HOW TO UNLOCK UNDERACHIEVING CHILDREN'S POTENTIAL TO MOVE AND LEARN REPORTING ON THE FIT2LEARN INTERVENTION

Background

Many children in the UK are not reaching their potential to move and learn within the constraints of the schooling system due to poor full sensory integration. Full sensory integration is the foundation of proprioception (i.e., the sense of where one is in space) which can benefit children's abilities to fully participate and reach their potential in physical education (PE) and readiness to learn. This includes:

- **motor skills:** postural control and bi-lateral integration of motor skills, which should be in place by 7 years old, are absent. With the retention of primitive reflexes, a child may never reach their full cognitive potential (Berne, 2006).
- **sound processing:** 80 per cent of children under 5 years old experience an inner ear infection (Berman, 1994) which suppresses the inner ear's ability to process sound (i.e., effectively send messages to the brain to make sense of the noises around them). These sound processing abilities are not checked or on the national agenda despite the impact on global development via the vestibular system.
- **binocular vision** and visual processing abilities are rarely checked or on anyone's agenda.

The purpose of this article is to report on the impact of using the Fit2Learn sensory integration intervention with children in two secondary schools in the north of England. Fit2Learn[1] is a social enterprise company that combines research and advice to help all people to develop full sensory integration. The Fit2Learn sensory integration programme is designed to help individuals to achieve their potential through good control of their own basic physiology.

Full sensory integration is a complex process in the central nervous system that is made of up of primitive reflexes, visual processing and sound processing. Primitive reflexes are a set of movement patterns that are present in the first years of childhood (Berne, 2006). Their main function is to aid a baby's survival in the world outside the womb and involve actions such as a baby rolling onto their tummy or grasping for a toy. As a baby develops through the first year of life, these involuntary movements are stimulated by the brain to allow for higher cognitive brain patterns to form. If the development of these early primitive reflexes is hindered in some way, cognitive and physical development can be impaired. This suggests that if the development of primitive reflexes is inhibited or 'retained', a child can never reach their full cognitive potential, leading to poor academic attainment and behavioural difficulties in school. Of notable importance for teachers of PE, children with retained primitive reflexes and poor motor sensory integration may be unable to perform movement skills competently (Gieysztor, Choińska & Paprocka-Borowiczm, 2018). Furthermore, Feldhacker *et al*. (2021) recommend that, as retained primitive reflexes can negatively affect scholastic performance, as 100 per cent of children tested in their research had at least one retained reflex, further research is required to help pupils to reach their potential.

Among typically developing children, strong motor skills signal better school readiness in multiple areas, suggesting that intervening with children whose motor skills are weak may smooth their transition to school (Pagani & Messier, 2012). There is further evidence which suggests that there is a correlation between cognitive growth and movement (Biddle & Asare, 2011).

Gross motor skill development is fundamental for:

- suppression of retained primary reflexes to have basic muscle control
- bilateral integration to make use of both arms to complete a task
- development of fine motor skills
- posture, to be able to hold the head in a manner that optimises the use and development of auditory and visual processing skills
- development of self-awareness, spatial awareness and orientation, and proprioception.

"The Fit2Learn sensory integration programme is designed to help individuals to achieve their potential through good control of their own basic physiology."

[1] https://fit-2-learn.com

Visual processing skills are what our brain uses to make sense of what we see in the world around us. This is achieved by the coordinated use of both eyes, in what is known as binocular vision. All children need to develop binocular vision to be efficient learners. This allows both eyes to work together so that children can: i) learn how to use their cognitive visual skills fully, hence be able to see patterns in 3D, distinguish relevant from irrelevant information, and read the world around them; and ii) track text smoothly with both eyes, hence read efficiently.

