone, the international benchmark for this skill is 3 years – as indicated by the downward arrow between columns 2-3 and 3-4. Here parents indicated that all children above four years of age were able to "climb well". What is of interest to this research is the percentage of children younger than the benchmark who were able to complete the skill. More than 90% of children between 2 and 3 years were able to complete the task as were 87% of 1-2 year olds. Also notable was the small percentage of parents reporting that their 6 month-12 month old child was able to undertake this activity. This latter reporting, observed on many items, is a limitation of the method due to the possible (mis)interpretation of the milestone. The Rasch Modelling process eliminated those items where there was statistically considerable variation within an item, thus rendering it invalid for this process. As the hypothesis foundational to the research was that participating in

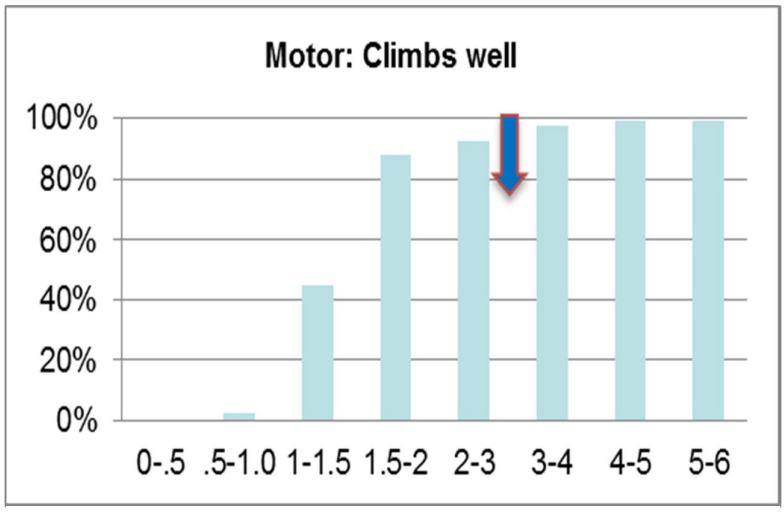


Figure 2: Percentage of children reported to "Climbs Well"

early-years swimming would add capital to young children, the most significant interest in the data were those achievements prior to the nominated age for the particular milestone. Those children who met the milestone prior to the nominated age could be achieving this milestone as a consequence of their involvement in early-years swimming. That is, within our framework, early-years swimming may be adding various forms of capital to young swimmers.

Child Assessments

As noted earlier in this report, tests were selected that had national or international norm-referenced populations against which we could compare the results of the child testing. In some cases (Woodcock-Johnson III), there were z-scores making comparisons quite simple. In other tests (Peabody Developmental Motor Scales 2) the results were reported as age equivalents so the statistical comparisons relied on paired-T-tests. Tests for skewness and Kurtosis were also undertaken to identify any anomalies in the data. (The analysis of the Strengths and Weakness Questionnaire has not yet been undertaken.)

Environmental Scan and Pedagogy Profiling

At this point, the data have been reported using simple descriptive statistics to provide illustrations of the environments and pedagogies used within the swim industry observed to date.

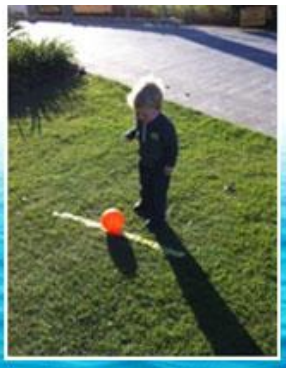
Environmental Scan

Many of the items on the environmental scan were either yes/no responses or rating. Scores were scaled and then adjusted so that each dimension was given a score out of ten. This enabled easy comparisons to be made across the four dimensions. The four dimensions included external factors; the centre itself; the facilities; and the pool.

Pedagogical Profiling

The pedagogical profiling was analysed using simple descriptive statistics and mean scores are reported on for the national sample.



Key Findings

Survey: Developmental Milestones

The data from the survey is represented through the use of graphs as there is little scope for appropriate inferential statistical analysis to be undertaken on these data given the inability to define the normal distribution for when a milestone is achieved. The CDC uses the milestones to identify when it is expected that a child should have attained each skill. As such, we have elected to use a protocol whereby it would seem reasonable that if a child were expected to reach a milestone at a particular age, for example 3 years, then it would also be expected that some children would achieve this before that time. With this in mind, we elected to identify those items where children were achieving the milestones 2 bands ahead of the nominated age group. For example, in considering the milestone "pulls self to standing" (below) this should be achieved by the time the child is 9 months so the arrow points to this age range. What is seen from the survey data is that almost 60% of parents reported that children in the 6 months to 12 months age group were achieving this milestone. Children were not achieving it any earlier than expected. As such, it appears that swimming children may not be achieving this milestone earlier. However, such a claim is difficult to make on the basis of our data collection since it is unclear of the mean age at which children within the population would be achieving this milestone.

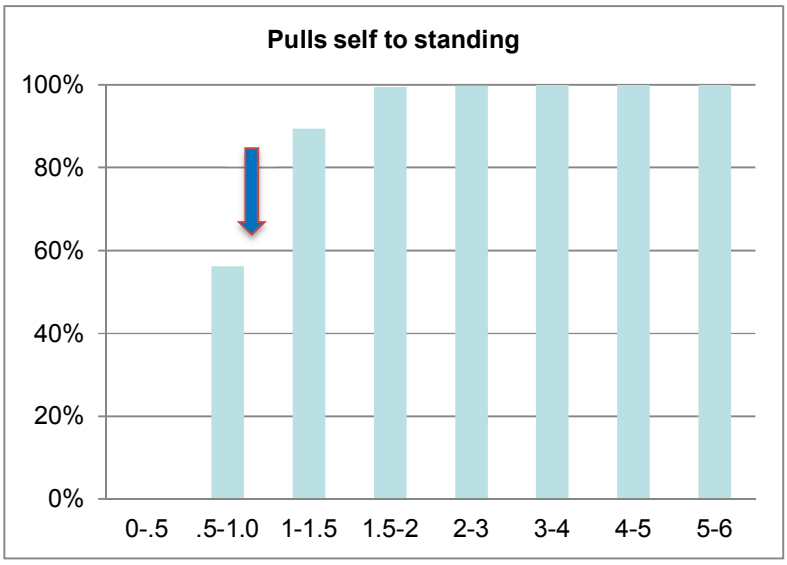


Figure 3 Percentage of children reported to "Pulls self to standing"

In contrast, the milestone "Climbs onto and down from furniture unassisted" is achieved by 2 years. In our cohort, 90% of children were achieving this in the period of 1.5-2 years which could be within the normal range but nearly 80% of children were reported to have achieved this between 1 and 1.5 years. To this end, we see this as an early achievement of this milestone. We have taken the benchmark then to be more than 50% of children acquiring the milestone 2 bands ahead of the nominated age group to be seen as a valid measure for inclusion in the data set. For example, in this example, if less than 50% of children in the 1-1.5 age group did not reach the milestone, then that milestone is not included in our report.

