Young Children's Research: Children aged 4-8 years finding solutions at home and at school.

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Abstract:

Children's research capacities have become increasingly recognised by adults, yet children remain excluded from the academy, with reports of their research participation generally located in adults' agenda. Such practice restricts children's freedom to make choices in matters affecting them, underestimates children's capabilities and denies children particular rights. The present paper reports on one aspect of a small-scale critical ethnographic study adopting a constructivist grounded approach to conceptualise ways in which children's naturalistic behaviours may be perceived as research. The study builds on multi-disciplinary theoretical perspectives, embracing 'new' sociology, psychology, economics, philosophy and early childhood education and care (ECEC). Research questions include: 'What is the nature of ECEC research?' and 'Do children's enquiries count as research?' Initially, data were collected from the academy: professional researchers (n=14) confirmed 'finding solutions' as a research behaviour and indicated children aged 4-8 years, their practitioners and primary carers as 'theoretical sampling'. Consequently, multi-modal case studies were constructed with children (n=138) and their practitioners (n=17) in three 'good' schools, with selected children and their primary carers also participating at home. This paper reports on data emerging from children aged 4-8 years at school (n=17) and at home (n=5). Outcomes indicate that participating children found diverse solutions to diverse problems, some of which they set themselves. Some solutions engaged children in high order thinking, whilst others did not; selecting resources and trialing activities engaged children in 'finding solutions'. Conversely, when children's time, provocations and activities were directed by adults, the quality of their solutions was limited, they focused on pleasing adults and their motivation to propose solutions decreased. In this study, professional researchers recognised 'finding solutions' as research behaviour and children aged 4-8 years naturalistically presented with capacities for finding solutions; however, the children's encounters with adults affected the solutions they found.

Key words: Finding solutions, early childhood, children as researchers, capabilities, children's rights.

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1. Introduction

This paper considers whether or not young children's naturalistic behaviours can count as research behaviour and whether or not this can be established by looking at ways in which children find solutions to problems. Recent revisions to English

education policy contain little emphasis on children's problem-solving, [1 2 3] an activity that is indicated in both higher-order thinking[4 5] and research processes.[6 7 8] Young children's capacities to solve problems and to develop 'a philosophy of what counts as knowledge and truth'[9] - epistemology - were established in the mid-twentieth century[10 11] yet there is currently little acknowledgement of the potential contribution that young children might make to research through their problem-solving, even in matters affecting them.[12] This paper reports on a small-scale empirical enquiry located in the early childhood education and care (ECEC) field, investigating problem-solving as research behaviour in young children aged 4-8 years in their English ECEC settings and homes. The driver for this study began when I moved from ECEC teaching to work in a university; as a teacher, I had witnessed anecdotally children's autonomous, natural epistemic-behaviour every day. However, as I entered the university, I recognised that such activity is barely acknowledged, let alone regarded as research by the 'academy': a space where 'learners and knowledge producers'[13] converge and where knowledge is produced[14]; a 'score-keeping world'[15] which sets itself apart from 'the people'[16] and from which children are excluded.[17] I wanted to explore this phenomenon further.

ECEC focuses on children's first eight years,[18] a phase widely regarded as a key indicator for lifespan outcomes.[19] It is a relatively new multi-disciplinary field that may be viewed as a subset of the field of education and it is informed by a range of other disciplines including education, 'new' sociology, psychology, economics and philosophy and health.

Whilst there have been attempts to position young children as researchers,[20 21] projects have predominantly focused on older children and young people.[22 23] However, exclusion of young children's enquiries conflicts with perspectives positioning children as competent social actors[24 25 26] and it disregards psychological studies reifying young children's significant cognitive potential.[27] Recognition of children's capacity for research participation has begun to emerge,[28] but remains under-developed in England. [29]

The present paper reports on children's problem-solving as one aspect of a larger study reconceptualising young children as researchers. Three research questions are addressed in this paper:

- Do young children aged four to eight years find solutions in their ECEC settings and homes?
- If so, what is the nature of their problem-solving and what factors effect and affect it?
- Does young children's problem-solving in their ECEC settings and homes count as epistemology?

