# WHO IS ACTUALLY DRIVING? A TRANS-THEORETICAL VIEW OF MATHEMATICS ANXIETY

**Nardia Randell**
**University of Johannesburg**
**South Africa**
**randell@sjc.co.za**

**Geoffrey Lautenbach**
**University of Johannesburg**
**South Africa**
**geoffl@uj.ac.za**

**ABSTRACT** – Mathematics anxiety (MA, or maths anxiety, for short) is a phenomenon which, at first glance, seems a simple term, but on closer investigation reveals itself to be a highly complex construct. For this reason, we propose in this paper that a trans-theoretical lens is needed when we look at maths anxiety in high school core maths pupils who are already under considerable pressure for their scholastic level. We integrate cognitive-behavioural theory with positive and social psychology tools, as well as drawing on fields of neuroscience, and STEM (Science, Technology, Engineering and Maths) education within the context of increasingly globalised education, which falls within the so-called 4th Industrial Revolution. We claim that not only pupils with poor maths ability can suffer from MA; average to top pupils can, too. These pupils often fall through the cracks where assessment policies drive pupils too fast but do not teach them to steer. We introduce the motorway model as a metaphor for education systems and propose a policy change that includes cognitive affective self-regulation and Mind-Body Skills strategies (which can be taught). These tools offer solutions alternative to medication, psychotherapy, or extracurricular classes.

**Keywords**: Mathematics, Maths, Anxiety, Somatic Experiencing®, embodied psychology, positive psychology, mind-body skills, high school.

## INTRODUCTION: THE NATURE OF MATHEMATICS ANXIETY

When a child goes through a challenging time in their lives, for whatever reason, one of the first places it becomes visible at school is in their science and mathematics marks. The literature suggests that the individual with maths anxiety may have a deficit in numerical reasoning processes without having a clinical anxiety diagnosis. The individual is described as experiencing this anxious state as debilitating, and out of their control, to the point where it disrupts their ability to solve a maths problem, and lowers their maths achievement grades. Attitudes towards mathematics have also received attention in the literature and are well-described (Hannula, 2002; Zan, Brown, Evans, & Hannula, 2006) but will not be dealt with in this paper. Psychometric literature is also very clear on the global consequences of mathematics anxiety. People who are anxious about mathematics tend to sidestep it as far as possible, evading elective coursework in school and university mathematics. They also avoid career paths that involve mathematics (Ashcroft & Krause, 2007). Mathematics anxiety is a phenomenon which, at first glance, seems a simple term, but on closer investigation reveals itself to be a highly complex construct.

As far back as 1972, Richardson and Suinn (1972) defined maths anxiety as “feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations” (p.551). Sherman and Wither (2003) point out that this assumes mathematical anxiety is a causative agent which impairs mathematical functioning. Rubensten & Tannock (2010) make an important point that maths anxiety as a concept, is “not clearly discussed or scientifically studied”, and is “specific to a maths context and therefore distinct and occurring in the absence of generalised anxiety” (p.2). Elsewhere, maths anxiety is defined as “a state of discomfort occurring in response to situations involving mathematics tasks that are perceived as threatening to self-esteem”. There are many other definitions in the literature but the concept lacks clarity, and in many cases authors try to embed it theoretically in either educational or psychological fields. This position paper makes the point that whilst the term math anxiety is currently accepted and used within realms of mathematics, education, and abnormal psychology, it is often approached from a single viewpoint, eg. from Mathematics- or Psychology- fields, or STEM (Science, technology, engineering and maths) education. We propose that if we are to adequately conceptualize the complex construct of maths anxiety, it would be best to consider an inter-disciplinary approach, viz. integrating the education, and/or mathematics fields, as well as the psychological and neurological disciplines.