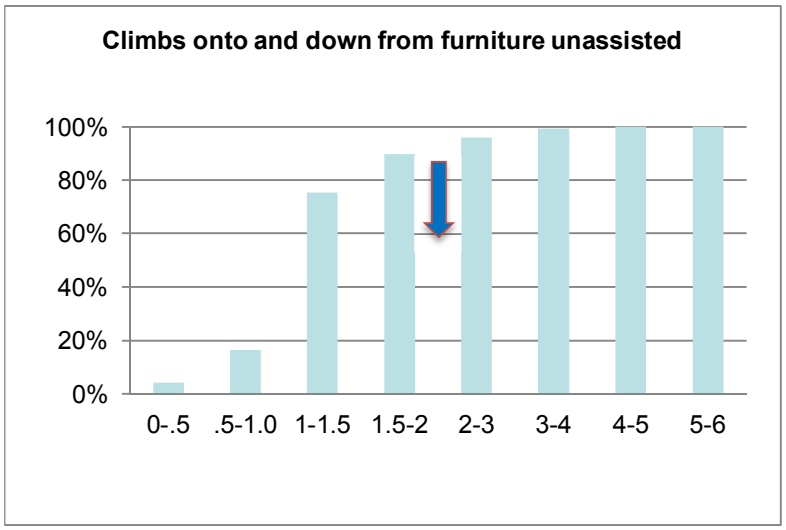


Figure 4 Percentage of children reported to "Climbs onto and down from furniture unassisted"

In Table 11, all the CDC milestones for which swimming children achieved the milestone at a rate of 50% for two bands ahead of the nominated age group are highlighted. The dark blue area depict the ages at which the CDC identifies where all children should be achieving the milestone. The mid blue cells show the 2 prior bands where swimming children have already achieved these at a rate of 50% or more.

Milestone		<0.5	0.5-1	1-1.5	1.5-2	2-3	3-4	4-5	5-6
Stands on tiptoe	Physical								
Climbs up and down furniture unassisted									
Walks up and down stairs holding on to support									
Climbs well									
Runs easily									
Stands on one leg for 10 seconds or longer									
Correctly names some colours									
Understands the concept of counting	Cognitive								
Begins to have a sense of time									
Recalls parts of a story									
Understands the concept of same/different									
**Can count 10 or more objects									
Correctly names at least four colours									
Enthusiastic in the company of other children	Socio-emotional								
Demonstrates increasing independence									
Begins to show defiant behaviour									
**Imitates adults and playmates									
**Spontaneously shows affection for familiar playmates									
Separates easily from parents									
Interested in new experiences									
Cooperates with other children									
Plays mum and dad									
Says several single words	Linguistic								
Follows simple instructions									
Follows a two- or three- word command									
Identifies common objects and pictures									
Understands physical relationships (in, on under)									
Mastered some basic grammar									
**Speaks clearly enough for strangers to understand									
Tells stories									
Uses future tense									

Table 11: CDC milestones for which swimming children achieved at a rate of 50% for two bands ahead of the nominated age group

What these data indicate is that parents are reporting that their swimming children are reaching many developmental milestones ahead of the “normal” or expected time. The above figure shows those milestones that appear to be acquired considerably ahead of the normal expected time for that particular milestone. There are some milestones (marked with 2 asterisks) where they appear to be acquired considerably earlier than would be anticipated. Similarly, there were some milestones that were just outside our nominal cutoff point of 50%. These have been marked by the percentage points. As a nominal scale, these items could have been included if a rounding process had been adopted.

It appears from the survey data, that swim children may be achieving many milestones in all areas of this study (physical, social, cognitive and linguistic) at an earlier age than the normal expected time for such milestones.

Child Assessments

The data collected for this part of the study were compared against larger populations – the tests were selected on the basis that normative data were available to which we could compare our swimming children. In most cases, these were Australian norm-referenced populations making it possible to undertake comparisons between the swimming children and a normal population. The test items did not necessarily align with the developmental milestones in the first part of the study but offered similar reference points.

Physical Capital

Physical capital is broken into three quotients – gross motor, fine motor and total motor. The latter is an aggregated score for motor skills using the two previous scores (fine and gross motor). It would be reasonable to expect that an activity, such as swimming, would have a strong emphasis on gross motor skills as these are central to being able to propel through the water. Using a two-tailed t-test, it was found that there were significant differences between the swimming cohort and the normal population against which it was compared. Swimming children were found to be significantly better on items of:

Subtest	Indicative items included in General Skill	Significance
Locomotion	Walking, hopping, running, climbing stairs	p>0.001
Stationary	Standing on tip toes, balancing, standing on one leg	p>0.001
Visual motor	Eye-hand coordination – drawing, copying objects, building towers	p>0.001

Table 11: Physical Capital: PDMS-2 Subtests in which independently assessed swimming children performed significantly better than normal population

As PDMS-2 used age equivalent in months for comparative purposes, we were able to see that across the whole group, our swimming children (on average) were performing approximately 2-3 months ahead of the normal population.

However, the swimming cohort performed significantly poorer on the object manipulation cluster. This cluster involved a series of tasks that involved ball handling skills (throwing, catching, hitting targets from various distances, kicking, etc.).

The grasping cluster was deleted as it was not sufficiently discriminatory and did not produce reliable analysis for this study.

Intellectual or Cognitive Capital

The basis for this aspect of the child testing was the Woodcock-Johnson III tests. Using a two-tailed T-test, a number of factors were found to be very highly significant. The Woodcock-Johnson III battery assesses children on a number of items, some of which can be aggregated into clusters which provide quick and accurate measures of performance for general skills.