The paper will open by providing a brief context for children's problem-solving, before detailing the study's design and findings. Key to whether or not young

children's problem-solving can be regarded as 'research' are children's capacities for developing 'a philosophy of what counts as knowledge and truth': Strega's definition of epistemology[30] so this is interrogated later in the paper. In conclusion, I will draw on evidence provided by the findings to argue that aspects of children's naturalistic problem-solving may count as epistemology.

2.Children's problem-solving in context

This section briefly addresses literature surrounding the nature of problem-solving and the nature of research, children's engagements in problem-solving and children's opportunities for problem-solving.

Definitions of problem-solving often allude to cognitive processing;[31] [32] [33] problem-solving processes may comprise an obscured goal, strategies and evaluation,[34] and problem-solving has been defined as '...thinking and learning in general'.[35] The present study assumes a broad definition of young children's problem-solving including social interaction,[36] [37] creating and solving problems,[38] [39] [40] practical uses for solutions and dissemination of solutions.

Problem-solving often provides a rationale for research;[41] [42] research takes many forms[43] but problem-solving is particularly characteristic of pragmatism,[44] a model of thinking identified by the ancient Greeks who devised an eclectic range of modes for thinking about thinking[45]. For example, Aristotle engages with experiential reasoning, whilst Plato adopts abstract thinking.[46] This dualism reappears in Enlightenment discourses, with Kant pursuing 'pure reason'[47] and Hume advocating empiricism.[48] Although Hume's view of inductive reasoning as inferior to deductive reasoning[49] has enjoyed popularity and longevity,[50] inductive reasoning may also result in logical ends.[51] Researchers draw on these paradigms to shape their values and practices:[52] whilst 'STEM' disciplines may be predicated on an 'idea of generality',[53] social sciences cannot assume such comforting predictability.[54] [55] Enquiry that is only considered worthwhile if it identifies 'what works' in practice may not 'work' in the 'complex social world(s) of interpersonal relations'[56] [57] where 'finding solutions' often means constructing multiple versions of 'truth'.[58] Popper describes epistemology as 'the source of certainty'[59], but for different researchers working in different paradigms that certainty will be shaped differently, according to the values they hold.

Nevertheless, Piaget's theory that aspects of human development are replicable[60] has been highly influential in the field of ECEC:[61] Piaget's proposition that humans have innate capacity to transform cognitive structures through problem-solving episodes - 'genetic epistemology'[62] – may also have proved attractive to those working with young children. However, his suggestion that this process develops in sophistication through the life course juxtaposes Isaacs' view that '…children's epistemic interest and inquiry is in every respect the same in the child as in the adult'.[63] Equally, Piaget's tendency to disregard context has

attracted criticism:[64] making tasks meaningful for children seems to be important for their engagement and for enabling them to reach self-actualisation.[65 66]

In educational contexts, problem-solving can enable children to transform their understanding;[67] children who develop new understanding with ease seem to be those who can apply their learning to solving new problems.[68 69] Moreover, young children are empowered when they pose *and* resolve their own problems in meaningful contexts,[70] which may include objects that they imbue with 'sense and meaning'.[71] 'Doing activities that people value and have reason to value' may help children to build their capabilities,[72] yet children's valued activities are often marginalised by adult hegemonies.[73 74] Teachers do not always provide meaningful opportunities for children, which may explain why children rarely display curiosity in school, whereas they are 'full of questions outside the school'.[75] Children seem to become more deeply involved in activities if they find them genuinely interesting,[76] whereas teachers' direct instruction and questioning seem to limit children's problem-solving.[77 78 79] Equally, children's problem-solving may present differently in settings and at home;[80] the 'here and now' seems to be important for young children in their ECEC settings[81] and adults can support young children to solve problems 'in the moment' by anticipating their problems and affirming their problem-solving.[82] Nevertheless, Tizard and Hughes note that children at home often discuss '...events outside the present context, including the child's own past and future'.[83]

