The experiences of homeschooling parents when teaching mathematics

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This paper compares and contrasts the experiences of two parents who have chosen to homeschool their children in mathematics despite having difficulties with mathematics at school themselves. It describes the strategies these two parents used to overcome their lack of content knowledge and/or mathematics anxiety and are illustrative examples of how these deficits can be overcome with sufficient motivation.

This paper compares and contrasts the experiences of two parents who have chosen to homeschool their children in mathematics despite having difficulties with mathematics at school themselves.

Homeschooling is a form of education where the parent makes all the decisions about planning, implementation and assessment of their children's education (Department of Education and Training, n.d.). It is different from other distance education programs where others set the curriculum and assessment. In 2016 it was estimated that approximately 17,000 children were registered to be homeschooled (Home School Legal Defense Association [HSLDA], 2017). Although all states and territories in Australia require homeschooling parents to register their children, according to Green (2012) there are many parents who choose not to do this. The number of children who are actually homeschooled in Australia, therefore, could be as high as 50,000 (Green, 2012). Whatever the true numbers are, the number of registered homeschooled children appears to be increasing (Drabsch, 2013).

Parents choose to home school their children for a variety of reasons. These include religious dictates, a desire to protect the child from influences of which they disapprove, a strong belief in the supremacy of the parents' role in a child's education, objections to the socialisation process that occurs in schools, a desire to protect their child from bullying, to provide an individual curriculum for a child with special needs, distance, and travel (Drabsch, 2013).

Parental influences on their children's education

Bandura (1977) describes self-efficacy as "the conviction that one can successfully execute the behaviour required to produce the [desired] outcomes" (p. 193). Mathematics self-efficacy is the judgement of one's capabilities to do mathematics successfully. For students of mathematics, it has been demonstrated that mathematics self-efficacy and achievement are not only strongly correlated, but that self-efficacy is predictive of mathematics achievement (Ayotala & Adedeji, 2009; Liu & Koirala, 2009).

It has been shown that positive parental attitudes to mathematics positively affect the attitudes and beliefs of their children (Soni & Kumari, 2015) and that parental involvement in their children's education has positive effects on their children's outcomes (Cai, 2005; Desforges & Abouchaar, 2003). Unfortunately, however, it is also known that, in general, parents of traditionally schooled children play a more important role in their children's

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language education than in their mathematics education (Cannon & Ginsburg, 2008), possibly due to their own perceived lack of efficacy (Marshall & Swan, 2010). Parents may also hold negative beliefs about mathematics believing that mathematics is difficult, boring, and/or for males (Lim, 2002). Parents may also have had unpleasant experiences in mathematics during their own schooling resulting in low self-efficacy. Parental attitudes and beliefs about mathematics may be passed onto their children (Burnett & Wichman, 1997).

This paper reports on the strategies and the motivations of two homeschooling parents who for varying reasons did not have good experiences of mathematics at school.

Methodology

These cases are drawn from a wider exploratory study of parents' self-efficacy in the mathematics education of their homeschooled children. To obtain potential participants, homeschooling associations in all territories and states in Australia that had an internet presence were contacted and asked to send out an information email to their membership with an anonymous survey link to Qualtrics (https://www.qualtrics.com/au). Once participants had filled out the survey, they were then asked to go to another link and add their contact details if they wished to be interviewed. This process retained anonymity of the participants. As a result, 80 completed surveys were received and 45 volunteered for interview. The participants were selected at random and interviewed until saturation was achieved (eight interviews). Owing to the recruitment process, it is not known how many information letters were sent out to potential participants and from which locations the participants originated. The interviews were transcribed and were coded and analysed using thematic analysis (Braun & Clarke, 2006; Charmaz, 2006).

This paper is based on two interviews. These interviews were selected because, unlike the other interview participants, these participants did not have good experiences of mathematics at school. These interviews illustrate how parents may respond to the challenge of homeschooling their children in mathematics, and how adult mathematics learners in general may respond when sufficiently motivated.

Results

Olivia (not her real name)

At the time of the interview, Olivia homeschooled one child aged 11, assisted with the learning of another primary school child, and had an older child who is now at high school but had been previously homeschooled. Olivia has bad memories of mathematics at school.