The general skills that had statistical significance can be seen in Table 12 below:

Cluster	Indicative items included in General Skill	Significance
Oral expression	Ability to name objects from illustrations and to recall short, but increasingly complex stories.	p>0.001
Brief achievement	Letter and word identification skills, prewriting skills, simple mathematical calculations.	p>0.001
Brief reading	Letter-word recognition and pre-reading passage comprehension skills (the ability to match symbols with pictures).	p>0.001
Mathematics reasoning	Simple mathematical calculations and counting and identifying numbers, shapes, and sequences	p> 0.001

Table 12: Intellectual/Cognitive Capital: WJIII clusters in which independently assessed swimming children performed significantly better than normal population

Within these measures, we draw attention to a number of items where there were strong skills being demonstrated by the swimming cohort in comparison to the normal population. Within these, swimming children scored significantly better than the normal population on items involving Letter-Word Recognition (p>0.05); Understanding Directions (p>0.001); Passage comprehension (p>0.001); Applied Problems (p>0.001); Picture Vocabulary (p>0.001) and Quantitative Concepts (p>0.001).

Social and Emotional Capital

The data from Goodman's Strengths and Weaknesses Questionnaire has not yet been analysed and cannot be reported at this time.

Adding Capital to Young Swimmers

The data from the child asessments confirmed the results from the large-scale survey in terms of areas of strengths. There were no marked differences in areas of strength noted in the two data sources. While it is difficult to ascertain any clear temporal gains due to the types of tests that have been administered, there is a sense that the swimming children are 2-3 months ahead of the normal population on a number of the test items and general skills.

Environmental Audits

A summary of each of the four dimensions is provided below. These are based on data collected up to April 2012. More data will be collected in late 2012 to ensure a more representative sample across the industry. Each graph illustrates the summative data for the 32 swim sites visited.

External Factors

Before accessing a site, the external factors were assessed in terms of their visibility, practical access and safety for parents. Parents or carers would have at least one child in their care, possibly more, so ensuring that the site was easily and safely identifiable and allowed safe carriage into the site were prioritized.

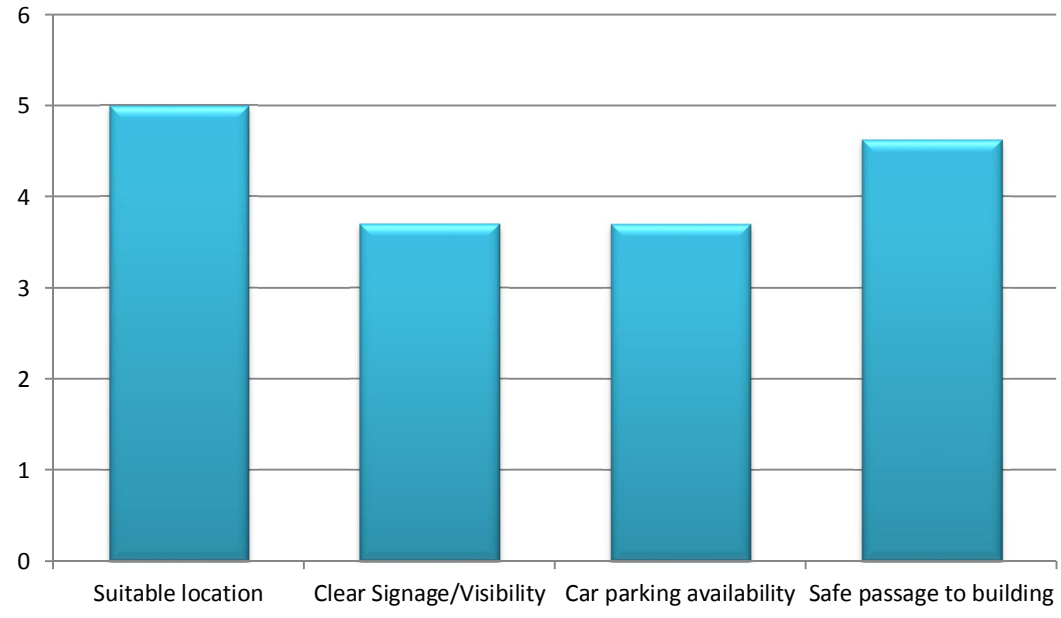


Figure 5: External factors of swim schools, summative data

As can be seen, across the board swim schools were rated very positively on the four elements within this dimension. The schools where signage or visibility was not scored highly were generally contained within facilities that provided other services.

The Centre/School

There was considerable variation in the physical layout of the schools ranging from purpose built to cater for early-years swimming, through to pools that operated from council swimming pools with minimal modifications. There was a range of swim schools operating from commercial/council pools which use temporary constructs (such as resting benches/islands) placed in the pool.

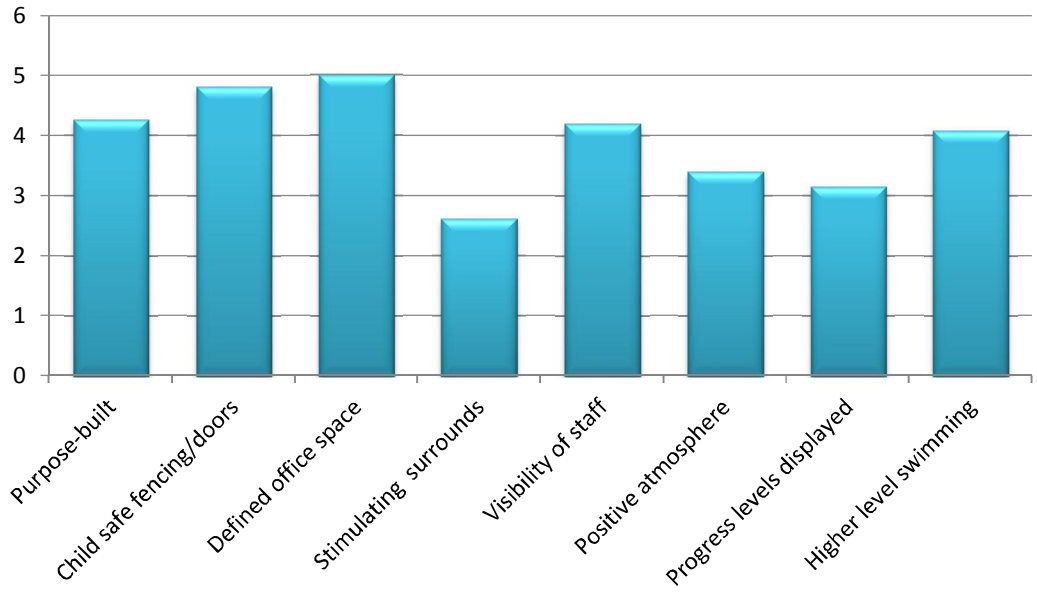


Figure 6: Assessment of swim school centres, summative data

Some swim schools located within shared facilities (eg. council pools) had limited opportunity for adapting the environment, even for the display of levels within the swim program. Most of the variation in this dimension was in the elements of stimulating surrounds and positive atmosphere.