Many examples of children's problem-solving have a socio-emotional focus,[84 85 86] with self-regulation, memory, attention, planning, organisation and partnership regarded as key features.[87 88 89] Vygotsky's notion[90] that cognitive structures are transformed when learners are supported by expert others has commonly been reified within adult:child models.[91 92 93] However, young children's peer interactions seem beneficial to their cognitive development.[94 95 96] Children between 18 and 24 months engage in problem-solving with peers;[97 98] equally, if children struggle to problem-solve in social contexts by five years they tend to be rejected by their peers.[99] Moreover, siblings aged 4-8 years are most likely to reach 'creative, agreeable resolutions' within positive relationships.[100]

Tool use in problem-solving involves acquiring, using and planning to use the tool, which young children often do 'in action'.[101] From eight months, infants' tool use provides them with '...a motor solution to a cognitive problem';[102] Pre-verbal children's physical tool use can reveal their plans.[103] Equally, from around two years children often use physical tools alongside symbols to solve problems,[104 105 106] for example in their mark-making.[107 108] Young children's problem-solving may also be mediated by their uses of gesture[109 110] and analogy,[111 112 113] as well as adult intervention tools such as Socratic dialogue[114 115] and De Bono's 'Thinking Hats'.[116 117]

Bridges suggests that pragmatists often neglect problem *setting,*[118] yet when children set their own problems they may classify, sort, categorise, quantify and represent data.[119] Equally, teachers may find it difficult to support children to set their own problems[120] because school curricula often focus on 'basic skills' rather than higher-order thinking;[121] in the English context of national curriculum prescription from birth, opportunities to engage where 'the problem is known (but) the solution is not'[122] may be especially rare.

3.Methodological Discussion

Drawing on emancipatory discourses,[123] [124] this small-scale interpretive study synthesises critical ethnography[125] within a constructivist grounded theory approach[126] to seek perspectives about young children researching. As an attempt to explore and undertake democratic research[127], ethical considerations permeate form and function of the enquiry which was conducted according to the British Educational Research Association[128] ethical guidelines, with adherence to literature concerning ethics in ECEC research.[129] The enquiry was framed in three stages that were designed to co-construct data with participants:
Stage 1: Professional Early Years and Educational Researchers (PEYERs)
Stage 2: Children and practitioners in ECEC settings
Stage 3: Children and families at home.

'Initial sampling'[130] indicated PEYERs as participants for Stage 1. Nine PEYERs participated in interview conversations[131] and five engaged in a focus group.[132] All had previously worked in children's services. This stage focused on the nature of educational and ECEC research, resulting in a framework of 39 research behaviours (RBF), including 'Find a Solution'. Furthermore, PEYERs indicated that young children, their parents and practitioners should participate: 'theoretical sampling'.[133] Through professional connections, three primary schools became the locations for Stage 2.

There were parallels regarding the nature and size of these settings (see appendix 1), although full parity was not sought in these 'real world' contexts;[134] initially 150 children and their practitioners in the three settings participated (see appendix 1). Power relationships were relatively equalised because participants were predominantly white British and middle class, as am I.[135] [136] Once access issues had been addressed,[137] I piloted the design in Ash Setting, then proceeded to Beech and Cherry Settings, initially working as a volunteer teaching assistant for several days. This enabled me to build understanding of each setting's culture through 'thick description'[138] and to move towards 'insider' status:[139] important for accessing authentic, naturalistic data in the settings.[140]

A series of multi-modal case studies[141] [142] [143] was constructed with participants in ECEC settings, each undertaken over six half-days and three full days. Later, five children and their families co-constructed their own multi-modal case studies

at home during a period of about a month (see appendix 2). Initially, data were constructed on multiple aspects of the settings, using fieldnotes, naturalistic observations, informal discussions and documents. Data were constantly evaluated with focus on the RBF behaviours, including 'find a solution'; these indicated seventeen children for closer focus (see appendix 3).