> I don't think I learnt anything. All I remember is sitting in maths class at primary school totally filled with dread. Because I didn't know any answers and I didn't know how to work them out and I was too shy to ask the teacher for help…I was terrified I was going to be asked a question in front of the whole class because I knew I wouldn't know the answer. And then in high school I stopped going altogether to maths classes.

Olivia's response to her own experience was to gain a determination that she would not pass her lack of self-efficacy on to her own children.

> I grew up spending most of my early adult life thinking I couldn't do maths and that I just didn't have that ability. I was a bit dumb at maths. And like so many people I just thought it was boring and difficult and I didn't want my own children to have any of these misconceptions. And I didn't want them to struggle with it so I just worked really hard at finding a way to understand it myself and then finding a way to love it and then help the kids and for them it was just easy. My [older child] went on

> to high school and …she's gone on to advanced level maths and she gets all A's, she's really thriving with maths so that gave me a lot of confidence…[that] my approach worked.

Olivia was also keenly aware of the effects of parental attitudes to mathematics on their children.

> I do often think that a lot of people don't understand the need for maths or that it's really not that necessarily difficult or tedious. I come across people a lot who aren't really into it and of course that rubs off on the kids. We know lots of kids that don't do that much maths and I think in general it would be good if people had a better attitude towards it.

She was also keen that her children should want to learn.

> We started off with natural learning and we like the children to be child-led but there's many essentials we just have to learn in life so I just make sure their life is set up and they're exposed to things and conversations that make them realise they do actually want to learn that.

Olivia used manipulatives including "fingers and objects" when she introduced her children to early mathematical concepts. She also liked to approach new topics from the perspective of "maths history". She also stated that the family practices their multiplication tables in the car and that she constantly monitored the children's progress. As the children became older Olivia used conventional text books and second-hand mathematics books that she had found. She did not take recommendations from other people in this selection, but instead went to a "curriculum supply place" and searched for a series of mathematics books that "looked aesthetically pleasing" and were "easy to read, pretty simple to understand to someone without a maths background and the lessons were self-explanatory." By these means she felt that she had found a program that matched the Australian Curriculum and did not have to find a program on her own. Whereas she did sometimes work with the children they generally worked independently. In addition, a neighbour who was "passionate about maths" occasionally assisted with the children's learning. She also stated that her son used the Khan Academy extensively because "He enjoys it".

Emma (not her real name)

At the time of interview, Emma homeschooled three children ranging in age from nine to sixteen years of age. Owing to unspecified circumstances, Emma had spent much of her youth living in places other than her home and so had missed "a lot of school". She did, however, study externally and as a result, had had to teach herself mathematical topics such as logarithms. Despite this history, she felt that she was "pretty good with numbers" and she had "gotten into jobs and things based on numerical testings and things." When it came to teaching mathematics to her children, however, she knew that there were many gaps in her knowledge. Her solution was to do extensive work in building up her own content knowledge.

> Last year I spent the year working through the Khan Academy. They have maths missions on it – I spent the year working on that from kindergarten to advanced Year 12. I got up every morning at 4 in the morning and spent two hours doing maths which is kind of fun…I got up to like integral calculus …and I just finished that in February so I'm heaps more confident now. [When my child asks for help] I'm like 'Oh, I know that!' Because I just didn't have the knowledge before, like I had confidence but I had no knowledge because I missed too much at school.

When her children were younger she used workbooks with them but also supplemented their mathematics learning through the use of play including board games, manipulatives such as counters, and including the children in practical activities such as measurement and budgeting with their own money. She was aware of the affective factors that may influence

her children's learning: "You have to be confident with maths and the kid's kind of have to be prepared to do a bit of maths because it takes a while; it's not fast".

Because of her own successful experiences with teaching herself mathematics it was her aim that her younger child, like her older children, should be able to "teach himself maths from his book." She also used the example of her oldest child.

> And you know like my Year 12 [who] had friends who have done exactly the same maths program at school and…one of them in particular using the same text book actually bombed out and said it was all the teacher and I said ironically [my child] had the same book and doesn't have a teacher and has managed to master the curriculum – just using those books.

She then went on to relate that same child had had good NAPLAN results in the past and was currently studying ATAR accredited mathematics subjects.