Facilities

In this dimension, the range of facilities available at swim schools was the focus of the profiling. This included toilets and change facilities; baby change facilities; storage facilities for parents to safely store their possessions while participating in swim lessons; access to the pool deck for non-participating parents; adequate seating for parents as they watched their children; play facilities for siblings or children not involved in swim lessons; availability of refreshments (such as food, coffee, drinks) and tables/chairs for families while they waited for their lessons.

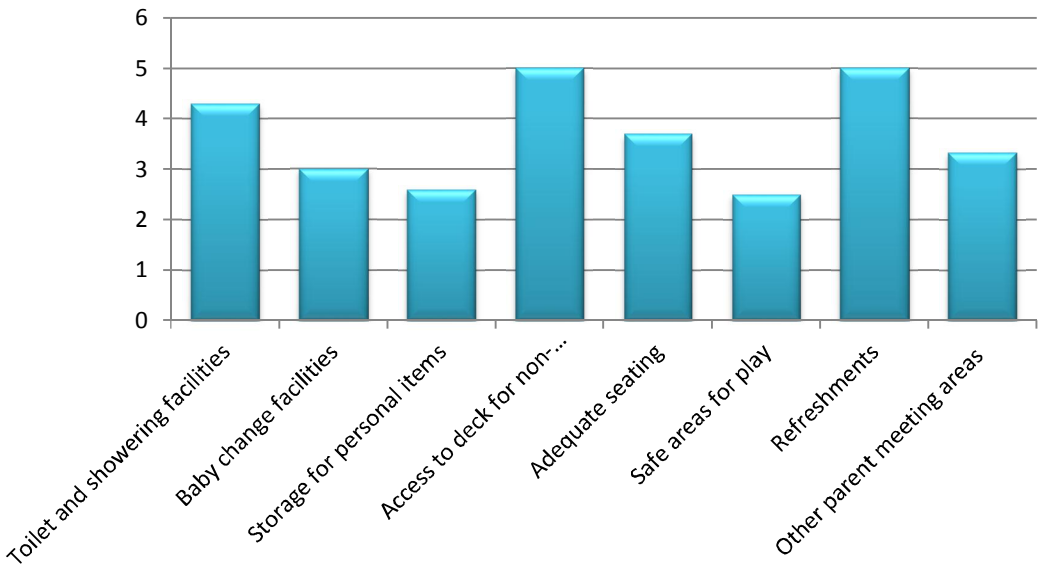


Figure 7: Assessment of swim school facilities, summative data

The areas of most variation in this dimension were the provision of a safe place for children to play and the provision of baby change facilities which is again a reflection of the purpose of the facility in which the swim school id housed.

The Pool

As the pool is the centrepiece for swimming lessons, this is an integral aspect of the swim environment audit. This included whether or not the pool was purpose built; the comfort level (usually heat and ventilation); lighting; sunsafe (particularly relevant for outdoor pools); noise levels; depth of the pool appropriate for the swimmers; ease of entry; destination swim points; availability of teaching resources for the teachers and children.

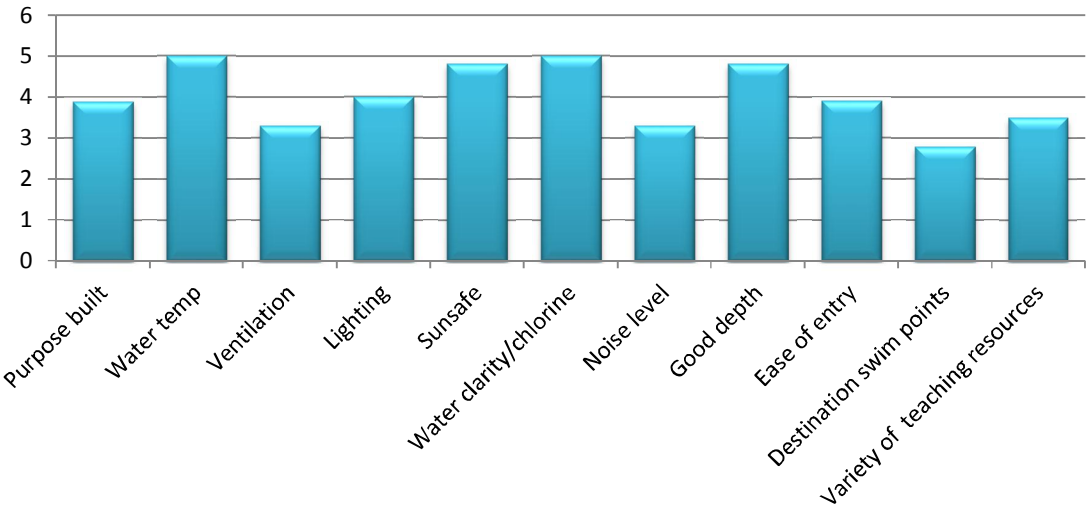


Figure 8: Assessment of swim school pools, summative data

The overall data here suggest that there are positive swim school environments across the board. It should be noted though that there was considerable variation across the sites in terms of noise levels. Again, this was dependent on the location and constraints of the environment. In many schools it was impossible to hear what the teacher was saying to young children from the poolside. Water temperature is a key factor in the comfort of young children in learn-to-swim. Some swim schools cannot offer baby swim classes because they do not have control over the water temperature in their pool as this may be controlled by owners/facility managers who operate independent of the school.

Swim Pedagogies

Ninety lessons were observed across the swim sites visited. The lessons included all age groups. There is a marked difference in the lessons for the babies/parents lesson than those where the child is in the pool without the parent/caregiver. With this in mind, we have separated these two types of lessons as they are markedly different in terms of what can be undertaken and achieved by the teacher. We provide an analysis on the lessons with/without parents and then an aggregated score for that dimension.

Dimension One: Orientation

The early lessons focus on ensuring the child is familiar with the water and various activities are undertaken, including basic familiarisation, submersions, early safety (turning to grab the edge of the pool). These lessons are undertaken with parents or carers in the pool. As the child ages and their physical development improves, later lessons begin to adapt for the gross and fine motor skills of the child. Some schools have a very strong emphasis on water safety whereas others focus on swim technique. These two categories are not mutually exclusive and elements of both are found in lessons/programs. However, the ethos of the swim school may prioritise one over the other.

