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**Investigating Learning Through Developmental Dance Movement as a Kinaesthetic
Tool in the Early Years Foundation Stage**

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Abstract

The understanding of the significance of movement to learning benefits from advances in neuroscience. This study considered a neurophysiological perspective in relation to the educational theory of Accelerated Learning (AL; Smith 2002a; 2002b) for which little empirical evidence exists. Childhood development themes and learning strategies from a neurophysical-psychological viewpoint were investigated through the use of developmental dance movement as a kinaesthetic tool over an eight-session programme with three early years practitioners and two reception classes in two UK primary schools.

The research strategy included both qualitative and quantitative methods to capture examples of accelerated learning and transfer. Qualitative data from three semi-structured interviews with early years practitioners was based on their observations of intervention sessions on a whole group level and selected case studies of children in their class. The data was analysed with the aim of addressing their views on the children's learning, which influenced and elucidated the practitioners own learning outcomes. Quantitative methods utilised the Goodenough-Harris (1963) draw-a-person test with participating children to explore change in visual-motor integration and developmental maturity as a measure of accelerated learning and transfer.

Findings supported neuroscientific research and highlighted useful and contradictory aspects of AL theory. Practitioners were able to identify benefits for pupils with specific learning needs. Case studies demonstrated accelerated learning through observed changed behaviour. T-test results from Aston index pre-post scored drawings showed significant differences ($p=0.005$) in visual-motor integration and developmental maturity. It is concluded that developmental dance movement can provide opportunity for physical/cognitive advancement for young children.

Keywords: early years; developmental dance movement; accelerated learning; transfer; neurophysical psychology; embodied learning

Introduction

There are numerous cases made for the recognition of the important part movement plays in cognitive development...The lack is rather in terms of hard evidence underlying the variety of beliefs and claims made, as well as substantial links with current educational and psychological theory (Davies, 1995, p.50).

Arts training purports to strengthen the brain networks related to the art being practiced; the hypothesis being that other tasks that rely on the same brain circuitry are positively affected (Posner & Patoine, 2009). Additionally, the positive effects of arts based interventions on the learning of younger children is acknowledged by current educational research (Hardiman et al., 2009; EEF, 2014). Nonetheless, more robust evidence is required to test the link between arts and attainment (EEF, 2014).

This study considers the impact of the effectiveness of arts based intervention on children's development in relation to the theory of Accelerated Learning (AL) (Smith 2002a; 2002b). The principles of AL can be summarised as the promotion of deeper and faster learning than that expected using conventional teaching techniques. The approach uses strategies to assist effective learning and advocates positive learning environments to help learners become ready physiologically and psychologically (cf. Rose, 1985; Smith, 1996; 2002a; 2002b). In addition, AL identifies enjoyment as an important element of learning and therefore emotional involvement and enjoyment of a dance movement intervention were investigated.

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AL theory has been supported within government guidelines, for example ‘Excellence and Enjoyment: A Strategy for Primary School’ (DfES, 2003) or a recent guidance document for primary school senior management teams (DfE, 2014). It has been adopted into the English National Curriculum and National Strategies (QCA, 2006) and implemented to varying degrees within schools (Slack & Norwich, 2007). It has also received considerable criticism, mainly as there is little empirical evidence that the theory holds up to independent scrutiny (Sharp et al, 2008). This juxtaposition opened up an opportunity for an investigative dance movement based project. Entitled Developmental Dance Movement (DDM), its practical content incorporated educational childhood development themes and learning strategies from a dance movement and neurophysical-psychological perspective (Blythe, 2004; Montessori, 1949). Whether the intervention might demonstrate potential for accelerated learning was then considered. The research further focuses on concepts of transfer through exploring how learning could be measured.

The terms *whole-brain learning* and *brain-based learning* are usually synonymous with AL theory (Hugues, 2005). AL theory advocates enhancing practice through knowledge of neuroscientific research. This includes using movement to enhance cognitive learning and music to positively affect learning environments. Additionally, the approach considers visual, aural and kinaesthetic modalities (VAK), recognises Multiple Intelligences (MI), promotes group activities, and connected and frequently reviewed learning (Smith, 1996; Hughes, 2005). In reference to Diamond and Lee (2011) finding the benefits of a multi-focused approach, the potential for dance movement to positively contribute to AL seems tangible.

The rationale for the study of reception class age groups (4-5 years) converged from several geographies. Embedded in the child development theories of Piaget (1952) and Maslow (1970) movement activity in early life is prioritised; its facilitation is attributed to the development of cognition and an importance is attached to the transition from primal reflexive

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patterns towards movement mastery. Emphasis on movement is similarly reflected in Montessori (1949) pedagogy, which was incorporated within the practical methodology of this study. Movement in early childhood is understood to be "...the primary and dominant means of action, expression, learning, communication and overall development" (Gruber in Zachopoulou, 2006, p. 281). Neurophysical-psychology supports this notion both from the perspective of demonstrating a readiness for school and a means of identifying early signs of developmental delay (Blythe, 2003/2005). Consequently, in this article the accelerated aspect of AL theory does not refer to pushing academic attainment but fosters the ideal environment and strengthens the link between sensori-motor development and controlled ability to access formal learning. Although a relationship between movement and cognition in early years development is widely recognised (cf Keenan & Evans, 2009), recent advances in neuroscience have elucidated distinct and important factors of this relationship. New insights are much less well known and understood and this knowledge has not yet been translated into practice or education policy (Tompsonski et al, 2015).

Theories such as AL can now be substantiated through advances in neuroscientific research, which indicates that myelination of synapses and brain growth in the early years is at a heightened stage of development, having the potential for the greatest 'plasticity' (OECD, 2007; Steele et al, 2013). Therefore, there are a variety of fields of child development research, which show that all young children are predominantly kinaesthetic learners (Bradley et al., 2014). Montessori (1949) highlights the notion of 'sensitive periods' which neuroscience now also acknowledges as critical windows for optimising learning by stimulating the brain through movement. Wiener-Vacher et al (2013, p.1) state: "...cognitive functions also have limited developmental windows when their underlying brain structures establish long-lasting connectivity with repercussions for life". This should be of concern to early years educators and dance researchers, as movement and dance may be the most useful tools to maximise

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healthy developmental maturity. Whilst access to high quality movement opportunities during this age and stage of growth may have an accelerated effect on motor and cognitive progress and processing, a lack of appropriate stimulation might have negative implications.

This article uses the term 'kinaesthetic' to mean awareness of and through the body (Kimmerle & Côté, 2007). The objective was to investigate how kinaesthetic dance-based experiences might support acquisition of knowledge from both a pupil and teacher perspective. Distinctions were made between procedural knowledge as procured *in the doing* – a result of concrete physical experiences (Anderson, 1990) – and embodied knowledge (Bresler, 2004), which builds a stand-alone frame of reference through muscle memory, development of cognitive skills, cognitive strategies, motor skills and proprioception. Whilst this study was more focused on procedural knowledge, as motor skills and proprioception are intrinsic to dance-based learning, a likely crossover with embodiment is acknowledged. For the purpose of this article aiming to explore concepts of transfer through embodiment, transfer is defined as the ability to use previously acquired knowledge in both similar and new situations and/or contexts (Hanna, 2008).