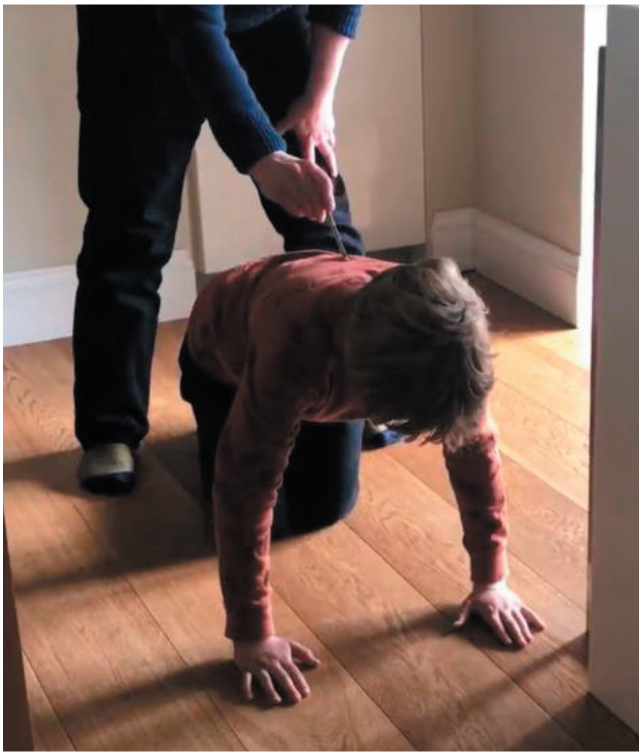
Inner ear infection is the greatest cause of learning barriers and auditory processing disorders (Madaule, 1997). This can inhibit children from developing sound processing skills. Acute inner-ear infection affects up to 80 per cent of children at some time before age 5 years (Klein, 1994) and hearing loss may persist well after the other symptoms have been resolved (American Academy of Family Physicians, 2004).

Tests are selected to assess whether the student has mastered working with both left and right sides of their body in a coordinated and fluid fashion in any direction, and that they have the core strength to support their head for a day at school.

Research aims

Our research objectives were:

1. Examine the relationship between completing the Fit2Learn programme and children's readiness to learn.
2. Examine how completing the Fit2Learn programme influences children's engagement in lessons.
3. Evaluate the feasibility of the Fit2Learn programme being implemented in school by teachers.
4. Investigate how PE lessons can be adapted to incorporate movement therapy to help take control of retained primitive reflexes.



Assessing retention of the Spinal Galant Reflex.

Methodology

We worked with a small group of young people in alternative provision and secondary school settings who were recognised to be at risk from poor emotional and mental wellbeing. The young people took part in a range of specific activities designed by Fit2Learn in school to help their motor-sensory development. By providing this targeted support, the programme aimed to improve their future opportunities by enabling their readiness to learn and improving their movement competence, self-confidence and motivation to make more positive life choices, thus influencing their future education and employment.

The study occurred over six months, from May to December 2022. The participants were pupils (n=12) from two schools in the north west of England: one mainstream secondary school (School A) and one special school (School B). Each school was asked to identify up to eight pupils who were disengaged from their learning, who struggled with regular classroom activities and who demonstrated poor motor skills. School A identified eight pupils and School B identified four pupils. These pupils (and their parents/carers) were invited and consented to participate in the intervention.

The participants were initially assessed for visual processing, audio processing, motor skills, primitive reflexes, emotional and mental wellbeing, fundamental movement skills competence, readiness to learn and perceived fundamental movement skills competence. The measurement tools were:

- primitive reflexes – Fit2Learn assessment protocol
- motor skills – Fit2Learn assessment protocol
- fundamental movement skills competence – Canadian Agility and Movement Skills Assessment (Longmuir *et al*., 2017)
- perceived fundamental movement skills competence – Pictorial Scale of Perceived Movement Skill Competence (Barnett, 2016)
- visual processing – Visagraph®
- audio processing – Tomatis® Testing protocol
- readiness to learn – Tansley Test and Wechsler intelligence scale for children (Wechsler, 1992)
- classroom engagement – semi-structured interviews with teachers.

This baseline testing was conducted in school by the director of Fit2Learn and two members of the research team from the university.

The participants were led through the Fit2Learn programme over the course of six months to develop their primitive reflexes, gross motor competence, vision and sound processing. The daily activities (for motor skill development and sensory processing) were delivered by school staff who were trained by the Fit2Learn director beforehand. The experimental groups were monitored at intervals of two to three months and re-tested for motor skills, primitive reflexes, audio and visual processing at these testing points.

The intervention

Primitive reflex exercises

Pupils were asked to complete six different exercises ranging from 'Meatball' to improve core strength, 'Star' to control the Moro Reflex and a panther crawl to improve bilateral integration. Pupils were asked to complete these every day for 40 days during their lunchtime.

Tomatis sound processing
This consisted of listening to specifically designed music (mainly Mozart) using Tomatis' unique approach to exercise the inner ear through air and bone conduction. The specially created music is delivered to the participant through two separate channels known as 'gating' and these differ by timbre and intensity. The music switches between each channel unpredictably having the effect of surprising the brain, thus developing greater listening clarity. The school committed to changing the pupils' timetables to allow them to listen to the sound therapy for 80 minutes per day, for 14 days.