Naturalistic observations continued, focused on the everyday activities of the focus children in their settings. Practitioners and children engaged in interview conversations focused on the nature of research as well as analysis of primary data.[144] Data then indicated two children from each setting who might go on to co-construct further rich data with their families at home (Stage 3); following adherence to ethical protocols, five children and their families engaged in this process (see appendix 4).

Initial interview conversations were arranged with families at home to discuss the project. Here I established 'outsider'[145] status so families retained power and intrusion was minimized.[146] I explained and implemented ethical procedures,[147] [148] provided resources, ensured the children and families were confident with data collection methods, then handed over data collection to the families. Again, the naturalistic approach to data collection was strongly emphasized; again, thick description[149] of children's 'real worlds' was the identified focus.[150] Second visits were arranged with each family for a month later to share, discuss, review and analyse data in interview conversations.[151]

Analysis was guided by Charmaz's model for constructivist grounded theory.[152] Data interpreted by participants 'in action' and 'on action'[153] informed further analysis I undertook until 'saturation'.[154]

4.Presentation of Findings and Discussion

Analyses were conducted with all primary data and meta-data gathered with participants according to Charmaz's model of analysis.[155] 32 axial codes emerged, for example, 'self-regulates' and 'deductive reasoning' (see appendix 6). Table 5 provides a numerical overview of analysed data (see appendix 5). Axial codes were then organised into further categories: provocations, barriers and effects relating to children's problem-solving. Provocations include free access to resources, social interaction and time and opportunity, while the two main barriers to children's problem-solving appeared to be insufficient time or opportunity for them to pursue their personal interests as well as adult direction. A selected range of empirical findings is now presented and discussed.

Free access to physical resources and 'free flow' play[156] [157] seemed to encourage children's problem-solving,[158] [159] engaging them in cognitive processes including evaluation, synthesis and analogy.[160] [161] [162] In Beech Setting Johnny tasked himself with creating a 'wristwatch' using paper, glue and scissors. He trialled a method of accurate measurement, placing a strip of paper around his wrist

and cutting a piece off the end, then readjusting the strip 4 times until satisfied with the fit. Later the 'strap' came unstuck and Johnny returned to the 'making table' to fix it successfully. Here, Johnny set and solved a problem then persevered to resolve another problem. He engaged in deductive and inductive reasoning,[163] [164] focused on something of personal interest, self-regulated[165] and devised a practical method to create a solution.

At Family B's home, Billy showcased a model tank he had made; he said:

> 'It's made out of paper... I've even made a seat – look! This bit gives the person who's controlling the tank here his seat. He's not allowed to sit anywhere else – he can't see so I made this here (periscope) so he can see.'

Billy had set himself a problem: to make a 'tank' that was fit for purpose. He had access to paper, sellotape and scissors to do so and his exploratory manipulation of the paper [166] provided '...a motor solution to a cognitive problem'.[167]

Children often solved problems by employing others.[168] [169] During free-flow play[170] in Beech Setting, India and Amelia (girl, 5 years) opted to play in two hollow black cylinders - each 2m x 0.5m – lying on the floor. India and Amelia stood behind one cylinder, and together they rolled the cylinder forwards until its end was aligned with the end of the second cylinder to make one long cylinder. In turn, the girls then crawled through the new long cylinder. India and Amelia set and solved a problem[171] by working together.[172] [173] They also engaged in self-regulation[174] and deductive reasoning[175] and had time and opportunity[176] to explore properties of the cylinders.[177] [178]

Outside on the drive of the Family D home, under his mother's tutelage, Harry had just learned to wind the electric cable and had finished winding it for the first time.

> MTHR-D said to Harry: 'Well done. Thank you. Where does it go?
> Harry walked into the garage with the cable reel.
> Harry said to MTHR-D: 'You come and help me.'
> Harry put the cable reel down.
> Harry said to MTHR-D: 'I'll just put it down then you can sort it out.'