For the practical methodology a set of DDM sessions were designed, comprising a combination of fundamental dance movement skills, cross-curricular content and neurophysical developmental exercises. This study aimed to test the hypothesis that a DDM programme would positively contribute to the learning process for both practitioners and children in the Early Years Foundation Stage (EYFS)¹ in order to answer whether DDM is a useful strategy to accelerate learning across the EYFS curriculum whilst accounting for diverse children's needs and abilities. In addition, we investigated whether the concept of transfer and enhanced development through the kinaesthetic experience might be practically, ethically and usefully observed. This is based on the theoretical hypothesis that Goodenough-Harris drawing scores,

¹ EYFS applies to children in preschool, nursery and reception classes, i.e., age five and under.

collected pre and post intervention to measure quantitative evidence of transfer, would be higher following the DDM sessions.

Impact of Physical Activity on Cognitive Development

As there are few existing dance studies into children's cognitive development, accelerated learning and transfer, studies into the impact of physical education (PE) upon cognition were considered. Studies within this area are more abundant than in dance but whilst it is suggested that participating in PE facilitates cognition, there is little empirical evidence regarding the specificity of the effects of particular programmes on knowledge enhancement or academic attainment. Sibley and Etnier (2003) draw attention to the general lack of true experimental designs on childhood exercise and cognition. Shepard (1997) has reported that children receiving an additional 15-25% of PE showed an acceleration of their psychomotor development, which could provide a mechanism for accelerated learning of academic skills. The study whose intervention is the most aligned with the present one is that of Trost et al. (2008) in which an eight-week 'move and learn' intervention was delivered to pre-schoolers. However, results reflect that the focus of the study was on monitoring levels of activity as a potential means of reducing the rise in obesity rather than measuring any learning outcomes. The study only barely mentions the possibility of enhanced academic performance and this lack of evaluation is documented as a limitation within the study.

A positive relationship between physical activity and cognitive functioning in children has been observed (Chang et al., 2013; Hanna, 2002; Sibley & Etnier, 2003; Wu & Hillman, 2013). The largest effects are seen in assessments of perceptual skills followed by tests of development, also categorised as academic readiness. Bailey and colleagues' (2009) critical review of PE and School Sport literature strongly supports the need for more research linking physical activity with school performance outcomes. One relevant example is Derri and colleagues' (2010) study, which demonstrates how a short intervention intended to integrate

motor and cognitive areas had a positive effect on preschool learners. They examined the possible relationship between the domains of movement and linguistics and of learning transfer through reinforcing previous knowledge whilst simultaneously introducing new concepts. Over five weeks, children in the experimental group performed better on follow-up and retention tests. Results support the use of movement as an interdisciplinary approach in teaching and recognises relationships between domains of learning. The time frame of Derri et al.'s (2010) study indicates that even short movement interventions, such as the one evaluated in the current study, can have noticeable positive effects. In terms of more global learning effects, Gerry et al.'s active music class study (2012) is worthy of consideration. The paper reports Schellenberg's (2004) findings of increased IQ levels in six year olds following a year of music training. Whilst Gerry et al.'s (2012, p. 399) methodology "emphasises movement" along with other examples cited within, music and movement appear to be correlated by assumption but not distinguished in research terms.

Approaches to Dance-based Interventions

Two recent UK-based early years projects highlight the multiplicity of possible approaches in creating a suitable dance-based intervention design. The research behind Greenland's (2009) developmental movement play sought to evaluate the impact of movement on development. It further explored learning using social, emotional, cognitive and physical dimensions. Positive results were seen from the social and emotional perspectives, but less tangible information was extrapolated in the physical and cognitive domains (i.e., those most closely aligned with the aims of the present study). With the exception of creative development Greenland's findings did not indicate clear influences on the outcomes detailed in the other five areas of learning of the EYFS². From a pedagogical perspective Greenland (2009)

² Effective from September 2012, the previous six aims, namely Personal, social and emotional development (PSE); Communication, language and literacy; Mathematical development; Knowledge and understanding of the world; Physical development; Creative development, have been combined into three prime and four specific areas.

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advocates less structure and adult-led activity in the practical aspects of the methodology differing from the design chosen for the current study. Whilst not philosophically opposed to Greenland's (2009) less structured approach, as the results did not substantiate any significant improvement in all but one of the researched areas of learning this provided justification for a more adult-led closed task focus which also fostered some creative opportunity. This objective differentiates general high quality dance practice from a deliberate developmental educational intervention.

The LearnPhysical *interactive* (Lpi) report, summarised research undertaken by The Place and the Open University in three primary schools. The intervention was designed as an eight-week series of lessons specifically to explore promoting cross-curricular concepts, that is crossing subject boundaries by using dance (alongside technology) as a vehicle to support core subject teaching and learning. Using a structured approach Lpi appeared particularly to benefit pupils with English as a second or additional language through providing alternative entry points to subject learning (Twiner et al, 2009/10). The Lpi programme shares parallel objectives with this study; to use dance as a kinaesthetic tool for accelerating cross-curricular learning whilst assisting educators to recognise movement methods as potent delivery strategies. Few other dance specific studies sharing these objectives exist, though some evidence suggests dance can improve visual-spatial skills (Keinänen et al, 2000; Priddle 1978 in Poretz, 1989). The effectiveness of using dance to teach reading and writing skills remains inconclusive (McMahon et al, 2003), suggesting that further research is warranted.

Dance, Embodiment and Early Years Development

A neurophysical perspective highlights that investigating learning through dance is also acknowledging concepts of embodiment; movement experience as perception, a connection of the body and mind. In reality the functional integration of these systems creates an inseparable 'body-minded brain' (Bradley et al., 2013; Damasio, 2006; Johnson, 2007). Current educational

reporting also recognises that separating physical and cognitive learning is not the most effective (Paul, 2014). It is now evident that these processes, enhanced through movement, can be especially relevant to early years development when neural networks are first forming; influenced less by genetics and more through experiences (Bryck & Fisher, 2012). Concrete physical experiences, especially those reinforced through multi-sensory rehearsed repetition, as is the nature of dance, are associated with facilitating long-term retention. Rinne and colleagues (2011) provide some neuroscientific basis for why arts activities may be an effective means to enhance long-term retention. As a non-dance specific paper, their discussion nevertheless has direct relevance to the potency of dance as a learning medium. Authors attribute positive benefits from the 'enactment effect', which is that concrete physical involvement requires more intense multi-level cognitive processing. Emotional involvement also plays an important role in memory consolidation (Damasio, 2006; McGaugh in Rinne et al, 2011; Paulson, 2012 in Bradley et al, 2013). As scientific underpinnings to Thomson's (2011) and Chappell and Young's (2011) findings, this supports the assertion that enjoyment whilst participating in dance based activity plays more than a superficial role. These notions are reflected in AL theory.