Despite her stated aim that the children should become independent, Emma did not have a completely hands-off attitude to her children's mathematical learning. She set a timetable for them each year although her oldest child was working towards doing this for herself. She also looked at the work her children would be doing before they completed it themselves. She marked her children's mathematical work and required them to redo questions where they had made errors so that they "don't make silly mistakes anymore." She encouraged her youngest child to talk through his work aloud which she has found helpful for him, "which would be harder in a classroom because you can't talk." She also chose her children's text books and encouraged them to go online for extra help when required. When choosing their books, she looked for books that had a high emphasis on problem solving and books that came with a solutions manual.

Summary and Discussion

The parents described in this paper both had negative experiences at school but for very different reasons. Whereas Emma had had a disrupted school life but showed high self-efficacy in mathematics, Olivia had a severe dislike of mathematics leading to avoidance of mathematics classes. In this Olivia is illustrative of the research that shows the importance of mathematical experiences in primary school; unpleasant experiences at this time often lead to a life-long dislike and fear of mathematics (Relich, 1996).

Both parents expected their children to work independently, however, they also invested considerable time into their children's mathematical learning. In this they reflect the widespread view that mathematics is important and useful (Coben et al., 2003). They both spent time working with their children and they both reviewed their children's work. Emma encouraged her children in the practical side of mathematics (measurement and money) and Olivia, aware of her own deficits, encouraged the children to "want" to learn mathematics and spent time looking for resources that she herself could understand.

Emma was remarkable for the time she took to address her lack of content knowledge. Olivia was notable for her level of self-awareness and for her knowledge of the importance of affective factors in mathematics and this was reflected in her determination to give her children positive experiences in mathematics. Her opinion that adults can regard mathematics as difficult and tedious is supported by the research literature (Lim, 2002). Emma also addressed the idea that success in mathematics can take time to achieve.

Both participants reported that their children were performing well at mathematics. As evidence Emma referred to her older child's current work to achieve ATAR accredited mathematics subjects and previous performance in NAPLAN tests. Olivia talked about her daughter's success regarding her grades in a traditional high school, and her son's voluntary time spent on a mathematics website.

There is much debate in the literature on the comparative success of homeschooled children in mathematics (e.g., Kunzman & Gaither, 2013). There is some literature to suggest that homeschooled children do well in academic achievement but this is confounded by the Socio-Economic Status (SES) of the participants. Much of the literature relies on studies that are volunteer based, and it appears in at least some of the studies that many of the participants belonged to families where, in general, the parents are well educated and well off financially and had a stay at home mother who took responsibility for the children's education (Kunzman & Gaither, 2013). In this study the SES characteristics of the participants are not known and this is a limitation of the study.

What has been determined, however, is that parental participation is a major factor in their children's academic achievement (Desforges & Abouchaar, 2003). Emma and Olivia both expected their children to work independently, but both of them also worked with their children to different degrees, either learning the work with their children, assessing their work, finding the resources or assisting when problems occurred.

The question arises as to why these parents were prepared to undertake such effort to either upgrade their lack of content knowledge or to avoid the transference of mathematics anxiety to their children. It is not unusual for adults to have negative views of mathematics and this can lead to the reluctance of adults to study further in this area (Klinger, 2011). This reluctance to learn mathematics, however, can be overcome with sufficient motivation; that is, people may become purposeful in the pursuit of their desired goals (Wlodkowski & Ginsberg, 2017). In his description of adult learners Knowles (1970) stated that as people mature, their readiness to learn becomes "oriented increasingly to the developmental tasks of [their] social roles" (p. 55). Hence adults might be ready to learn mathematics in their roles as employees in the workplace (Coben et al., 2003) or may return to formal mathematics education in order to fulfil their current employment needs or to gain a qualification so that they can fulfil their desires for later employment (Ali, 2013). In this context, Emma and Olivia's roles as homeschooling parents desire to do the best for their children, as evidenced by their own mathematical development and their children's mathematical achievements, gave them the motivation to do what they felt necessary to enable them to fulfil these roles.

This paper examined the experiences of two parents who homeschool their children in mathematics but it has wider implications for other adults (including pre-service teachers) who, for various reasons, study mathematics, even if they have had poor experiences at school. What motivates these adults, and to what extent can this motivation overcome previous mathematics anxiety and lack of content? More research in this area would be worthwhile.

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