
EARLY YEARS SWIMMING AS NEW SITES FOR EARLY MATHEMATICAL LEARNING

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Australia is a country that has a strong interest in water and swimming with most of the population living within one hour of a body of water. Significant numbers of parents take their under-5s to swimming lessons. Anecdotally, the swim industry believes that swimming enhances many aspects of young children's growth and learning. This paper explores the ways in which the swim environment for under-5s offers significant opportunities for learning many mathematical concepts that have transferability to school contexts. However, with the costs of swimming lessons being high, questions are posed regarding equity and the potential of swimming to further advantage the already advantaged.

In this paper we discuss the opportunities for learning mathematics that are afforded by early-years swimming lessons. The data are drawn from a very large study that focuses on the broader benefits of swimming lessons for under five year old children. While working through this large data set, it was clear that the early years swimming environment was rich with mathematical concepts and language, and also included a range of structures that helped children prepare for school in general.

Initially, the importance of prior-to-school mathematical experiences are briefly discussed, before the study is contextualised by outlining the significance of swimming in Australia. Then, after briefly outlining the details of the study, we use the data to show how in simple ways children who experience early years swimming lessons can be advantaged in their preparation for school and more specifically, the learning of mathematics.

Mathematical experiences prior to school

Research into early childhood mathematics learning has received increased attention in the last decade (Perry, Young-Loveridge, Dockett & Doig, 2008). The importance of this area was emphasised by the Australian Association of Mathematics Teachers and Early Childhood Australia (AAMT/ECA) in their *Position Paper on Early Childhood Mathematics* (2006, p. 2):

The Australian Association of Mathematics Teachers and Early Childhood Australia believe that all children in their early childhood years are capable of accessing powerful mathematical ideas that are both relevant to their current lives and form a critical

foundation for their future mathematical and other learning. Children should be given the opportunity to access these ideas through high quality child-centred activities in their homes, communities, prior-to-school settings and schools.

There is a general consensus amongst researchers that, prior to school, children are able to experience and engage with meaningful mathematical ideas and concepts. Through this they are able to begin to develop a mathematical foundation, and this enhances their future learning in mathematics (Clarke, Clarke, & Cheeseman, 2006; Kilpatrick, Swafford, & Findell, 2001). Therefore, it is important that children are able to access mathematical concepts and ideas through a range of activities prior to school settings (Perry & Dockett, 2005).

Research on prior-to-school mathematical experiences has focussed on both educational settings (e.g., pre-school centres) (e.g., Fox, 2005) and informal everyday settings (e.g., Clarke & Robins, 2004). In informal settings the activities are often more playful and not explicitly focussed on the learning of mathematical ideas, but they are nevertheless replete with mathematical concepts that can be experienced and understanding developed (Clarke, et al., 2006; Goos & Jolly, 1994). For example, in observing toddlers playing outside, Lee (2010) noted activity related to a range of mathematical categories including (in descending frequency): spatial concepts, number, measurement, patterning and shape. She noted that not only were the children engaged in activities that were mathematically rich, but that they were also using and learning mathematical ideas and problem solving. In this project we are also examining activity that is not specifically focussed on mathematical development, but rather we are examining the swim context to see what opportunities it affords for the incidental and informal learning of mathematical ideas.

Swimming in Australia

In a country where 90% of the population lives near the ocean, water is a significant recreational activity and part of the Australian identity. With families having pools and living near water (both salt and fresh water), having a nation that is competent in the water is critical to the national health as well as being a strong part of the national identity. Accidental death by drowning is the leading cause of death among children between 1 and 4 years of age, and 80% of all child drownings occur with the under 5 age group (this was 229 children in 1999 and 2003) (Australian Bureau of Statistics, 2006). Similar figures exist for New Zealand (Kypri, Chalmers, Langley, & Wright, 2000) and the United Kingdom (Sibert et al., 2002). However, and sadly, for every death, there are approximately eight near deaths which often result in brain damage and other permanent impairments. Therefore, swimming and water confidence need to be a critical part of children's learning.