Rubinsten and Tannock (2010) note that it is generally accepted in lay circles that maths is stressful. Their 2010 research focus was in the realm of the diagnosis of Developmental Dyscalculia (or DD); which in Psychology is classified as a specific learning disability involving "a deficit in processing numerical information" (Rubinsten & Tannock, 2010, p.2). They argue that from a young age the lack of maths abilities may precede and give rise to maths anxiety, creating a vicious cycle. They claim that maths anxiety is distinguishable from other types of anxiety symptoms and has a direct and damaging effect on underlying cognitive processes as the individual performs a maths task. They found this was especially true for individuals with DD. This would suggest that the individual has a pre-existing numerical processing or reasoning deficit. It makes sense that pupils with DD would be more susceptible to maths anxiety, but it would be important to note that maths anxiety is not only found in subjects with poor maths achievement or ability. As an Educational Psychologist based in a high school, the author has observed that high school pupils in the top 10 percent of Maths achievement (and, by implication, ability) also struggle with maths anxiety, despite excellent grades. Others appear average in terms of marks or ability and have erratic performance in tests or exams while displaying significant anxiety levels which disrupts their functioning in many subjects – which is a more general test anxiety – or specifically, in Maths. Thus, for the purposes of this paper, the focus is specific to high school, core maths, pupils, who are under considerable pressure during a crucial cognitive and socio-emotional developmental stage.

This paper suggests firstly that maths anxiety needs to be considered holistically, across multiple theoretical disciplines, and as a complex construct. Evans, Dougherty, Pollack & Rauch (2006, p.10) confirm that various approaches to maths anxiety should be "neither conflicting nor overlapping: they can be seen as complementary, as different lenses that allow researchers and teachers to assume different points of view, in order better to understand students' mathematical behaviour." Secondly, we claim that maths anxiety may also be a function of the current social and educational context, and national assessment policies, and is thus not necessarily a pathology of anatomy or cognitive processing. Maths anxiety may often only gain attention when it is due to a learning disability such as Developmental Dyscalculia, or Dyslexia, and when the pupil's overall grades are low. Thirdly, we based our ideas in this paper on the assumption that there is a complex inter-relationship, unique to the individual, between the individual's mind (cognitive thoughts and attitudes, reasoning and logical assessment of numerical problems), their body (in particular, the autonomic nervous system, and especially with respect to the primitive fight, flight, or freeze threat response), their internal psychological emotions (neurologically based in the Limbic brain system, involving mood, affect, disposition), as well as their environment, and past experience.

## 'STEERING' MATHS ANXIETY: KEEPING THE DRIVER IN CONTROL AND ON THE ROAD

It would be helpful, at this point, to consider an analogy of individuals who are "driving" their "vehicle" - referred to by Walker and Walker (2015) as "affective-social self-regulation", or "steering cognition". These authors refer to the adolescent's scholastic "journey" as the 'educational Motorway.' Steering cognition is described as the way in which the human brain tends to bias its attention toward some things, yet will 'tune out' others, before sifting through past memories and experiences, as well as past patterns of self-representation, before it responds. The analogy of the car is sometimes used to explain steering cognition. As the 'controls 'of our mind, this steering cognition regulates the mind's direction, brakes and gears. Studies have shown that steering cognition is not the same as the 'engine' of our mind, sometimes referred to as algorithmic processing, which is responsible for how we process complex calculations (Walker, 2015; Evans 2011). Steering seems to involve a primitive system (autonomic nervous system/ANS) which rapidly integrates memory and perception as well as the associated thoughts and sensations in a given situation, leading to a decision or an action.

Walker (2015) draws on a general theory of the mind called Dual-Mind Theory, which asserts that the brain has two parallel systems for processing data. The first system is fast and intuitive, and works by associative thinking and comes up with approximations that may contain error. He explains that this system can be understood as intuitive and unconscious (Walker, 2015). The second system is thought to be a conscious, slower and effortful system, which works by