Harry and his mother conducted their dyad within a social-constructivist context, recognised as beneficial for problem-solving.[179] [180] Harry increasingly assumed 'power and autonomy':[181] his mother had set him a problem and Harry's solution was to employ her '...you can sort it out'.

Data suggest that time and opportunity may also be important for children's problem-solving;[182] [183] [184] these factors seemed to affect children's capacity to both find *and seek* solutions and to engage the children in higher order thinking.[185] [186] [187] In Cherry Setting, Pedro selected a practitioner-planned activity: using sugar cubes to construct a mini igloo. However, his initial attempts were unsuccessful: the activity was located on a table in a busy thoroughfare and Pedro predicted accurately that his construction would be broken by a passing child nudging the table. Consequently, Pedro decided that he would build a tower, designing and successfully constructing it with a sturdy base and a protective wall. Working alone, this process took Pedro seven minutes: he was deeply engaged,[188] despite activity surrounding him, and he found a solution. Pedro engaged in high-order thinking skills, including evaluation,[189] analogy[190] and deductive reasoning.[191] Pedro explored the properties of the sugar cubes[192] self-regulated[193] and autonomously set his own problem:[194] to construct a tower. He was also keen to preserve what he had done.[195]

Conversely, where little time or opportunity was afforded for children to pursue their own interests, their problem-solving tended to be limited to – and by - adults' agenda; children often seemed to lacked motivation in these instances. During an adult-directed lesson in Ash Setting, the learning objective was displayed: 'To be able to understand what it was like for people in South Africa in the 1960s'. While his teacher gave an exposition, interspersing it with questions, Billy sat quietly with his peers and fidgeted with his fingers, traced his thumb with the opposite forefinger, sucked his thumb, looked out of the window, stretched and looked intently at a table. Billy conformed by sitting quietly but he did not appear motivated to find solutions for the teacher's questions. He appeared more deeply engaged with the table than the teacher's agenda,[196] suggesting he did not find the latter meaningful;[197] [198] Billy's potential for problem-solving seems to have been limited because he was not engaged in activity that was meaningful to him.[199] [200] [201]

At Family's C's home, Gemma filmed a 'guided tour' of her house with the camcorder. Gemma's mother asked her: 'What have you got here?' and Gemma focused the camcorder on her father sitting on the sofa. This closed question is characteristic of 94.5% asked in ECEC settings;[202] these limit opportunities for young children to construct their thinking. Gemma was not motivated to respond verbally but physically demonstrated her filming, reproducing prior knowledge while engaging in inductive reasoning.[203]

Adults' direction of children, sometimes coupled with children's apparent desire to please, also seemed to limit children's problem-solving[204] [205] [206] and often there was focus on outcome rather than process. Adult direction even appeared to confuse children sometimes. During a literacy lesson in Ash setting, Annie seemed

enthusiastic initially, raising her hand eleven times in quick succession. However, the teacher did not invite her to respond and Annie's manner became subdued. Finally the teacher asked Annie to respond to a question: 'What is typical of a mystery story?' whereupon Annie provided a non-sequitur: 'When he went to visit Sylvester Renard, he found one of the things Sylvester said was something that King Bling had tried to see'. Initially, Annie appeared motivated to find solutions, but as she was denied opportunities to share her solutions, she appeared less motivated. She attempted to answer the teacher's closed question[207] but did not appear to respond logically,[208] [209] suggesting she was disengaged or confused.

At Gemma's home, her grandmother directed her to work through a literacy workbook :

> Grandma: 'Why are you making your "e"s like that?'
> Gemma: 'It's because I forgot how to do them' 'I don't want to do any more of these.'
> Grandma: 'Let's see what's the next one.'
> Gemma : 'No I don't want to do it though.'
> Grandma: 'It looks easy.'
> Gemma: 'No I don't want to do any more'
> Grandma [reading]: 'Write each word in the correct corner of the table.'
> Gemma: 'I don't want to do it.'