Benefits of Dance-based Intervention for Children with SEND

Whilst Keinänen's and colleagues' (2000) meta-analysis was restricted to dance studies with non-impaired populations, choreographer-movement researchers Gottlob and Oka (2007) created a dance-based preschool programme³ specifically to re-integrate children unable to function within mainstream settings. Two compared control groups - one within the setting and another in the mainstream - supported results that the treatment children were able to demonstrate accelerated motor progress. This validates the notion that children with special

³ Methods incorporated the work of Laban and Bainbridge-Cohen with their own Spiral Praxis methodology as conducive to the sensory-motor stage of development.

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educational needs and disabilities (SEND) may particularly benefit from specific developmental dance movement programmes. Additionally, Finn and Valkova's study (2007), a follow up of motor skill performance in pre-schoolers with developmental disorders, revealed that after a years' training of body awareness games and dance activities, not only did motor skill development improve considerably but social and behavioural patterns also improved. The researchers acknowledge that literature on the benefits of motor skill intervention for this population is limited. The dance specific nature of Kirsch and Cross' (2015) study evidences how multiple modality experiences shape perception. The component of empathy, illustrated through functional mirror neurons, supports the argument for a dance intervention appropriate for children with autism who experience difficulties with interaction, communication and social imagination in differing degrees.

Whilst some literature suggests that delays in motor development can be indicative of cognitive delay (Blythe, 2003; 2005; Green et al, 2009; 2010), evidence that acknowledges the impact PE may have on learning disabilities is lacking (Shepard, 1997). The non-specific content of the intervention is possibly the crucial factor, highlighting that it is likely to be the nature of the movement and not general physical activity that is of importance. Sibley and Etnier's (2003) findings of a positive relationship between physical activity and cognitive functioning applied to all children. The authors highlight the large effect sizes on early elementary aged children (4-7 years) and also those with physical and intellectual impairments. However, commenting on the findings from the National Centre on Accelerated Student Learning (CASL), Oxaal (2005, p. 3) suggests that "seldom are interventions designed to focus in a comprehensive way on the multi-faceted difficulties experienced by many children with and without disabilities". Music and dance is acknowledged by current autism research as a likely beneficial intervention tool, however specific programmes that meet the needs of these children has been identified as an area currently lacking and in need of further development

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(Stephens, 2008). Inclusion of physical activity for children with learning disabilities may be an important component of their educational programme (Pontifex et al., 2012).

The Institute of NeuroPhysical Psychology (INPP) focuses on research concerning the relationship between physical and cognitive developmental deficits. A KS1 research project (Bertram in Blythe, 2003) highlighted that 100% of pupils in the lowest general ability group showed signs of physical developmental immaturity. Fifteen minutes of developmental exercises delivered for one year in a class of KS1 pupils led to a reduction in problems with balance, co-ordination and reflexes, which positively correlated with improvements in visual and aural processing, whilst a control group made minimal progress (Blythe, 2003). Another INPP study (Blythe, 2003; 2005) tested children aged 8-10 on literacy and drawing using the G-H test before and after the programme delivery. Results indicated marked improvements in these areas. A further study with children aged 7-9 included a control group and a general exercise group (Blythe, 2005). The general PE group showed improvements in balance and co-ordination but not in academic transfer. The trend was that children who demonstrated the highest degree of neurological dysfunction at the start of the programme showed the greatest improvement in academic measures. Children who had a reading age equivalent to their chronological age still demonstrated improvement in physical assessment. These findings represent some of the most compelling research linking particular exercises to specific academic improvements, illustrating the interrelation of these aspects of growth and development. In another study with younger children (Blythe, 2005) almost 50 percent of children showed elevated levels of retained reflexes, which correlated with poor balance, co-ordination, cognitive development and concentration, prior to the intervention. These results suggest that a number of children may be disadvantaged in neurophysical capacities *already at the time they enter school*. In consideration of the specificity of movement to optimally affect cognition, many of these movement patterns are inherent in dance. In the present study,

investigating learning through DDM offered the opportunity to integrate patterns to stimulate neurophysical development with cross-curricular content delivered through multiple modalities. Relative to general PE or unstructured physical activity it provided a platform by which to critically address AL theory; that DDM might promote deeper, faster learning for all children including those with SEND.

Methods to Measure Development and Transfer

Research into the impact of physical activity programmes within the EYFS could offer a unique context by which to address neurotypical⁴ development and the transition from play to formal learning for all children. In addition, it could provide teachers with enhanced opportunities to observe potential areas of developmental delay. Crucial elements of the Keay (2011) report include highlighting the importance of class teachers' knowledge of child movement development and its pedagogy, increasing teachers' competency and confidence in PE, providing opportunities for professional development and supporting cross-curricular approaches. Dance has the potential to make a major contribution to these areas. However, progression within the area is dependent on suitable and reliable methods to measure development and transfer. Bransford and Swartz (1999) observe that measurement methods have been inadequate and not focused towards direct application. They conceive transfer to be more appropriately understood as dynamic rather than static. This is explained as "...the ability to learn during transfer and mechanisms for transfer as 'knowing with' which provides a context that guides noticing and interpreting" (cited in Hanna, 2008, p. 500). Quantitative evidence of transfer is limited, but some studies indicate that using the Goodenough-Harris (G-H) Draw-a-Person Test (Harris, 1963) can be a promising approach (Shepard and Lavallée in Shepard, 1997 and Blythe, 2003; 2005).

⁴ Typical neurological development is regarded as a normal human difference.

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Some examples of mixed-methods approaches also exist. For instance, the Dance City Report (2009), a North East Dance and Health Project, used mixed methods to investigate wellbeing outcomes from dance activity in pre-schoolers. Qualitative analysis indicated positive mental wellbeing outcomes, whilst quantitative measurements of physical benefits found no significant changes over a 10-week programme. Conclusions reaffirm the lack of evidence of the physical and psychological benefits of dance, especially within preschool children (Ells et al., 2009). The current research aims to address this gap in the research through evaluating the benefits of movement, in particularly developmental dance, as a simultaneous approach to physical and cognitive development. In summary, the aim of the present study was to investigate the potential of accelerated learning and measure transfer in early years development through dance.

Method

A mixed-methods approach was chosen because it facilitated accessing multiple perspectives and provided insights into the experiences of 'different stakeholders' (Barbour, 2008); in this case early years practitioners and the children in their care. Two primary schools within one inner-London borough were invited to participate. Schools were selected based on their relative location and similarity. One school elected to have all the children (N=26) participate together during their regular allocated PE time. The other school elected to split the group into two halves ($n=13$, $n=14$).

Qualitative Methods: Interviews and Case Studies

Our methods were predominantly qualitative with a quantitative component. Qualitative data was collected through semi-structured interviews (approx. 1h long) with three practitioners. These were the keyworkers who were most familiar with the particular group of children they were observing. The interviewees are described as an abbreviation of their initial, school and group. LB1, had a Masters degree and qualified teacher status. JB2 had been at the

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school eight years, two of which as acting teacher in the nursery. WH3 was a qualified early years practitioner of 28 years, 14 of which were spent at the participating school. All three practitioners spent eight weeks observing their group in DDM sessions and taking written notes. In addition, the educators together with the Foundation Stage Co-ordinators of both schools chose eight case studies. The researcher had no influence on which children were chosen for case studies. Foundation Stage Co-ordinators and teachers based their choices on the written information they had been given about the project and their familiarity with the children, combined with their own observation objectives. Case studies were selected for a variety of reasons, including stages of physical and cognitive development and parental consent considerations (See Table 1).