algorithmic processing to reach conclusions; in other words, the brain will apply a “step by step algorithmic procedure in which it works its way through a series of steps to the right answer” (Stanovich, West & Toplak, 2011; Walker, 2015). Walker explains that the brain will choose the intuitive, rapid processing system (System 1) before the slower trial and error system (System 2), because it takes less effort. In other words, if System 2 can override the System 1 with conscious effort we may be able to alleviate anxiety. If anxiety triggers an ANS stress response, which prioritises survival and rapid response rather than rational algorithmic processing, it is clear that an individual suffering with maths anxiety will not think harder, or more rationally, to solve the maths (or the anxiety) problem, since the primitive, intuitive speed-dial circuit has taken over the steering wheel. In response to the question ‘Does the brain think straight?’ the dual-mind theory answer is: “it can but it often chooses not to” (Walker, 2015, p3.). It seems that with Maths Anxiety, it actually cannot. At least, it cannot rationally self-regulate and resume steering and algorithmic processes, until the primitive ANS is regulated. Pizzie and Kraemer (2018) state that “conceptually, maths anxiety encompasses physiological stress responses, negative thoughts and cognitive appraisals due to past and present experiences with maths, as well as more general attitudes and stereotypes associated with maths, gender, and self-identity as it relates to intelligence and academics (p.2). However, they also add that the experience of maths anxiety is equivalent to other types of anxiety, in terms of autonomic nervous system activation.

Walker and Walker (2016) first coined the idea of the Motorway Model to describe a model of education which, they argue, lies behind the current UK secondary school academic assessment framework. The Motorway Model is based on an ideological belief that the quality of education can be measured by the number of pupils, and their distance travelled down an academic road toward narrowly defined, publicly examined, academic targets (Walker & Walker, 2016). They maintain that this model has driven a culture and pedagogy within UK schools to fulfil these motorway goals. For example, schools have narrowed the educational road by reducing the diversity of styles of pedagogy in the classroom and curricula beyond the classroom. They argue that schools have consequently emphasised certain academic streams and types of national exams as indicators of their excellence. The researchers imply that higher academically performing schools within this assessment framework are likely to exhibit greater Motorway Model characteristics than lower performing schools. In South Africa, the independent/private schools often release their Matric results with statements intended to showcase their excellence, such as boasting of a 100% BD (Bachelor’s degree entrance to a university) pass rate. This implies there is only one route to occupational success post matric and ignores any technical or trade driven qualification. Students in South Africa may feel this is the only way to achieve success, rejecting other, or divergent, routes, to occupational careers.

An affective impact on self-efficacy and self-esteem is readily acknowledged in the literature (Pekrun, Goetz, Perry, Kramer, Hochstadt, & Molfenter, 2004), as is a worrying increase in adolescent mental health challenges, such as generalised anxiety, depression, substance abuse and suicidal behaviours, which Walker and Walker (2016) blame on the high stakes testing pressures caused by the Motorway model of education. If we are to address maths anxiety in the South African classroom, we need to suggest a new approach. As such, our starting point would be a psychoeducational strategy (alongside cognitive affective steering or self-regulation principles) but with a more physiological or ‘embodied’ approach. This would involve teaching skills for self-regulation of the body, (i.e. working out exactly who is driving at the time - or, which system has the wheel?) and then follow up with co-regulation and self-regulation skills, to control the mind and emotions. This proposed intervention would be well aligned with Walker and Walker’s (2015, 2016) cognitive affective steering analogy, and their motor way model, but would also incorporate Stephen Porges’ theory of polyvagal processing (Porges,2009), in that we would first help the individuals (using co-regulation initially) to learn to regulate their autonomic nervous systems (ANS) and then we could incorporate cognitive steering or self-regulation strategies involving cognitive-behavioural techniques (CBT) (see also Lautenbach & Randell, 2017; 2018). Porges explains that the primitive brain, or ANS, if it perceives threat, will short circuit the rational neocortex and emotional or limbic neurological systems; i.e. The ANS takes the wheel and drives

the car, whilst the executive functions needed for maths problem solving are relegated to passengers at the mercy of the new driver, who is focussed on surviving the threat.