The results have been reported in three groupings. The first grouping shows the average rating for lessons for all children aged 5 years and under. The second grouping has been labeled “Baby Swim” and this represents all children, generally under the aged of 2½ years, who are participating in a swimming lesson accompanied by a parent/carer. Some swim schools do not require parents in the water from when the child turns two, others require parents to actively participate until the child turns four. The principal determinant here is the presence of the parent. The third grouping, labeled “Preschoolers” represents children, generally aged over 2½ years who are participating in a lesson without a parent. These children could be aged up to 5. The separation of babies from preschoolers was made in order to recognise the significant differences in approaches used.

The three components that make up the Orientation dimension: water familiariation; water survival skills; and swim technique skills for each of the groupings are displayed in Figure 9 below.

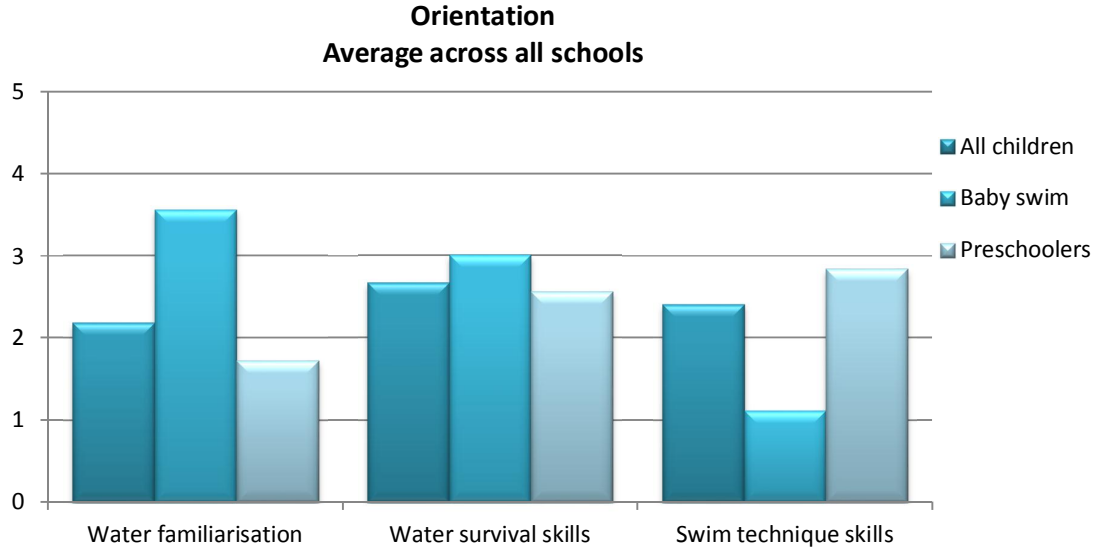


Figure 9: Profile of orientation of learn-to-swim lessons, summative data

The data here are not surprising – in baby swimming there is a considerably higher profile for water familiarisation. This tends to reduce over time so that as children age, there is little or no water familiarisation as the emphasis has shifted to the teaching of technique. In terms of safety, there is a good score for both categories of lessons.

Dimension Two: Physical Capital

This dimension of the profiling is the core business of swimming – one would anticipate that swimming lessons are building on the physical capital of children. In terms of the data, the elements of this dimension focused on aspects of what is taught as part of swimming. This dimension comprises:

- **Co-ordination** where there is an expectation that the child will exercise a number of physical movements concurrently.
- **Differentiated activities:** where variation of children's skills/abilities/ages is evident, a number of activities are used to cater for this variance.
- **Participation/flow:** Teacher maintains constant flow of the activities presented in the lesson so children are continually engaged in some form of specified activity with limited down time.
- **Activity progression:** Teacher has designed the lesson so that activities progressively build on each other.
- **Integrated communication strategies:** Teacher uses a range of communication strategies: talking, singing, demonstrating, using visual aids (eg. toys/pool aids).

Figure 10 below depicts the results for observed lessons on each of the physical capital elements:

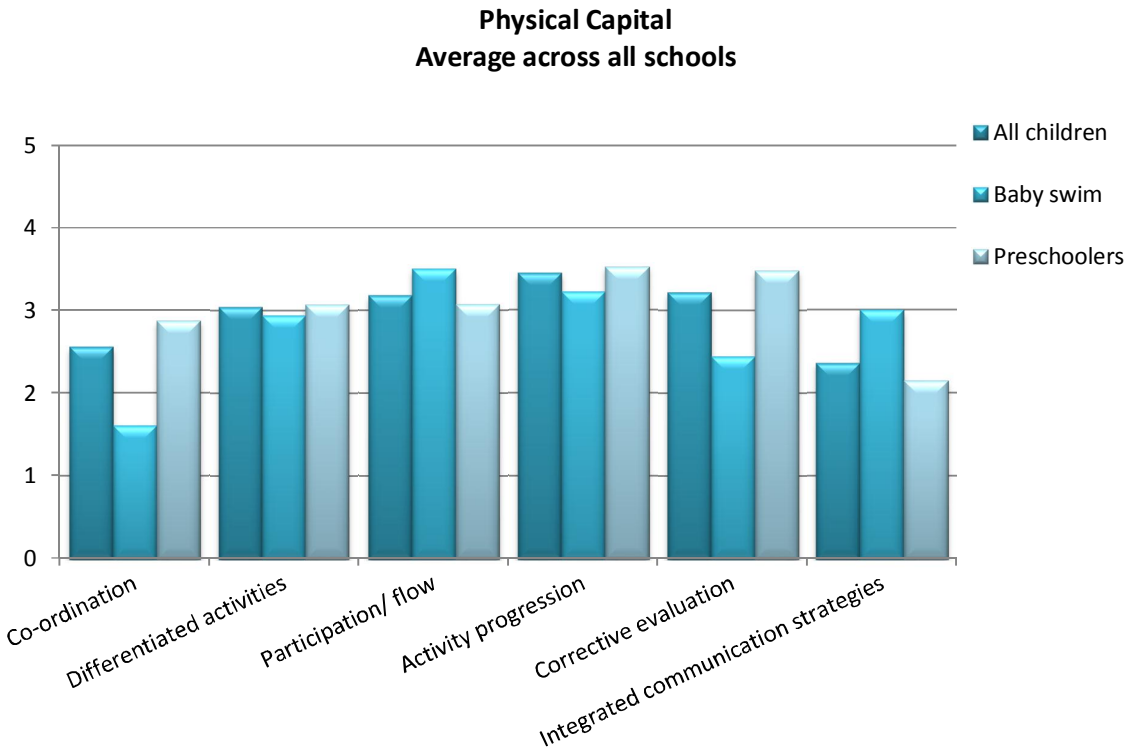


Figure 10: Profile of "physical capital" within observed learn-to-swim lessons, summative data

Unsurprising in these data is that there is a strong link with the physical development of the child and how the lessons are structured. What is of interest however, is the variation among schools on some of the elements. Particularly, the participation/flow element has the most variation. This is most likely a reflection of the ethos of the school where some schools allow children to either sit on the edge of the pool while others swim (so that they are only actively participating in perhaps 25% of the lesson), some schools allow children to play in the water while the teacher focuses on particular children so that there is some water activity happening albeit unstructured, while other schools endeavour to have children actively involved in the majority of the lesson.