This vignette is one of several collected that exemplify the spread of 'schoolification' into young children's lives outside school;[210] [211] [212] it indicates a narrow construction of a 'good' 'home learning environment'.[213] Gemma's grandmother attempted to 'scaffold' through direction,[214] but Gemma lacked motivation to solve problems presented to her.

5.In conclusion: Does young children's problem-solving in their ECEC settings and homes count as epistemology?

The present study began with PEYERs' empirical reiteration that problem-solving is research behaviour, [215] [216] [217] affirming that finding solutions may 'count as knowledge and truth': Strega's definition of epistemology.[218] Children appeared to construct their own 'multiple versions'[219] of what they 'count(ed) as knowledge and truth'[220], demonstrating this by engagement and involvement in some situations, whilst in different circumstances rejecting what others may 'count as knowledge and truth'[221] by displaying disengagement and lack of motivation.

Many examples emerged of children aged 4-8 years engaging in problem-solving in their ECEC settings and homes; a few are presented in this paper. Children found diverse solutions to diverse problems, some of which they set themselves. Provocations for their problem-solving included free access to physical

resources, time, freedom and opportunities to engage in activities of their choosing and people with whom they could co-construct solutions. Whilst the children's problem-solving was oriented to pragmatism[222] and their solutions were part of their everyday worlds,[223] children revealed various 'components' within their problem-solving. The 'components' include high-order cognitive processes: evaluation,[224] analogy,[225] deduction,[226] and inductive reasoning,[227] as well as 'flow',[228] self-regulation,[229] autonomy[230] and exploration of the properties of materials.[231]

These problem-solving 'components' illuminate the children's constructions of knowledge. Many are the same 'components' that characterise '…the norms of technical rationality – the prevailing epistemology built into the research universities'[232] - home to the 'academy' - aligning this study's findings with Isaacs' view that young children are just as able as adults to engage in 'epistemic inquiry'.[233] This study offers new empirical evidence that solving problems in their everyday lives may enable children to develop logically derived philosophies of 'what counts as knowledge and truth'[234] in the same ways as adult researchers who publish peer-reviewed material. It can be argued, therefore, that in these circumstances, young children's problem-solving in their ECEC settings and homes may count as epistemology.[235]

However, findings also suggest that the quality of children's solutions and their motivation to initiate them was sometimes limited by adults. This indicates that current education policy in England - characterised by a centralised 'basic skills' curriculum, adult hegemony and the imposition of 'schoolification'[236] at home - sometimes limits children's opportunities for autonomous thought and action. As a result, whilst adults in children's ECEC settings and homes may intend to support young children's constructions of knowledge, they may be underestimating and undermining their potential for problem-solving as well as the contribution that this could make to research, particularly in matters affecting children.[237]

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Appendices

List of appendices

1) Table 1: Stage 2 participants

Ash Setting	7-8 year-old boys and girls (n=32) and their practitioners (n=3). Inspection grade: 'Good'.
Beech Setting	4-5-year-old boys and girls (n=46) and their practitioners (n=7). Inspection grade: 'Good'.
Cherry Setting	4-5-year-old boys and girls (n=60) and their practitioners (n=6). Inspection grade: 'Good'.

2) Table 2: Multi-modal approach to collecting data

Table 2: Multi-modal approach to collecting data (Clark and Moss, 2011)	Documents (e.g. planning, school prospectus)	Practitioners' Analysis sheets
Parent Analysis sheets	Live Observations	Interview conversations
Children's Artefacts	Child Analysis sheets	Focus Groups
Photographs	Video observations	Field notes

3) Table 3: Stage 2 - Setting 'Focus' Children

Table 3: Stage 2 - Setting 'Focus' Children					
Setting	Pseudonym	Girl	Boy	Age (years) during setting fieldwork	Home language
Ash Setting	Annie	√		7	English
	Billy		√	8	
	Costas		√	8	
	Demi	√		8	
	Edward		√	8	
	Florence	√		8	
Beech Setting	Gemma	√		5	
	Harry		√	5	English/French
	India	√		5	English
	Johnny		√	5	
	Kelly	√		4	
	Laura	√		5	
Cherry Setting	Martin		√	5	
	Nora	√		5	
	Oscar		√	5	
	Pedro		√	5	Turkish
	Querida	√		4	English