Evans et.al. (2006) summarise two different arms of investigation in mathematics education research on affect: 'mathematics anxiety', and ‘attitude toward mathematics’ (ATM). Most of these researchers assumed a 'negative' relationship between test anxiety and performance: test anxiety inhibits cognitive processes, e.g. recall of prior learning, thereby reducing performance. Others considered test anxiety as being the effect of repeated experiences of poor performance. Evans et.al. (2006) cites studies that believed that ATM is related to achievement (good grade) outcomes, and affective outcomes (such as liking mathematics) which depend on the memories and experience of past test situations. Once again there is a link between cognitive theory, affect (positive or negative pre-test baselines or post- test situations) and the physiological autonomic stress response (due to associated past memories and experiences); we need to consider the big picture.

We therefore suggest a complex strategy be applied to addressing this complex construct, whereby we would integrate cognitive-behavioural theories and techniques, with positive and social psychology tools, as well as drawing on fields of neuroscience, and STEM (Science, Technology, Engineering and Maths) education principles. These are seen within the context of the increasingly globalised educational context, which falls within the so-called 4th Industrial Revolution.

**WHY DO WE HAND OVER THE STEERING WHEEL?**

In the light of the above discussion, it would seem that the handing over of the cognitive steering wheel in tests or exams is primarily linked to the neurophysiology of the stress response. Pizzie and Kraemer (2018) define the construct of maths anxiety as one which works on multiple levels, influencing biological responses, social attitudes including self-identification, and cognitive changes, all of which are consistent with the biopsychosocial model of negative affect. They add that maths anxiety exerts changes on a biological level, such that maths-anxious individuals show “amplified activity in regions of the brain associated with risk and awareness, and decreased neural activity in regions associated with mathematical processing” (Pizzie & Kraemer, 2018, p.2).

Integrated, trans-theoretical approaches are emerging. Wilson (2018) proposes the Structured Image Framework Theory (SIFT) model, which aims to integrate the psychological and neuroscientific concepts of information processing and emotional ANS activation. The below figure shows the SIFT Model for how information is perceived, filtered, evaluated, organized, and remembered. It integrates emotional processing, established personal beliefs, as well as illustrates how the primitive brain structures interact with these, enabling higher executive function and perception processes as well as memory encoding, that “consolidates established belief structures.” These belief structures then “influence future emotional processing, thinking and behavioural patterns, for everyday functioning and survival, if warranted, with trauma” (Wilson, 2018).

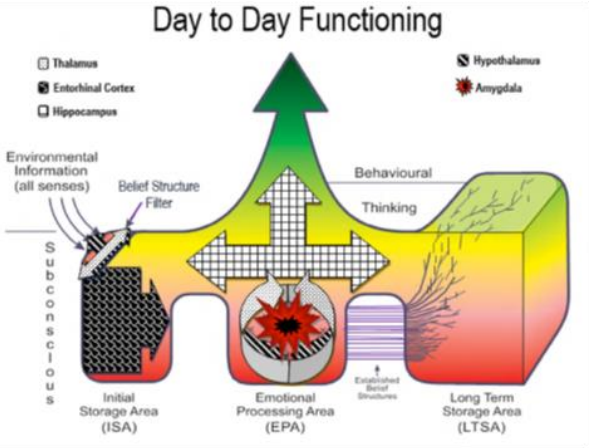

**Figure 1: The SIFT Model (Wilson, 2018)**

## TAKING BACK THE STEERING WHEEL – DEALING WITH MATHS ANXIETY

Past solutions for dealing with maths anxiety have followed unidimensional theoretical approaches to the concept, since treatments or programmes reflect the lens through which the Maths Anxiety problem is viewed. Fortunately, current trends in dealing with maths anxiety are not restricted to one framework or theory. Spangenberg (2018) mentions studies from the early nineties which offer some basic options to reduce mathematics anxiety, such as cognitive restructuring tools (cognitive behavioural therapy, or CBT techniques) in combination with relaxation exercises, mathematical games outside the classroom and group counselling. Spangenberg (2018) also refers to a 2018 study where psychodrama was used with significant changes in levels of mathematics anxiety.