Dimension Three: Social Capital

Lessons were also assessed for how the pedagogies employed may contribute to the social capital of child participants.

- **Social support:** Teacher exhibits behaviours, comments and actions that encourage effort, participation and taking risks to learn.
- **Child engagement:** Children exhibit on-task behaviours that signal involvement/satisfaction with the swimming lesson, including attentiveness, doing the assigned activities, anticipating lesson structure, showing enthusiasm.
- **Parent/carer engagement:** Teacher engages parents/carers in lesson activities. (Parents/carers exhibit behaviours that show an investment, including attentiveness to the child/teacher, interaction with the child, anticipation of lesson structure, enthusiasm.) **Confidence building, emotional well-being:** Teacher employs strategies to build confidence and emotional well-being in children. The approach is consistent and dependable. The positive sense of self and copying skills of children.
- **Self-regulation:** Teacher encourages self-regulation of students. This is demonstrated by both implicit behaviour management techniques (where little time is aimed at disciplining children's behaviour and children are demonstrating high self-regulation) and, where children are not demonstrating high self-regulation, instructional techniques that gently remind/reinforce good behavior.

The results for the dimension of social capital are:

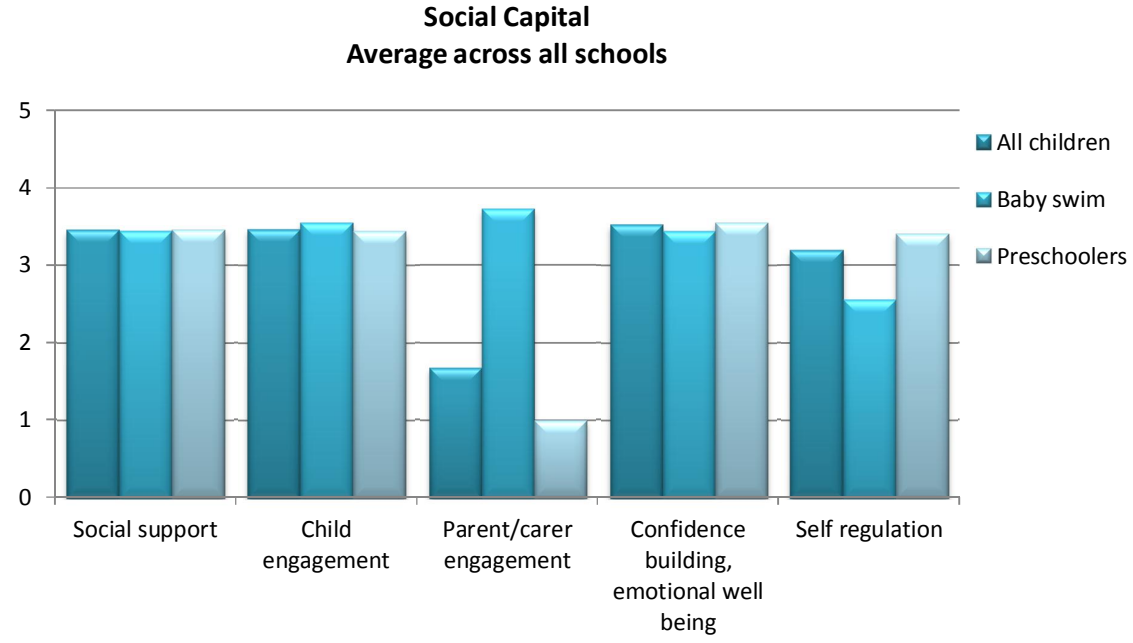


Figure 11: Profile of "social capital" within observed learn-to-swim lessons, summative data

The scores for social capital are quite strong and there is a strong sense of the swim pedagogy creating a positive learning environment. Very encouragingly, there is very little variation across schools on these elements suggesting that there is a strong sense of the schools overall creating very positive learning environments for the children.

Dimension Four: Intellectual capital

The observed lessons were also profiled as to the contributions they make to intellectual capital in children. Pedagogies were observed on literacy, numeracy and "other" curriculum areas.

- **Literacy:** Teacher incorporates instructional techniques and/or activities in the class that develop literacy. (eg. explicit instructional techniques, the development of listening skills, the use of rhyming in songs, letter formations on instruction cards.)
- **Numeracy:** Teacher uses instructional techniques and/or activities in the class that develop numeracy. (eg. the use of counting while instructing, using visual cues with number representations.)
- **Other curriculum areas:** Teacher incorporates instructional techniques and/or activities in the class that develop other areas of the curriculum. (eg. music).

Figure 12 outlines the observational findings for intellectual capital:

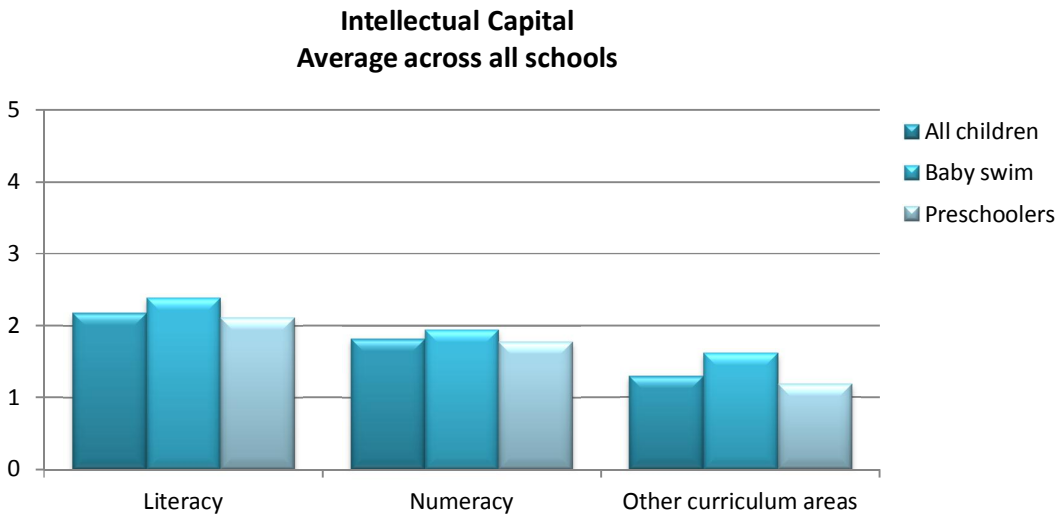


Figure 12: Profile of "intellectual capital" within observed learn-to-swim lessons, summative data

While this dimension is not a strong feature in the lessons, there is still evidence that the teachers are working on elements of literacy and numeracy learning. The babies' lessons have scored higher on the "other curriculum areas" due to the number of songs that are often part of the swimming lesson. This dimension, along with language, is an important factor in school readiness.