Data collected from interviews, which took into account volunteered information and that generated through probing, formed the basis for content analysis. It was considered beneficial to the research aims to focus on practitioners' observations rather than video documentation as the teachers were likely to have a greater insight into the children's development and to be best placed to make observations across all learning areas and situations, including those which might evidence transfer of learning. As a secondary aspect, this chosen methodology would encourage a growth of knowledge and promote a deeper understanding in the practitioners' own awareness of how the intervention might function as a useful assessment tool. The data was used as a resource, by which to apply the theoretical frameworks underpinning the research aims whilst staying mindful of internal inconsistencies (Barbour, 2008). AL theory was never overtly discussed prior to or during the interview process. The author took on the role of interpreter of the observations and reflections of the three expert early years educators (Chappell, 2005). Audio files were transcribed as intelligent in verbatim. The process facilitated a familiarity with the raw interview data.

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Each interview was treated independently. Memos were coded and written adjacent to the raw data. Themes began to emerge from these meaning units. The identified themes were supported by frequency of distribution and relevance to the research aims, thus responding to the theories (Yin, 1994). Counting was not intended to force the data into a quantitative mould, but for transparency and to guard against real and perceived researcher bias in weighting some data themes over others (Miles & Huberman, 1994). Similar themes were found common to all three interviews. Through interrogative interaction between the three sets of data and the theory, common categories were found to reflect the practitioners' views/perspectives on learning. Additional documentation of children's participation during the sessions comprised of teachers' field notes and recorded digital video and still photography. Interview data was prioritised, but compared with the other data sources to triangulate and draw out detail (Chappell, 2005; Watson, 2009).

Quantitative Methods: Goodenough-Harris Draw-A-Person Test

Quantitative data was obtained through human figure drawings using the G-H model (Harris, 1963) measuring visual-motor integration and developmental maturity as a means to evaluate accelerated learning and transfer. The reliability and validity of the G-H test have been investigated several times and found to be adequate and high (Behkit et al, 2005). Data collection was taken before and after the eight DDM sessions. The standardised protocol including the verbal prompt for the G-H test was followed (Harris, 1963). Drawing took place in the classroom on the same day prior to the introductory session and after the concluding session. Children were provided with plain A4 paper and an ordinary graphite HB pencil. Children's paired drawings ($n=21$) were scored using the 50-point Aston index where achieving higher scores requires physical and cognitive development and indicates increased capabilities.

The Aston index scores various aspects within the G-H drawings such as presence or absence of body parts and clothing, figure proportion and drawing control. The raw score

transposes to a Mental Age (MA) comparative figure. The drawings were blind scored by the same individual and rechecked by another independent scorer for inter-rater reliability. Raw data scores were analysed with the statistical software SPSS (IBM, Version 19, 2010) in order to quantify the difference between the pre- and post-scored drawings. These were compared using a t-test. The standardised difference, which describes the meaningfulness of the results, was calculated to express a percentage: $\Delta M = \frac{M_{post} - M_{pre}}{M_{pre}} \times 100$. The theoretical hypothesis was that the children would score more highly after the DDM sessions than before. Relative to the mixed-methods design the qualitative value of the drawings was seen to be of additional interest.

Procedure

Each school formally agreed to participate in the study. Ethical considerations of informed consent, disclosure agreements, anonymity, safeguarding and data protection were addressed. Both schools elected to act as gatekeepers between the parents and the research project, therefore parents received information from and gave informed consent for their children participating to the school. There are specific ethical issues associated with research projects involving children. Whilst children should be regarded as vulnerable participants requiring safeguarding, Mikherji and Albon (2010) argue that their competence and confidence to be active participants should be acknowledged.

Intervention

The intervention comprised eight 35-minute sessions of developmental dance movement (DDM) directed towards aspects of development and learning within the EYFS curriculum. These were piloted and refined within several preschool settings. The decision to adopt adult-led closed activities was driven by the necessity for clarity of intent facilitating potential outcomes in relation to the research aims and not as a fixed philosophical viewpoint. Experts have noted that for many children, especially those with learning and behavioural difficulties,

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explicit instruction is desirable and useful in the context of a meaningful learning environment (Harris et al, 2003; Williams, 2003 in Oxaal, 2005). The prescriptive nature of adult-led closed activity was countered by contextualising activities as games during which the children were able to make some creative contributions both conceptually and physically. Children were not cajoled into participating. Sessions alternated three times across six weeks plus an introductory and concluding session. The introductory session established the structure whilst the concluding session introduced the notion of internal transfer, supplementing familiar activities with developmental progression whilst maintaining the same protocol and parallel learning objectives. This rationale guided the five-part protocol below:

A physiologically sound warm-up focusing on bodily and spatial awareness.

Figure 1: About here

A dance game with a focus on a non-dance learning objective including: Experiential shape incorporating spatial/directional concepts; Even numbers combined with developmental dance movement.

Figure 2: About here

A developmental dance game incorporating balance and proprioception.

Figure 3: About here

Stillness and sensory integration (Ayres, 1970)

Figure 4: About here

Windmills (Palmer, 1995) - proprioceptive development.

Figure 5: About here

The objectives of the study were addressed using Body/Effort/Shape/Space principles⁵. Classes were not focused on technique, but on learning through focus on self-awareness and

⁵ Related to the four modes of human perception identified by Jung (1921) and developed by Myers-Briggs: Body Sensing, Effort Feeling, Shape Intuiting, Space Thinking (Laban Movement Analysis (Newlove,1993); Bartenieff Fundamentals (Bartenieff et al, 1970).

proprioception (Green, 2002). Physical actions were used to enhance abstract concepts and cognitive recognition of spatial concepts highlighting seriation (Athey, 1990 in Davies 1995) and antonyms. Music was incorporated to address musical orientation, logical rhythm and pattern. Supported by AL theory, music also helped deepen specific ideas and was an appropriate backdrop (Davies, 1995).

Results

Qualitative Findings

The primary data presented in this section focuses on the practitioners' enhanced understanding through observing children during the intervention and how it informed their own views on the needs, abilities and development of the children and their learning. This approach was chosen because their observations would be informed by an in-depth knowledge of the children's prior learning status. Themes emerged relating to the aims of the study to investigate the theory of Accelerated Learning and concepts of transfer, and these are illustrated in Figure 6 and detailed, one-by-one, below.