Similarly, education theorists Adams and Dove (2016) found that students exposed to flipped classroom approaches had significantly decreased anxiety scores. This makes sense in the light of the literature around 4IR (Schwab, 2017) and 21st century skills (Silva, 2009; Dede, 2009) with modern students who turn to learning from the internet as second nature. Besides the collaborative and practical experiences online, there is still room for more innovative solutions related to maths anxiety. Some 4IR-driven studies are emerging in fields of education and psychology involving the use of virtual reality, or VR, which immerses the pupil in the game or situation at hand (Anderson, Price, Edwards, Obasaju, Schmertz, Zimand, & Calamaras, 2013). This raises exciting possibilities for maths anxiety sufferers – imagine a VR world within which they have maths problems to solve, with VR 'guides' to assist with autonomic nervous system responses, (which are tracked in real time by their mobile phone's haptics) and cognitive self-regulation tools. Evans et. al. (2006) note that perhaps the most exciting and integrative research pertinent to maths anxiety is emerging from the fields of 4IR, education tools, and neuroscience. Neuroscientific findings as to the interaction among cognition, metacognition, affect, and maths problem solving, further highlight the interrelationship between the primitive brain, emotions, memory and decision-making processes.

## DISCUSSION: WHERE IS THIS CAR GOING?

Walker (2016) raises concerns as to the impact of the Motorway Model on mental health – and calls for policy revision in terms of assessment policies. Long term policy revisions are an essential part of this process – and getting these changes in place feels overwhelming when we consider the nature and density of the educational motorways of the world. This suggests that education departments'- and schools'- policies may need to make top-down changes, if young people are suffering mental health issues as a result of the pressures imposed by these policies. If they don't consider this, they are simply approaching rising levels of maths anxiety by either medicating young people too readily, or labelling them as' having a problem', which requires remedial or psychological therapy, which are also costly in terms of time, energy and resources, let alone in terms of the impact on an individual's self-esteem, and higher education curriculum choices. We also propose in this paper that in order to assist in the immediate situation, a less invasive, and less pathologizing approach to managing maths anxiety in high school students would be integrating existing cognitive theories (such as "self-regulation", "cognitive affective steering"), and psychological strategies (such as cognitive-behavioural therapy techniques), with embodied approaches (such as mind-body skills, mindfulness interventions).

An emerging, integrative, neuropsychological, and somatic (or embodied) approach to therapeutic and educational fields is yielding promising results around 'mind-body skills strategies' and how they assist with anxiety and resilience (Saunders, Tractenberg, Chaterji, Amri, Harazduk, Gordon, & Haramati, 2007). With Yoga breathing exercises (pranayama breathing), for example, people practice controlling the breath, or 'prana', to achieve a calm, focussed state. Research findings are also finding multiple benefits from improved sleep quality to inducing an overall sense of wellbeing, as well as reducing anxiety. As early as 1991, neuroscientists at UCLA found an area of the brain which contains neurons that fire rhythmically with each breath, called the pre-Bötzinger complex (Smith, Ellenberger, Ballanyi, Richter, & Feldman, 1991). Also known as the 'breathing pacemaker' it controls several different rhythms in breath – such as yawns, sighs, or

gasps - which are associated with social and emotional signals to the brain (as cited in Kwon, 2017). Psychological and embodied therapies and theories, such as Somatic Experiencing© therapy by Peter Levine (2010), or Bessel van der Kolk (1994), are providing significant relief to trauma and generalised anxiety sufferers. For this reason, it would seem wise to consider that the ANS stress or threat response mechanisms, which associate with limbic system affect and memory to override algorithmic or higher order thinking, need to be the starting point with maths anxiety, too.