Dimension Five: Language Capital

Lessons were also profiled as to how the linguistic capital of children may be enhanced. Specifically, they were profiled by the "rich" language employed and the instructional discourse used.

- **Rich language:** Teacher incorporates instructional techniques or activities that endeavour to link with the understandings of the child to the world outside the aquatic environment.
- **Instructional discourse:** Teacher incorporates instructional techniques that develop a range of skills in children that will benefit them in the school environment.

Figure 13 below outlines the results for each of the elements within the Language Capital dimension:

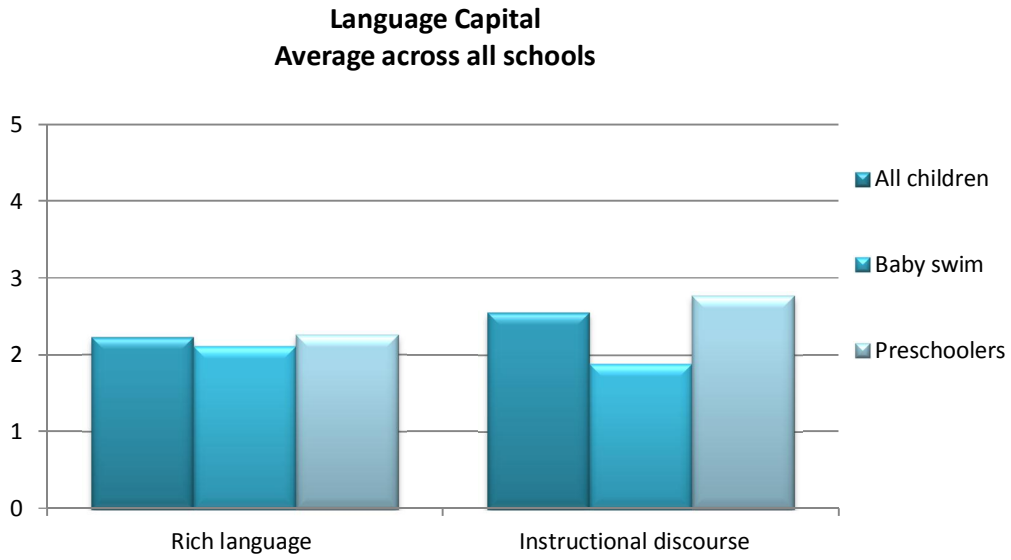


Figure 13: Profile of "language capital" within observed learn-to-swim lessons, summative data

This dimension is not quite a rich as the other dimensions, in part due to the repetitive nature of the swimming instructions. The richness of the language is perhaps constrained by the ways of teaching, but the instructional discourse used by teachers is stronger for children than the baby classes. We contend that this difference may be due to the stronger play environment of the baby class and having parental involvement. Whereas, with the older children, the teachers do need to focus more on how they deliver instructions but in a context where there is a lot of coordination between body movement and language (e.g. "kick, kick, kick"). Here the language is not rich as the co-ordination between movement and language appears to have a stronger emphasis in the pedagogy.

Project Conclusions and Recommendations

Conclusions

As there are still some areas of the project that are to be analysed more deeply, for this report, we comment only on the analysis that has been undertaken to date.

It does appear that children who participate in swimming are achieving a range of milestones earlier than normal populations. This has been supported strongly from the parent survey, but also (to a lesser degree) in the child testing.

Many of the skills, dispositions and knowledge that swimming children are displaying in both the survey and the child testing are those that one would expect from intense training in swimming – namely their physical capital. However, we also note that swimming children, as reported by their parents and through child tests, are also performing better than normal populations in other areas – their language, intellectual and social capital.

Many of the skills that swimming children are displaying earlier than the normal population are in areas that are valued in contexts outside swimming. For example, the survey showed that young swimmers are reported by their parents to be counting to 10 much earlier than is expected on developmental milestones. Many of the parental reports in the survey have been confirmed by the child testing. We note that the child testing confirmed many aspects of the parent reporting (survey) but not as strongly. As such, there is triangulation in the data but with a need to moderate some of the parental reporting. Collectively, the two sources suggest that children who participate in swimming achieve a range of milestones (skills, knowledge and dispositions) earlier than the normal population.

We also found that there were some areas where swimming children were not performing as well as the normal population, particularly in the area of object manipulation – namely ball handling skills.

The analysis of the survey indicated that the swim school that children attended appeared to have a significant influence on parent responses. This suggests that there are differences in schools and this must be considered by parents in any selection of schools.

Our observations of quality swim lessons suggest that the swim lessons can offer considerable potential to add capital to young children. In early swimming lessons young learners are exposed to new experiences that extend their repertoire of skills, knowledges and dispositions. We have noted the strong mathematical experiences in early swimming (counting to three, counting to ten, one-to-one correspondence between counts and actions; rich language around colours and shapes, rich language of mathematics in general) (Jorgensen, Funnell & Klieve, under review). All of these experiences enrich and enhance children's learning and the results may be shaped by these experiences.

It appears that there are advantages for young children who participate in early-years swimming. There is clearly the water safety focus and the physical benefits for participating in any activity, but this research suggests that there are many areas of positive difference between swimming children and the normal population. Many of these differences will be of advantage to children as they transition into school or preschool settings. They have developed many of the skills needed for school – academic, social and personal.

Caveats

We cannot conclusively claim that swimming is responsible for the differences we have identified in this study. Simply, we can say that children who participate in swimming achieve a wide range of milestones (survey) and skill, knowledge and dispositions (child testing) earlier than the normal population.

We cannot conclusively claim that more lessons or time per week would have an even more significant difference for swimming. The number of children in this study who participated in more than one lesson per week was too small to draw any firm conclusions.