To reduce the incidence of young children accidentally drowning, many swim programs have been developed for the under five year olds. Langendorfer (1990) argued that there was considerable anecdotal evidence to suggest that such programs not only improve children's water safety, but they may also enhance the development of young children, although there was little empirical evidence to show any links. That said, aside from the immediate benefits of 'drown-proofing' young children, it would seem that early swimming programs offer considerable other benefits to children.

Broader benefits of early years swimming

The instructional environment that is a feature of the pedagogy of the learn-to-swim program may offer new opportunities for young children to be exposed to a pedagogic discourse (Bernstein, 1990) that would not otherwise be available to them, particularly for those children whose home environment does not align with the school environment. By exposing young children to this pedagogic interaction, their early habitus (Bourdieu, 1981) may be shaped by this environment, thus predisposing them to engage within this form of interaction in ways that prepare them better for school. As such, this interaction may create new forms of habitus for all participants. Participating in environments where the pedagogic discourse is a feature of interactions may well help enhance the linguistic capital of participants in terms of coming to understand the pedagogic relay. As Zevenbergen (2000) has argued, being successful in school discourses is as much about ‘cracking the code’ of the pedagogic discourse as it is about intellectual concepts and processes.

The instructional discourse of the learn-to-swim programs creates opportunities for young children to build their intellectual capital of which linguistic capital is a key element. For example, as Zevenbergen (2001) has noted in mathematics, students from disadvantaged families, particularly working-class families and Indigenous families are less likely to use the formal register of school. As such, many of these children come to school with an impoverished language in comparison with their middle-class peers. She has noted that many of the linguistic terms common to early mathematics (e.g., colour, shape, number) may not be a feature of some families’ out-of-school language. The instructional discourse of the learn-to-swim programs fosters many of these terms—“get the red ball”—so that the children have greater opportunities to learn the school discourse. In this way, there is every chance that the students may have greater success in schools due to their exposure to the patterns of signification (concepts/language) within the learn-to-swim program that augers well with school knowledge. Through the instructional discourse, students will be exposed to rich iterations of language, thus offering potential to extend their linguistic capital. The swim environment may thus add to the students’ repertoire of skills and dispositions that ultimately may position them favourably for schooling.

The study

The data reported here are drawn from a much larger project that seeks to identify the possible ways that early years swimming adds capital to young children. In this paper, we draw on the data around mathematical concepts. The swim environment, because of its three-dimensionality, offers rich language that resonates well with the language of school mathematics. We contend that exposing young children to the early years swimming environment offers new potential for learning many aspects of mathematical language and concepts in an environment that is different from most other learning contexts. The research question posed for this paper is: “In what ways, if any, does the early-years swim environment offer potential for learning mathematical language and concepts?”

Framework

This project draws heavily on the work of Bourdieu to frame the project. Often progress in young children is described within developmental frameworks where there are identified stages of development with characteristic features. Walkerdine (1984) has argued that often the theory shapes the practice, which, in turn, results in the predicted child behaviour, therefore confirming stages of development as if they are natural orders. Walkerdine has been foundational in challenging the status quo. In this project, we see the environment as a critical factor in shaping children's learning and dispositions. To this end, the work of Bourdieu has been useful in theorising the ways in which practice, in this case—swimming, is instrumental in shaping the learning outcomes of young children.

Sample

A total of 45 swim schools across Australia are participating in the lesson observation component of the larger study. As most lessons for under-5s are conducted in the mornings, there are usually six sessions offered each day—30 mins for each lesson between 9 am and 12 noon. During each session there can be as few as one class, and as many as eight classes, depending on the size of the swim school. This is the general pattern across the swim schools, although some swim schools offer lessons on the weekend and/or after school.