Figure 6: About here

Accelerated Learning (n=69)

The primary data indicated a *Growth of Practitioners' Understanding (n=55)* as a result of observing the DDM sessions. For instance, they explained that their enhanced understanding changed their perceptions of some of the children and highlighted specific abilities and needs previously unrecognised. "For me some of the things that you asked them to do I found very interesting. Observing the children you think 'yes so and so will be able to do this, oh they can't do that'. It's been a learning curve for me in that sense" (WH3). Crucially, evidence of Accelerated Learning can only be evaluated convincingly with an informed baseline of what level of understanding already exists. For example when commenting on Martin, a case study pupil with English as a second language (ESL) previously regarded as a passive learner with

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non-physical learning preferences, one interviewee stated: “I learned that Martin could follow many more instructions than I perhaps thought he could” (LB1). Bakari and James, two pupils previously identified by practitioners’ as potential kinaesthetic learners (See Table 1), in sessions demonstrated difficulties with some of the movement tasks and/or demonstrated other modality preferences. Martin, Armani and Malik, all pupils who showed little previous interest in physical development activities responded positively to the session approach, however.

DDM as a Tool (n=23)

A strong theme was recognition of the multiple uses of *DDM as a Tool*, for which emerged three sub-themes. Commenting on the multi-modal nature, in particular the sensory aspects including responses to music and props (n=8), Martin's teacher recognised the impact: "I think the session really benefited him not just from the listening but from the physical things" (LB1). Learning outcomes from the multi-sensory aspect were readily acknowledged: "It was interesting ...how many of them over the weeks learned to lie still because by then they realised that you were coming round with the material" (WH3).

The cross-curricular potential (n=16) was also recognised. For example, the children were introduced to new spatial concepts such as right and left, diagonals, semi-circles and spirals: "That did benefit them because if anyone now asks them show me a diagonal, they could do it with their body" (JB2). The practitioners had noted the children talking about the movement sessions in other learning environments and remembering the use of shapes better from week to week. “Things to do with shapes that you did - that has been good, they have remembered shapes” (WH3).

The usefulness of *DDM as an assessment tool* (n=9) was acknowledged. “It did tell me more things. You could really do some planning based on what you have seen” (LB1).

In particular it was suggested that if the sessions were introduced earlier in the academic year they might serve as a pre-assessment tool, and that by observing children in the *DDM* sessions

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it would be an aid to both establishing and further documenting individual progression across all the learning areas of the EYFS. "...that would be quite good insight, to see the children from the beginning, from day one..."(JB2).

Enjoyment (n=18)

Practitioners all perceived *Enjoyment* to be an important factor in the DDM sessions. Put simply, the multi-modal and multi-sensory nature of the DDM sessions supported the cross-curricular content and increased the children's enjoyment of the experience. "I think they really enjoyed the sessions; they enjoyed the different activities that you did with them. They learned new things from them" (WH1).

Findings also provided a contextual comparison from a practitioner's viewpoint:

It seemed to me they didn't have any inhibitions about it...they didn't ever feel or they didn't look like they had to do it and had to get it perfect, so they didn't mind just participating and having a go. Whereas in the classroom...something like writing, unless it's perfect they won't try because they don't want to fail... (JB2).

The enjoyment aspect furthermore appeared to have a positive influence on other emerging sub themes.

Progression of Physical Skills (n=16) and Memory Impact (n=3)

As they were often linked, Progression of Physical Skills and Memory Impact are outlined here in the same paragraph. Generally, it appeared that they may have both been influenced by the motivating factors and the repetition embedded in the DDM sessions. As one interviewee explained:

Because it is repetitive and ...every other week you did the same session, it was interesting to see over that fortnight ...that they had remembered what they should be doing and seeing how much they had improved on it (WH3).

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Another practitioner defined progress in physical skills also in terms of increased ability to demonstrate cognitive strategies and motor planning like this: "They were using their thoughts to get around...rather than just running around" (JB2).

Examples of Changed Behaviour (n=26)

According to the interviewees, the intervention led to *Examples of Changed Behaviour*. Not unexpectedly for a dance movement based intervention, there was some shared content between *Progression of Physical Skills*, those that could be considered *Evidence of new Physical Skills* and *Examples of Changed Behaviour* (see Figure 6). For example, in the below quote one practitioner describes new skills as improvements in fundamental movement:

When you first introduced skipping, a lot of them were doing side step along and they did that for a good few weeks, side stepping but, by the end, they seemed to be moving their legs one after the other and actually getting the notion that this is skipping. So quite a few of them, their movements had changed (JB2).

Nonetheless, examples of changed behaviour did not always indicate progression or evidence of new physical skills. Individual responses towards learning became apparent. For example, Keyana, a case study identified as having severe autism, previously did not engage in classroom activities or interact with peers. The noted improvement was in her level of engagement:

She's not like that in class at all, she is not part of the group. She tends to do her own thing. She doesn't like sitting, she sits now and again at her workstation but she's not as focused for that amount of time, where she was in the movement groups (JB2).

Eleven out of 26 observations of changed behaviour specifically related to SEND and/or ESL/EAL children. Anthony, recognised as having an 18 month developmental delay, Armani with a suspected Autistic Spectrum Condition (ASC) and Keyana diagnosed with Autistic Spectrum Disorder (ASD) all showed increased levels of engagement and progression

in their physical development. Improvement in aural attention was also observed. Three out of four of these cases were with ESL/SEND pupils. Hence, it was possible to discern a relationship between Visual/ESL and Aural Enhancement, allowing the assertion that these observations relate to accelerated learning outcomes for children with ESL such as Malik and Martin (see Table 1). For instance Martin's ability to follow more instruction is supported with additional examples of his changed behaviour: "... his face changed because, as I say, he is passive and quite often he looks very blank and he wasn't looking blank in those later sessions" (LB1).

Transfer (n= 18)

The data addressed how transfer might be usefully and practically measured. Findings identified supporting factors as *Concepts of Measurement (n=6)* and *Ideas of Positive (+) and Negative (-) Transfer (n=7)*. One practitioner considered "...they could show it with their body but I don't know if they could then put that onto paper until we have actually tried and tested that ...if I thought about that before, maybe I could have tried ...to get them to draw a diagonal" (JB2).

A conservative approach was taken when transfer was implied but unsubstantiated. For instance the following comment was not included as a tangible example of transfer but categorised for the ideas related to it: "...they would most probably know how to make a spiral..." (JB2).

These supporting factors had no direct effect on actual *Individual Examples of Transfer (n=5)*. Two examples of transfer, one minor and one rather more substantial, were extrapolated from the interview data. Findings specifically related to the content of the sessions "...one child said about their heart beating. Yes that was sports day" (JB2). This child had made the connection that increasing their movement activity produced a physiological response and as such it is a small but clear example of recognising a learning experience and being able to apply

the information to a completely new situation. Bakari was noted as acting differently in the classroom:

I don't know whether I can completely correlate the movement with the change in him or whether it is a developmental thing that he has been the whole year in reception and now he feels comfortable about sitting down and trying to use a pencil or doing some nice activities but that has happened in the past month that he has started to do those things (LB1).

Quantitative Results

There was a significant difference between the pre- and post raw scores on the G-H drawing test: $t(20) = -3.168, p = 0.005$. There was also a significant difference between pre and post Mental Age (MA) scores: $t(20) = -2.539, p = 0.02$. Calculation of the standardised difference revealed that average scores for the sample increased by 15% and MA scores increased by 7%. The 21 individual test results for both scores are illustrated in Figure 7.

Figure 7: G-H Individual test results⁶.

Optimising on the mixed-methodology approach, a sample of the drawings are presented and considered from both a quantitative and qualitative perspective.