Eye-strengthening exercises
All pupils' baseline tests identified ineffective binocular vision which can create difficulties in the classroom, such as poor focus and tiredness. The intervention consisted of using the eye muscles to their full range, for example: learning to wink with both eyes, moving eyes around without moving their head, crossing the mid-line, i.e., moving items from pots with one hand and placing them in the other pot (without moving their head), and juggling to develop peripheral vision.

Results

Part 1: A summary of the baseline testing for pupils who were evaluated using the Fit2Learn motor sensory integration protocol

Baseline testing showed that all of the 12 pupils had developmental challenges with motor-sensory integration. This was evident in the following ways:

- *motor skills:* retained primitive reflexes; bilateral integration of motor skills and postural control.
- *sound processing:* suppressed and confused.
- *binocular vision and visual processing:* limited to very limited.
- *cognitive processing skills:* restricted by problems with motor skills, sound processing and visual processing.

On completion of the baseline testing, an individual report was produced for each pupil and shared with the school. The report was used by the Fit2Learn consultant to design an individualised programme for that pupil, which was then delivered during the intervention.

Part 2a: Summary of overall changes to pupils' motor sensory integration measured at regular intervals during and upon completion of the Fit2Learn programme

Motor sensory integration
As the results are based on individual engagement and progress it is difficult to give a fully accurate, overall result to this project. However, after two rounds of Tomatis Sound Therapy and 40 days of movement therapies and eye exercises, the headline findings at the end of the intervention were as follows.

- All pupils' sound processing improved (some significantly) as a result of two rounds of Tomatis Sound Therapy. This will help their brains to process the sounds (e.g., instructions) they hear during the school day and especially in the classroom, where they can make more sense of their environment.
- Some pupils improved (strengthened) their posture which will impact on visual control and sound processing.

Zombie test to assess retention of the Asymmetric Tonic Neck Reflex (ATNR).

- Some pupils made progress with control of their eye muscles which will help them to concentrate and feel less tired in class.
- Some pupils have improved mid-line crossing, although more work is required to master this skilfully (without involuntary head or body movements).
- Some pupils can now hold binocular vision, although more work is required to master this skilfully.

Movement competence
Overall, all pupils in the project had low levels of movement competence when measured at baseline. This is typical for children with retained poor motor sensory integration (Gieysztor, Choinska & Paprocka-Borowicz, 2018). Within two weeks of completing the intervention, pupils' movement skills were re-assessed in school. The results show that improvements were made to their movement competence. This is significant due to the positive association between movement competence and educational outcomes (see Da Waal & Pienaar, 2020; Jaakola *et al*., 2015; Veldman *et al*., 2019) and increased physical activity and health-related fitness in children (Holfelder & Schott, 2014; Robinson *et al*., 2015; Stodden *et al*., 2008).

Perceived movement competence
At baseline testing, pupils' perceived movement competence was low across the participant group. At the point of follow-up testing in school, improvements were recorded to children's perceived movement competence. Overall, greater improvements were made to perceived competence than actual movement competence. Earlier research has indicated that perceived competence is a good indicator of physical activity levels (Bolger *et al*, 2018) and global self-worth (Bardid *et al*, 2016). Thus, there is a potential indirect benefit of the Fit2learn programme on children's outcomes through fostering their perceived competence.

Part 2b: Teachers' perceptions, experiences and observations of changes in pupils' engagement in the classroom

Baseline results

When some of the pupils were told their visual processing was not strong and was probably contributing to poor concentration levels in class, some pupils were relieved to be able to make sense of their daily learning challenges.

Feedback from class teachers

The overriding change in pupils was the level of confidence around school and in the classroom. Participants also fed back that they could feel a positive change in themselves. The intervention made a particular impact on Child HA who had been labelled as a pupil with poor concentration levels. Her baseline sound processing test showed that, in a busy, noisy classroom, she would not be able to hear her own name due to the distractions. Child HA's teachers commented that not only had her concentration levels improved, she was now contributing in class. Another pupil, who previously struggled to regulate his emotions, was able to self-regulate due to his planned sound processing therapy session. Child HB, who has cerebral palsy, was using her weaker arm more following the intervention, which her teacher suggested was due to improved performances in the motor skill exercises. As a result of the sound processing, two pupils who enjoyed singing were sufficiently confident to feature in the school's Christmas performance. Finally, it was observed that a transitioning pupil was feeling more confident and comfortable in who they wanted to become and was happier fitting in with other pupils. Teachers reported that this pupil felt less anxious about what other pupils were saying and thinking and was more talkative.