Data collection

What is reported in this paper is drawn from a much larger project where we are using multiple methods of data collection including surveys, interviews, observations, and formal testing. This paper draws from the observational data component of the project, and some supporting data is also drawn from the interview transcripts. While the larger project will have, over time, a large data base of observational videos, this paper draws from one case—a 30 minute lesson with five 3-year-old boys. The rationale for this process was based on the depth of analysis of the video to enable identification of possible forms of mathematics learning being made possible through the environment.

In focusing our observations for this aspect of the project, we were seeking to identify potential learning outcomes. As such, the focus was to identify possibilities for learning, rather than the strength or frequency of such potential learnings. This aspect will be developed later in the project once a more robust database of terms and categories has been established from the data.

Observations

At least two researchers visited each site to observe the swimming lessons. The observers videotaped aspects of the lessons and took detailed field notes, including noting examples of language used in the instructional discourse of the teachers. The observations included a classes taught by a range of teachers from relatively new to very experienced instructors, and spanned the entire range of pre-school age groups. The observed classes also included lessons where the parents/caregivers were in the water with the children and ones where they sat poolside. Immediately after each site visit, the researchers involved set aside time to review the experience and the data collected, and during these discussions key features of the data were noted and marked

for future analysis. The researchers also discussed the key mathematical concepts they observed, and together they negotiated a shared account of each site visit. For this paper, aspects of pedagogical discourses have been drawn out from the observational and interview data. Indeed, we have tried to use the ‘common’ and ‘everyday’ aspects of the data to underpin and exemplify the points raised in the remainder of the paper.

Findings

As noted previously, in this paper we are only focussing on the data related to opportunities to learn mathematics, hence the results outlined below are limited to this aspect. The findings are discussed as they are presented in turn.

Pedagogic discourse in learning mathematics

Mathematical learning occurs via the pedagogic discourse. This discourse is one that has particular regulatory rules and protocols that are part of the discourse. Students are exposed to the discourse as they inserted into the teaching/learning environment (Zevenbergen, Mousley, & Sullivan, 2004). As the swim environment is one where there is a high emphasis on safety, teachers work in small classes and are focused on ensuring all children are engaged with the lesson.

In the following extract, the teacher is relaying a number of important aspects of the teaching/learning environment. Here he is directing the student about where to commence, but also explaining the importance of waiting until it is the student’s turn to undertake an activity. By waiting, the teacher is then able to work with, and assess, the student’s behaviour and undertake any necessary corrections. The importance of being able to take turns is embedded in the interactions.

Teacher: Jack¹, go back to the wall, start from the wall and wait your turn, Buddy.

This was also noted in an interview:

Teacher: You need to have eyes in the back of your head. As soon as you hear a splash or yell, your immediate reaction is to see what has happened, to see if it is one of your kids. You don’t get much a chance if they fall over: you have to make sure you know where each of them are at any point in time.

In observing lessons, schools had various ways of managing safety and learning. The structure of the pools allowed children to sit on long underwater benches so that while they were in the water they were not submerged. This ledge was also useful for babies who crawled and hence would not have their faces below the water. Children were taught to line up by having illustrations, such as feet, under the water and they would follow the foot prints. Teachers would elicit instructions, such as “kick, kick, kick, kick, stop” and then pause, waiting for the children to stop kicking their feet in the water. These simple patterns of interaction are similar to those found in school so, from a very early age, young children were being exposed to the instructional discourses that would induct them into similar practices that they would find in the school context.

Within a Bourdieuan framework what can be seen is that the swim environment is adding new forms of knowing to children that, in turn, is internalised into their habitus. These new dispositions to the learning environment will position them more favourably with teachers as they display these new learnings. The displays of learning that can be

¹ Pseudonyms are used in this paper to protect the identity of participants and sites.

observed in the children need to align with the practices valued in the field if the child is to be seen as displaying valued knowledge. Such displays, in turn, can then be exchanged for other rewards in the learning environment. In the swim environment, these are often certificates that acknowledge what has been learned and, as a consequence, progression into a different class. While the swim environment primarily focuses on skill development leading towards independent swimming, what is of value is the incidental learning that can be readily observed. For us, there were many practices that created potential for mathematics learning that would prepare students for their mathematics learning but also support them in their transition into formal schooling. It is this aspect of the swim environment that is the focus of the remainder of this paper.