A summary of the case studies is presented in Table 1.

Table 1: About here

Discussion

The present study sought to enquire whether DDM could be a useful tool to enhance practitioners understanding and accelerate learning across the EYFS for a variety of children's needs and abilities. Additionally the study explored the potential for measuring transfer. The sub-themes of the use of *DDM as a Tool, Enjoyment and Memory Impact; Progression of*

⁶ Numbers 1-21 represent the individual children who completed the drawing.. Mental Age corresponding to raw scores according to the Aston Index is abbreviated as MA.

Physical Skills and *Changed Behaviour* will be discussed in order. Due to the fact that a large proportion of the practitioners' observations of changed behaviour related to pupils with ESL/EAL and SEND the significance of these findings will be considered. *Measurement and Concepts of Transfer* together with *Individual Examples of Transfer* follow later in the discussion.

Accelerated Learning

DDM as a Tool

Through observing the children in the sessions there was a growth in the practitioners' understanding in terms of how DDM sessions could make a valuable contribution to EYFS learning objectives. It was noted how the dance activities were able to support cross-curricular content, whilst focusing their young pupils for longer periods through simultaneously engaging multiple senses through the visual, aural and kinaesthetic modalities (VAK). The practitioners' own understanding of the children in their class deepened, often in unexpected ways, by providing a new context in which to observe their pupils participating in a social group activity. Two particular case study examples, Keyana and possibly also Novia, highlighted orientations towards modalities of Multiple Intelligences (MI; see Table 1). These findings positively align with AL theory (Hughes, 2005; Smith, 1996) and suggest that observing developmental dance activity can make a positive contribution to an enhanced understanding of pupils learning characteristics and assist educators towards improving children's learning outcomes. Raising profiles of each individual child's progress is a statutory framework in the EYFS thereby, as no additional demands on practitioners were made, other than the interviews for the present study's analysis, observations of DDM sessions, as a repeated measure, may function for EYFS practitioners as a very useful assessment tool. This not only supports Levy's (2008) suggestion that finding a useful pre-assessment tool would allow a teacher to look at pupils more objectively but also that DDM sessions may act to disseminate content, indicate where each

pupil is in terms of physical and cognitive development and may also highlight learning strategies (Slack & Norwich, 2007).

Enjoyment and Memory Impact

Positive comments in relation to level of enjoyment were substantiated for all three participating groups and manifested as observed enthusiastic engagement. Thomson's (2011) and Chappell and Young's (2011) studies also place emphasis on the enjoyment factor and the relevance of this as a supporting factor to learning is echoed in previous writing outside of AL literature reminding us that vivid, vital, pleasurable experiences are highly mnemonic (Holt, 1991, p. x). Recent evidence in neuroscientific research further supports previous anecdotal suggestions that emotion and heightened attention are effectual for retention (Damasio, 2006; Paulson, 2012 in Bradley et al, 2013; Posner & Patoine, 2009; Rinne et al., 2011).

Evidence of memory impact related to both general and specific content, acknowledging reinforcement through repetition within the protocol. Whilst acknowledging that connected and frequently reviewed learning underpins AL theory (Hughes, 2005; Smith, 1996) the notion of increasing retention through elaborative rehearsal is also a recognised strength of performing arts activity (Rinne et al., 2011). One practitioner specifically perceived the children's enjoyment of the repetitive structure of the sessions and, indeed, in early childhood development, routine is a basic psychological need (Maslow, 1970). Additionally, it has been noted that children with learning difficulties respond positively to predictable patterns (Stephens, 2008). Whilst progression of physical skills is an important component, the rehearsed physical activity required to make progress may have a more weighty effect on accelerated learning outcomes.

Braced through support from multi-modal and sensory aspects, the notion of 'the enactment effect', namely the fact that physical engagement is positively linked to memory impact and progression of physical skills, was also acknowledged. It is the idea that the physical

medium of dance further magnifies the potential impact on memory (Rinne et al., 2011) and thus enhances learning (Hannaford, 2005). Deeper retention through kinaesthetic or motor encoding is discussed within (Hugues, 2005) and outside (Magill, 2011) the theoretical framework of AL. The impact of multi-modal processing is also offered as an explanation independent from any reference to AL theory (Mohr et al.; Senfor et al. in Rinne et al, 2011). Altogether, it appears that the nature of dance provides the ideal supporting factors in terms of enjoyment, enactment, rehearsed activity and multi-modal and sensory aspects to enhance memory, support understanding of cross-curricular concepts and therefore accelerate learning. Whilst AL theorists cannot claim these as original ideas, advocating the theory in applied educational practice appears warranted.

Progression of Physical Skills

The practitioners acknowledged the development of fundamental movement skills (bi-lateral, uni-lateral and contralateral movement, proprioception, balance, control and spatial awareness). In discussing learning outcomes from physical activity these results would appear to be somewhat unremarkable; that DDM was able to evidence some reasonable improvements in physical skill is, after all, what is regarded as a key strength of dance and arguably needs no further evidence. However, the underlying research aim was also to consider the cognitive impact of DDM and how the multi-modality experience might enhance possible processing. This objective was evidenced in the interview accounts.

There were observed instances of cognitive development demonstrated as more mature strategic approaches to tasks. As well as acquiring more physical control, the children were able to demonstrate a change in strategy, an advancement in motor planning, more appropriately directed to better achieving a given task. This demonstrated the crossover that exists between the definitions of procedural (Anderson, 1990) and embodied knowledge (Bresler, 2004). With an awareness that this notion is in itself fraught with philosophical

problems (Carr, 2011) it is nevertheless worthy of inclusion in this discussion because of its relevance to the neuroscientific perspective. Put simply, learning through dance movement may have a double impact, as immediate sensation (procedural knowledge) whilst having the capacity to develop a cognitive frame of reference and hence cognitive strategies (embodied knowledge).

The notion of embodied cognition spans various research fields including psychology and educational theory. It gives rise to the idea that a localised brain is an error of perception (Damasio, 2006). It alludes to the possibility that all cognition is embodied "...that the brain lives in and with a complex, thinking organism, that sweats, feels, thinks and learns and should lead all educators to understand the value of dance education" (Bradley et al., 2013, p.46)⁷ Moeller et al.'s, recent study (2012) applies this theory in a cross-curricular educational context. The concept of embodied cognition is potentially even more potent when considered in relation to any cognitive improvements gained from the practice of specific movement patterns, a concept associated with brain-based learning (Dennison & Dennison, 1989; Jenson 2000).

Learning Outcomes for Pupils with English as a Second or Additional Language and Special Educational Needs and Disabilities

Whilst a convincing body of evidence for specific exercises impacting cognition is lacking, more efficient cognitive functioning achieved through stimulating effective movement integration for developmental delay has been supported by previous findings (Blythe, 2004;2005). Furthermore, sensory movement integration is generally reported to enhance operational thought and formal reasoning (Hannaford, 2005). Examples of changed behaviour specifically in pupils with ESL/EAL and SEND were evidenced. Martin (ESL) was noted

⁷ Current dance research in the area of embodied cognition largely focuses on the cognitive processes of elite dancers which has relevance to the potency of the 'enactment effect' and explores learning through mirror neurons (Bläsing et al., 2012).