Conclusion

The results of the project illustrate positive outcomes for children through completion of the Fit2Learn programme. Each pupil improved their motor-sensory integration. In some cases, improvements were seen to pupils' movement competences and perceived competences, which are both associated with academic attainment and higher physical activity levels (De Waal & Pienaar, 2020; Jaakkola *et al*, 2015; Holfelder & Schott, 2014).

The purpose of the project was to evaluate the impact of the Fit2Learn programme on children's capacity to learn. The reports from teachers provide considerable evidence of how pupils' engagement in the classroom and attitude to learning have improved. Previous evidence suggests that improving primitive reflexes and movement capacities can improve cognitive ability (Krog, 2011), thus unlocking children's potential to learn. The findings of this project illustrate that children's engagement and attitude towards learning in the classroom may be inhibited by poor motor sensory integration and that greater focus is needed in mainstream schools and alternative provision to identify and support children who have poor motor sensory integration.

Despite the progress evidenced with the pupils who took part in this project, further work and improvements are still required for all pupils in postural control and sitting upright, strengthening of eye muscles, crossing the mid-line with hand, eye and brain, and learning to use eyes and brain to see and process puzzles and problems.

Snow angel to assess bilateral integration of motor skills.

An unintentional, yet significant, finding from this project was that there are children in mainstream schools who have poor motor-sensory integration. Previous studies within alternative provision (Krog, 2015; Krog & Kruger, 2011) suggest motor-sensory and movement interventions have helped to improve pupils' academic ability but there is a lack of research in mainstream schools where such issues are likely to be unnoticed by teachers given motor-sensory development does not feature in the National Curriculum (Department for Education, 2013a; Department for Education, 2013b). Thus, it could be hypothesised that children with poor motor sensory integration in mainstream settings are missing support that might improve their cognitive function and capacity to learn. To address this disparity, school staff would benefit from motor-sensory integration training to correct motor functions (Gieysztor, Choińska & Paprocka-Borowicz, 2018) along with the inclusion of designated time in the school day to promote pupils' motor sensory integration.

Recommendations

As a result of this study, we recommend involving more schools and pupils in the Fit2Learn programme so that:

- More schools and pupils learn about the impact of improving pupils' motor sensory integration to give them the greatest chance of success in the classroom.
- More teachers are encouraged to understand that many children are low achievers because a lack of full sensory integration is preventing them from learning like others, despite the same levels of intelligence.
- An understanding of children's challenges regarding posture, sound processing, binocular vision and retained primitive reflexes is shared with pre-service teachers.
- Senior leaders consider adapting their existing timetables to incorporate these therapies into their normal school day and/or see the benefits of incorporating them into regular PE lessons for all pupils.
- Pre- and in-service teachers are offered professional development to recognise movement restrictions in pupils and include the correct movement therapies that will help all pupils to maintain control of their retained primitive reflexes. ■

Daily movement therapy intervention example

If a pupil...	*(Likely) retained primitive reflex or ineffective use of body*	*Test*	*Daily exercise to remedy*
Struggles to sit on the carpet or is fidgety when sitting on a chair	Spinal Galant	Run your finger along a child's spine **https://www.youtube.com/watch?v=zBXLRjxpSYE**	Robot (x5 performed slowly and controlled on both sides) **https://www.youtube.com/watch?v=qm9NfP4cx0M**
Cannot turn their head independently of neck/ shoulders	Asymmetric Tonic Neck Reflex (ATNR)	Zombie **https://www.youtube. com/watch?v=bEPcgyDXUV4**	Robot (x5 performed slowly and controlled on both sides) **https://www.youtube.com/watch?v=qm9NfP4cx0M**
Struggles to use opposing limbs	Poor overall bilateral co-ordination	Skip (with arms) forward and back	Panther crawl (x5) **https://www.youtube.com/watch?v=pACGpAr0Tcs**
Slouches when sitting at a desk	Poor abdominal strength	Meatball hold	Meatball (5 seconds x 3) **https://www.youtube.com/watch?v=GE 3wlwTBkOo**
Has poor bilateral integration	Can't cross mid-line	Snow angel (moving lefts and rights)	**https://www.youtube.com/watch?v=YWB63IRddzQ**

Visagraph® visual processing test.

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Tom van Rossum and **Paul Ogilvie**

Dr Tom van Rossum is Senior Lecturer in Physical Education at Carnegie School of Sport, **Leeds Beckett University**.
Paul Ogilvie is Course Director of PGCE Secondary at Carnegie School of Education, **Leeds Beckett University**.