Mathematical discourse

Throughout the observation there were many times when the teacher used mathematical language and ideas in their instructions. In this section we will present some of those aspects, and all the extracts are instructions given by the teacher while taking the lesson with the 3-year-old boys.

The terms used in mathematics lessons relate to aspects of the mathematics curriculum including number (one, two three), to measurement (big, fast, slow), to space in the areas of geometry (circle, straight, line, edge) and positions (up, down, underneath, side-by-side, together, backwards, edge). For example:

- T: After one-two-three, we are going to push off with our hands like a rocket.
 T: I need to see really big arms, big and slow.
 T: Clinton, can you follow the big line on the roof? [points to the line painted on the ceiling]?
 T: Okay watch me, I am going to have my hands on the edge, toes on the wall, head backwards, looking up at the line on the roof. Watching me, push off the wall, eyes up, glide, like a ferry boat [teacher demonstrates]. Alex, hair in the water first, and push and glide. Hold your body nice and straight and long.

As can be seen from the few examples above, these routine instructions—instructions that could be heard constantly throughout all the lessons, are rich with mathematical language and concepts. It is important to note that as many of these instructions were given, they were accompanied by gestures or signals to reinforce the spoken words.

Also, the use of ‘little’ words (e.g., prepositions, adverbs) are important as these often have important meanings in mathematics (e.g., off, up, out). Being exposed to mathematical discourses where prepositions have been used is integral to learning, and it has been found that when students are not able to grasp the use of prepositions, there is considerable scope for error (Zevenbergen, Hyde, & Power, 2001). Below are a few examples:

- T: Sitting on the edge of the pool, rockets up in the air, now on one, two, three, slide in and push off the wall swimming out to me using big arms.
 T: Alex, put your rockets up like Benjamin. No, not hands side-by-side, hands one on top of the other. Keep your toes underneath the water, nice long legs, no spaghetti legs, nice long straight legs.
 T: Climbing up out of the pool, using your muscles, tummies, hands and one knee. Standing on the edge now. Now, using your hand making a circle with your arm. Going up past your ear and around to your leg, up past your ear and around down to your leg. Big circles, I want big straight arms [teacher manipulates the child’s arm to demonstrate].

The quotations above are representative of the common instructional dialogue of the swim lessons observed. Indeed, the few included above only came from one observation, and certainly there were many more that could have been included from the lesson. Thus, it can be seen that the swimming lessons are replete with mathematical terms and concepts, and the important ‘little words’, and they are experienced in meaningful context. These mathematical ideas include the concepts identified by Lee (2010), and others that are particularly relevant in the water context. Furthermore, it was clear during the observations that the children understood the mathematical terms, and they demonstrated their understanding by performing the appropriate action or behaviour.

Concluding comments

What we propose is that the swim environment offers considerable potential to add new forms of capital to early learners. In this case, there is ample evidence to suggest that the swim environment can add or enhance the mathematical vocabulary of young learners and which, in turn, we trust would enhance mathematical understandings. In Bourdieu’s exchange economy, the learnings that young children gain through their exposure to the pedagogic discourse and the mathematical discourse may create new forms of knowing and acting in the social and academic worlds. Their transition into formal schooling may be enhanced through the exposure to these discourses and as a consequence they are better prepared to interact in the formal discourses and discursive practices of schooling.

Of course, the children who are offered these opportunities are generally from the middle/upper class, so in further iterations of the study we hope to open the swim school experience to children who do not usually have access. Also, we will be working with some of the children involved in the swimming lessons to see if the mathematical understandings evident in the pool transfer to other contexts (i.e., outside the pool). If, as we suspect, the mathematical learning advantages are clear, then it will provide impetus to make these sorts of experiences available for all young Australians. This is particularly the case because the learning benefits add to the already significant gains for the children in terms of the obvious safety and physical development gains.

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