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participating in things he would not ordinarily do independently and reacting with an intense concentration: "Knowing him very well ...that is rare to see that look on Martin's face" (LB1-*Examples of Changed Behaviour*). Increased learning in special populations including ESL and SEND is supported with a variety of previous research from different areas of literature (Blythe, 2005; Gottlob & Oka, 2007; Green et al., 2010; 2011; Hardiman et al., 2009; Twiner et al., 2009/10). Armani was described as having suspected autism. Her accelerated learning from the sessions can be exemplified through her progress in one particular developmental dance game:

Armani doesn't participate in many physical activities through choice, she won't go into the playground and try and do things,... but for her to actually participate and have a go...she couldn't get back out of the spiral but I think it was the week later she was able to do that. (JB2-*Progression of Physical Skills/Evidence of new Physical Skills/Examples of Changed Behaviour*)

Findings like this corroborate the SEND movement research (Blythe, 2005; Cantell & McGehee; 2006; Green et al, 2009) that developmental movement may function simultaneously as an observational developmental marker and as intervention. Five out of the six case studies previously identified within this category demonstrated increased levels of engagement through the sessions. The remaining case study, Novia, still showed improvements through her G-H drawing and her case is discussed separately. Two particularly vivid examples of the impact of DDM on children with SEND was the increased level of participation on the part of Keyana and Anthony. For Anthony, DDM as a group activity promoted his inclusivity and his accelerated learning outcome could be regarded as a response to a positive learning environment (Hughes, 2005; Rose, 1985; Smith, 1996; 2002a; 2002b). In the case of Keyana, her level of participation far exceeded that observed by her teacher in other school-based activities. In fact, her positive response allowed her to participate mostly independently (i.e. without the one on one support she usually required). "For anyone walking in, I don't think

they would have noticed her being an autistic child” (JB2–*Examples of Changed Behaviour*). This was attributed to her musical and kinaesthetic processing preferences. Within the framework of AL theory this can arguably be attributed to a Musical Intelligence. Interestingly, and as argued by Hughes (2005), Musical and Kinaesthetic Intelligences have the fewest opportunities to be expressed as learning strengths. Similarly, Stephens (2008) observes that the use of music and dance is an important area of further enquiry in autism research.

Transfer

One of the study aims was to address the concept of transfer, defined as the ability to adapt knowledge to new contexts and situations. This was evidenced through the results of G-H drawings. Three sub-themes addressed the question from the following perspectives: concepts of measurement, ideas of transfer and examples of transfer.

Concepts of Measurement

In the interview process some useful approaches to measuring learning outcomes were offered. This came from the practitioners’ understanding that the ideas presented through dance had cross-curricular value and validity in other learning environments. The practitioners seemed keen to explore these ideas and reflected upon if they could be measured. It is recognised that the transfer of learning is not automatic and needs further exploration. Current interests in educational research advocate enquiry into how pupils can be encouraged to apply their learning from arts practice into more formal contexts (EEF, 2014).

Keinänen et al. (2000) requested more evidence on the power of dance to transfer, driven by theories about possible transfer mechanisms. Levy (2008) recommends that similar strategies like drawing visual shapes and figures, could function as summative assessments in the form of 'teacher-made' tasks that could be objectively graded. However the means adopted would not retain the external validity of the G-H test or similar measurement tool and would

therefore primarily function for practical internal assessment purposes rather than as empirical data.

The inclusion of the G-H test in this study served as an exploratory investigation of a suitable empirical measurement tool for dance science research. A quantitative measure of possible transfer was important to advancing this area of research. The purpose of choosing this method was exploratory as the short duration of the intervention was expected to negatively influence the strength of the results. The positive nature of the quantitative results does not detract from the original research intention to also consider the qualitative aspect of the drawings as being essential for providing a thorough evaluation of the usefulness of the G-H test. **In this context it appears to be important to note that the ability of children to draw influences their ability to represent their understanding of their body.** A selection of drawing samples is included.

Within the sample of 21 paired drawings, 15 pairs improved, 4 stayed the same and 2 decreased. Cases 1 and 19 scored lower on the post testing (Figures 8a/b & 9a/b).

Figures 8a: (pre)

8b: (post)

One of these pairs of results was that of Bakari whose learning, from his teacher's perspective, was one of the strongest (See Table 1). As a negative case analysis Bakari's second drawing may be considered an anomaly as it appears to be scribbled over. It has however been scored strictly according to the Aston index and stands as a negative result.

Renzo's pre drawing score is higher than his post score due to the presence of a body in the first instance. The second figure facially may arguably be more appealing. As well as a measure of developmental maturity, the G-H test has previously been used as qualitative aid to supply evidence of conceptual deficits and suspected neurological differences (Behkit et al, 2005).

Figures 9a: (pre)

9b: (post)

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Scores in paired drawings 2, 3, 5 and 10 remained the same. Martin's positive learning outcome from the practitioner's perspective was also one of the strongest (See Table 1). His drawings exemplified a score that remains constant from pre to post. However, qualitatively his second drawing is a noticeable improvement on the first.

Figures 10a: (pre)

10b: (post)

Scores in all the remaining pairs improved in either raw scores and/or M.A scores. Novia's second drawing like many of the others in this selection shows a tangible amount of increased detail including intricate patterning and additional environmental references in the picture such as the sun, flowers and butterflies. These elements receive no scored points from the Aston Index yet their presence is so prevalent in many of the post drawings that they are hard to ignore. As a case study Novia was described as above average, currently under-achieving, less drawn towards physical activities, and more inclined to oral communication. Her lack of focus in DDM sessions was attributed, by the teacher, to external influences. (See Table 1). This suggests that the novelty of the social group learning environment influenced her learning state thus impacting on her performance (Slack & Norwich, 2007). In other words, she saw the situation as a strategic opportunity to interact with her peers. Within the framework of MI theory, this may also be explained by a potential trait orientation towards engagement with others. Despite inconsistency in her focus Novia's drawings are among the sample of drawings selected to illustrate both scored and qualitative improvement. This, however, might be explained by the fact that she was performing above average at the beginning.

Figures 11a: (pre)

11b: (post)

The two final selected paired drawings are highest and lowest scores respectively and serve to illustrate the range of ability within the sample and the relative degree of improvement. Blythe's research (2005) found that children with the highest degree of neurological dysfunction showed the greatest improvement in academic measures. The lowest pre-scored

drawings 14, 6 and 8 respectively collectively suggest the greatest improvement. As an example outcome of a child with SEND Raoul's drawing diverges from an unrecognisable figure to a bold human representation.

Figures 12a: (pre)

12b: (post)

This result should be weighed against the substantial improvement from a single example of a high pre-score in paired drawing Figure 13 which for which there are no previous research findings to apply. Shereen's second drawing also contains a greater degree of unscored detail and external references.