Recommendations

As the early years of life are so critical to later successes, there is now a strong emphasis on the early years of learning and the transition into schooling. Many of the children who participate in early-years swimming are those who come from families able to afford swimming lessons. The cost of lessons can vary considerably. While the swim schools the Early-Years Swimming Research team visited in 2011-2012 charged between $11 and $24 per lesson, RLSSA's Swim School Managers Report (2010) showed that across Australia, the average thirty-minute swimming lesson was just under the $30 mark for children up to 5 years of age. For many families, this cost is beyond their budget and are disadvantaged by not being able to participate in swimming and the resulting possible benefits to be gained for children aside from swimming and safety.

- All children should be encouraged to participate in swimming for safety and overall wellbeing.
- Quality swimming lessons are rich in opportunities for learning beyond swimming skills so there is the potential for children to extend their learning which may help in the transition to school. It would be prudent for at-risk children to be able to access early-years swimming. These children are least likely to participate in swimming due to the high cost of lessons. Subsidizing lessons may be a way forward for disadvantaged families to enable better access to school.
- Recommendations for determining what constitutes quality swimming programs could be developed to help parents in the selection of swim schools which may enhance skills, knowledges and dispositions to support the transition to school.

References

Australian Bureau of Statistics (2007) *Environmental Issues: People's Views and Practices (*4602.0). March. http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4602.0Main+Features1Mar%202007?OpenDocument Accessed: 06 June 2012.

Australian Bureau of Statistics (2009) *Children's Participation in Organised Sport and Dancing, Perspectives on Sport* (4156.0.55.001), December. http://www.abs.gov.au/ausstats/abs@.nsf/Products/4156.0.55.001~Dec+2009~Main+Features~Children%27s+Participation+in+Organised+Sport+and+Dancing?OpenDocument Accessed: 06 June 2012.

Australian Taxation Office (2012) *GST and personal aquatic survival skills*, http://www.ato.gov.au/businesses/content.aspx?menuid=0&doc=/content/39995.htm&page=2&H2 Accessed: 05 October 2012.

Bourdieu, P. (1983). The forms of capital. In J. G. Richardson (Ed.), *Handbook of theory and research for the sociology of education* (pp. 241—). New York: Greenwood press.

Bowes, J. Harrison, L., Sweller, N., Taylor, A. and Neilsen-Hewett, C. (2009) *From Child Care to School: Influences on Children's Adjustment and Achievement in the Year before School and the First Year of School:* Research Report to the NSW Department of Community Services. Children and Families Research Centre, Macquarie University and School of Teacher Education, Charles Sturt University.

Bugeja, L. & Franklin, R. (2005) Drowning deaths of zero- to five-year old children in Victorian dams 1998-2001. *Australian Journal of Rural Health, 13*, 300-308.

Centre for Disease Controls (CDC) (2012) *Developmental Milestones*. http://www.cdc.gov/ncbddd/actearly/milestones/index.html Accessed: 10 April 2012.

de Lemos, M. & Doig, B. (2000) Who Am I?. ACER Press: Camberwell, VIC.

Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA), the Australian Institute of Family Studies (AIFS) and the Australian Bureau of Statistics (ABS). *Growing Up in Australia: The Longitudinal Study of Australian Children*. Source: www.growingupinaustralia.gov.au/index.html Accessed: 26 October 2012.

Diem, L. (1982) Early motor stimulation and personal development. A study of Four-to-Six-Year-Old German Children. *Journal of Physical Education, Recreation and Dance*, 53, 23-25.

Folio, M. R. & Fewell, R.R. (2000) *Peabody Developmental Motor Scales* (Second Edition), Austin, Texas: Pro-ed.

Font-Ribera, L., Villanueva, C. M., Nieuwenhuijsen, M.J., Zock, J-P., Kogevinas, M. & Henderson, J. (2011). Swimming Pool Attendance, Asthma, Allergies, and Lung Function in the Avon Longitudinal Study of Parents and Children Cohort**.** *American Journal of Respiratory Critical Care Medicin*e. March 1; 183(5): 582–588.

Fragala-Pinkham, M., Haley, S. & O'Niell, M. (2008). Group aquatic aerobic exercise for children with disabilities. *Developmental Medicine and Child Neurology,* 50 (11), 822-827.

Giles, D. (2008) DVD gift to stop children drowning**.** *The Sunday Mail* [Brisbane, Qld] 25 May: 2.

Goodman, R. (2012) *The Strengths and Difficulties Questionnaire*. http://www.sdqinfo.com/ Accessed: *24 April 2012.*

Hair, J., Black, W., Babin, B., Anderson, R., & Tatham, R. (2006) *Multivariate data analysis* (6th ed.). Upper Saddle River, NJ: Pearson.

Hutzler, Y., Chacham, A., Bergman, U. & Szeunberg, A. (2008) Effects of movement and swimming program on vital capacity and water orientation skills of children with cerebral palsy *Developmental Medicine and Child Neurology,* 40 (30), 176-181.

Jorgensen, R. (2012) Under-5s Swimming as a Site for Capital Building: Supporting and Enhancing the Transitions *Australian Journal of Early Childhood .37* (2), 127-131.

Jorgensen, R. Funnell, R., & Klieve, H. (under review) Supporting early mathematics learning: Building mathematical capital through participating in early years swimming. *International Journal of Science and Mathematics Education.*

Jun, D., Huang, L. & Dan, Z. (2005) The effects of infant swimming on the passage of the meconium. *Journal of Nursing Science,* 2005.

Linacre, J. M. (2012) Facets computer program for many-facet Rasch measurement, version 3.70.0. Beaverton, Oregon: Winsteps.com

Royal Life Saving Society (Australia) and AUSTSWIM (2010) *2010 Survey of Swim School Managers Report*. RLSSA: Sydney. www.royallifesaving.com.au/www/html/2808-research-reports.asp Accessed: 12 October 2012.

Royal Life Saving Society (Australia) (2011) *National Drowning Report 2011*. RLSSA: Sydney.

Sigmundsson, H. & Hopkins, B. (2010) Baby swimming: exploring the effects of early intervention on subsequent motor abilities. *Child: Care, Health and development, 36* (3), 428-430.

Stagnitti K., Malakellis M., Kershaw B., Hoare M., Kenna, R. & de Silva-Sanigorski (2011) Evaluating the feasibility, effectiveness and acceptability of an active play intervention for disadvantaged preschool children: a pilot study. *Australasian Journal of Early Childhood*, 36 (3) Sep: 66-72.

Wang, J-S. (2009) The effects of a swimming intervention for children with asthma. *Respirology* (Carlton, Vic). 14 (6), 838.

Woodcock, R. W., McGrew, K.S. & Mather, N. (2009) Woodcock-Johnson III *Edition - Australian Adaptation*, Riverside Publishing.