4) Table 4: Stage 3 'Home' Focus Children

Table 4: Stage 3 'Home' Focus Children	Ash Setting		Beech Setting		Cherry Setting
Pseudonym	Annie	Billy	Gemma	Harry	Martin
Gender	Girl	Boy	Girl	Boy	Boy
Age during home fieldwork	8 years	8 years	5 years	5 years	5 years
Living with	Mother (MTHR-A) Father (FTHR-A)	Mother (MTHR-B) Father (FTHR-B) Sister (SIS-B) – aged 9 yrs	Mother (MTHR-C) Father (FTHR-C) Brother (BRO-C) – aged 8 yrs	Mother (MTHR-D) Father (French) (FTHR-D) Brother (BRO-D) – aged 4 yrs	Mother (MTHR-E) Father (FTHR-E) Sister (SIS-B) – aged 4 yrs
Description of home	Modern, detached 4 bedrooms, on a develop-ment in an established large English Midlands town. Garden	Modern, detached 4 bedrooms, on a develop-ment in an established large English Midlands town. Garden	Modern, detached 4 bedrooms, on a develop-ment in an established large English Midlands town. Garden	Modern, detached 4 bedrooms, on a develop-ment in an established large English Midlands town. Garden	Modern, detached 4 bedrooms, on a develop-ment in an established large English Midlands town. Garden
Home language	English	English	English	English and French (bilingual)	English
Social Class category*	A	A/B	B	A	A/B
FAMILY	A	B	C	D	E

*Market Research Society, *Occupation Groupings.* London: Market Research Society. Retrieved: 18.4.12 <http://www.mrs.org.uk/publications/publications.htm>

5) Table 5: Numerical overview of analysed data

Table 5: Numerical overview of analysed data	n = Analyses featuring children finding solutions	n = Incidences of children finding solutions	n = Axial codes for the category 'find a solution'
Data from settings	56	179	505
Data from homes	36	126	584
Combined data from settings and homes	92	305	1089

6) Table 6: 32 Axial Codes emerging from children finding solutions

5 categories: children finding solutions:	32 Axial Codes emerging from children finding solutions
Control by others : BARRIERS	4. Following adult's direction 5. Responding to adult's closed questions 6. Responding to adult's semi-open questions 7. Reproducing knowledge s/he already had 8. Believes s/he has failed
Solution is unrecognised: BARRIERS	9. Denied opportunity to share solution 10. Solution not shared with or witnessed by others: unconfirmed 11. Solution not shared with or witnessed by others 12. Solution unconfirmed
EFFECTS when solution is unrecognised	1. Gives up 2. Has become disinterested 3. Unmotivated
Antecedents / contexts for 'Find a solution': PROVOCATIONS	13. Self-regulates 14. Creates a problem to solve 15. Time and freedom to explore, investigate, experiment with something of personal interest 16. Focused on something of personal interest 17. Exploring properties 18. Perseveres to resolve problem 19. Devises practical method to create solution 20. Applying rule to create solution 21. Deductive reasoning 22. Inductive reasoning 23. Finds own solution 30. Employs others to help with finding a solution 31. Able reader 32. Theory of mind
EFFECTS of finding a solution	24. Finds practical use for solution 25. Resolves another person's problem 26. Shares solution 27. Motivated by finding solution 28. Excited by finding solution 29. Wants to preserve what s/he is doing

Jane Murray worked as an early childhood teacher for twenty years before moving to the University of Northampton where she teaches undergraduate and postgraduate students and engages in research. Her research interests include epistemological issues in early childhood education and care, 'new sociological' issues relating to early childhood and early childhood pedagogies.