Figures 13a: (pre)

13b: (post)

Ideas of transfer

Cross-curricular approaches and multi-sensory enhancement are supported by AL theory. Bransford and Swartz's advocacy of recognising dynamic mechanisms for possible transfer (cited in Hanna, 2008) was apparent in the observations. For instance, one practitioner mentioned that the counting and shapes used in the DDM sessions echoed areas of learning in mathematics.

Bransford and Swartz's (1999) concept of dynamic mechanisms recognise that 'knowing with', that is working with an idea first presented through one context or modality, may provide a practical framework which can guide noticing and interpreting similar ideas (cited in Hanna, 2008). Hardiman et al. (2009) support this approach from a neuroeducational perspective; that connecting memorable contexts to learning through subject crossover is a means to transfer skills and knowledge. They make the point that this mirrors the way neurological connections occur and develop in the brain.

Examples of Transfer

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It is encouraging that relative to the short duration of the study, examples of transfer were substantiated. The child who made a connection to the physiological similarities experienced during sports day is somewhat remarkable considering that as a reception pupil this was likely to be the very first time he participated in a sports day. As background to Bakari's observed changed behaviour the ability to remain still is one key distinction in the EYFS marking the transition from play to exhibiting readiness for formal learning and is an example of how the impact of physical activity programmes may assist in the process (Keay, 2011). Bakari's teacher stated that until recently he was unable to sit still even for short periods of time. It was suggested by his teacher that Bakari's DDM experience might have transferred into classroom behaviour:

...if it did feed back into the classroom Bakari would be the child. ...now I say to him 'why don't we sit down at the writing table and try to do something' he now does, whereas he couldn't cope with that a few months ago (*LB1-Examples of Transfer*).

It is not possible to claim that the session focus on acquiring skills of immobility caused the change in Bakari's classroom behaviour. However, it is possible to state that part of the weekly protocol involved finishing each session with 2-3 minutes of stillness and relaxation on the floor in which Bakari took part and improved in his performance. Blythe's (2005) research similarly showed marked improvements in children's ability to sit still and concentrate. Documented knowledge of Bakari's previous frenetic behaviour and the observational marker of his difficulties in crossing the midline might contribute something towards substantiating an explanation. Crossing the midline exercises and promoting stillness through sensory stimuli may have been an appropriate intervention. His previous inability to be still relative to his teacher's recognition of his more recent developmental progress in this regard may have a relationship with his DDM experience. Relative to Chappell's (2011) research framed in Claxton's (2008) definition of dispositions, it appears that aside from differences in theoretical

approach there is some poignant crossover of interest. As dispositions encompass aspects pertaining to being 'ready, willing and able' to learn, it is worthy of serious attention if, as Blythe's results suggest, as many as 40% of children aged 4-6 may be disadvantaged in their ability to progress in school purely from a neurophysical perspective. In other words, whilst all children are naturally disposed to learn they might not have reached a level of experience relating to the maturity that allows them to make a transition to a more formal learning situation.

Limitations

As a small-scale dance science study, although highly favourable, results need to be interpreted cautiously. There are distinct disadvantages of direct observation and measurements of transfer. Learning is inferential; defined and demonstrated as changed behaviour, there is an inability to conclude causation. This is further exacerbated with this study being fundamentally exploratory. Furthermore, the pool of interviewees was small. Another related disadvantage is that learning is non-linear; therefore, whilst direct observation may indicate that learning has occurred it does not necessarily eliminate the converse. Results should be considered with these aspects in mind and within the context of the short duration of the project.

Due to practical limitations of the time frame allowed for formal acceptance of participation, only one school was able to action the G-H drawings prior to commencement of the sessions. It was considered unethical to instigate this once programme sessions had begun which reduced the amount of data available to analyse. Whilst these measures were addressed there is no guarantee that the sample itself was representative but nor is there any reason to suppose it was unique (Babour, 2008). Moreover, in respect of the drawing exercise it is worth considering that not all young children may be engaged in demonstrating application through drawing. This makes it more difficult to determine whether it may be a matter of readiness or

interest. This is why a mixed methods study is beneficial to increase validity and reliability of data (Bradley et al, 2014).

Conclusion

This study aimed to discover whether Developmental Dance Movement (DDM) might be a useful tool to accelerate learning across the EYFS curriculum for children with a variety of needs and abilities. It further addressed the concept of transfer through the kinaesthetic experience by exploring ways in which transfer might be practically, ethically and usefully observed/measured. As a piece of dance science research it sought to discover whether the theory of Accelerated Learning (AL) could be investigated by using DDM as a kinaesthetic tool. A mixed-method design yielded new perspectives from qualitative analysis and significant quantitative findings. Results respond to calls for evidence for the important part movement plays in cognitive development (Davies, 1995) and support that physical development has a related neuropsychological foundation. The nature of these findings are not widely recognised in the broader field of physical education research.

As a main finding, enjoyment and multi-modal/multi-sensory aspects seemed to support memory impact and contribute to children's positive learning outcomes. These contributing qualities are more specific and arguably unique to dance practice. SEND and ESL/EAL pupils appeared to have particularly benefited from the experience both in their own learning outcomes and from the practitioners enhanced understanding of them through the DDM observation. Early years practitioners considered dynamic concepts of transfer as potentially useful measurement tools of learning and development. Transfer was evidenced from the practitioners' perspective of changed behaviour and from the results of the Goodenough-Harris (G-H) drawing test.

Illustrating Hanna's (2008) advocacy of the capacity of scope that exists in using dance movement as a kinaesthetic tool, DDM may provide an opportunity to enhance physical and

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cognitive development and learn curricular concepts from movement. Using this knowledge could serve a variety of interests and substantiates the provision of dance movement activity for young children within an integrated curriculum. From the widest of perspectives, scientific evidence of the impact of dance-based learning has the potential to influence educational practices and policy. Furthermore, the potential benefits for dance to contribute to raising attainment outcomes may be particularly relevant in a time when there is a focus away from the arts in education and movement opportunities are being reduced in favour of core curriculum.

To bolster confidence, replication of the study within a controlled group experiment is in process. Furthermore, this study was only able to highlight aspects of a broad range of areas of potential impact, many of which warrant deeper exploration. As there is not a substantial amount of specific scientific dance research in this area it is suggested that an in depth theoretical discussion across the disciplines would enhance the perspective of future investigation. The US Dana Foundation emphasise that it is important for researchers to work with educators to design and carry out studies that build upon the findings that arts training provides transfer effects, and determine whether this training also results in far reaching cognitive benefits (Posner & Patoine, 2009). Considering the neuroscientific evidence supporting the integrated relationship of movement and cognition, dance was surprisingly underrepresented in the neuroeducational summit report (Hardiman et al, 2009) and is equally unrepresented in the UK EEF body of research formed in 2010. There is much scope for dance professionals to work with teachers, nursery staff, and researchers to improve practice. Recognition of new directions for dance training and teaching based on scientific principles is thus an important area for research:

...perpetuated by a technological culture that results in a focus on virtual experience, and artistic activities that move away from the body, it may be now more crucial than ever that we bring learning back into the body... (Green, 2002, p118).

In this field of dance science this study represents a first step, which will hopefully serve to promote both interest and further research in this highly important area of movement and cognition involving a broad spectrum of stakeholders.

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