In theory, pupils with maths anxiety (which is not a generalised anxiety disorder) would benefit as much as those who are diagnosed with such a disorder. Pupils in high stakes exam situations who struggle with maths concepts, and thus maths anxiety, would equally benefit as much as those who are top achievers, and who are experiencing maths anxiety due to the perceived threat of the testing situation, from mind-body skills strategies. There is room for a wealth of research into education systems, high stakes exam pressures, and mind-body skills strategies teaching (see Lautenbach & Randell, 2017;2018), if we are to address this complex problem holistically.

## A FINAL WORD

This position paper proposes a trans-theoretical approach to dealing with maths anxiety. South Africa's government and private school systems should also heed the warning signs. If this were a road sign, it would resemble those indicating "high accident zone – proceed with caution." The cost to the mental health future of our country and globally to the youth is significant, when we drive students too fast, without teaching them to "steer". Mind-body skills strategies are key tools towards the teaching of steering skills, as well as to managing maths anxiety (both preventatively and reactively) – It would seem significantly better than medicating our youth to cope within the chaos.

## REFERENCES


Adams, C., & Dove, A. (2016). Flipping Calculus: The potential influence, and the lessons learned. *Electronic Journal of Mathematics & Technology*, *10*(3).

Anderson, P.L., Price, M., Edwards, S.M., Obasaju, M.A., Schmertz, S.K., Zimand, E., & Calamaras, M.R. (2013). Virtual reality exposure therapy for social anxiety disorder: A randomized controlled trial. *Journal of Consulting and Clinical Psychology*, *81*(5), 751.

Ashcraft, M.H., & Krause, J.A. (2007). Working memory, math performance, and math anxiety. *Psychonomic Bulletin & Review*, 14(2), 243-248. doi:10.3758/bf03194059

Evans, K.C., Dougherty, D.D., Pollack, M.H., & Rauch, S.L. (2006). Using neuroimaging to predict treatment response in mood and anxiety disorders. *Annals of Clinical Psychiatry*, *18*(1), 33-42.

Evans, B.R. (2011). Content Knowledge, Attitudes, and Self-Efficacy in the Mathematics New York City Teaching Fellows (NYCTF) Program. *School Science and Mathematics*, 111(5), 225-235.

Hannula, M.S. (2002). Attitude towards mathematics: Emotions, expectations and values. *Educational studies in Mathematics*, *49*(1), 25-46.

Kwon, D. (2017). Meditation's Calming Effects Pinpointed in the Brain. In *Scientific American*, march 30 2017:22-46. Accessed online June 2019 at https://www.scientificamerican.com/article/meditations-calming-effects-pinpointed-in-brain/

Lautenbach, G. & Randell, N. (2018). *Distraction or opportunity? Technologies for adolescent stress management.* In. Proceedings of ISTE International Conference on Mathematics, Science and Technology Education, 22 – 25 October 2018. Held at Skukuza Camp, Kruger National Park, Limpopo, South Africa. (pp.363-370). University of South Africa, Unisa Press. ISBN. 978-1-77615-047-2

Lautenbach, G. & Randell, N. (2017). *Using mobile technologies for self-regulation in high school learners' stress managemen*t. In. Proceedings: Towards Effective Teaching and Meaningful Learning in Mathematics, Science and Technology Education. 23–26 October 2017 UNISA/ISTE Conference on Mathematics, Science and Technology Education. Held at Mopani Camp, Kruger National Park, Limpopo, South Africa. pp.94-99. Available at http://uir.unisa.ac.za/handle/10500/23444.

Levine, P.A. (2010). *In an unspoken voice: How the body releases trauma and restores goodness*. Berkeley, California: North Atlantic Books.

Pekrun, R., Goetz, T., Perry, R.P., Kramer, K., Hochstadt, M., & Molfenter, S. (2004). Beyond test anxiety: Development and validation of the Test Emotions Questionnaire (TEQ). *Anxiety, Stress & Coping*, 17(3), 287-316.

Pizzie, R.G. & Kraemer, D. J. (2018). The Academic Anxiety Inventory: Evidence for dissociable patterns of anxiety related to math and other sources of academic stress. *Frontiers in Psychology*, *9*, 2684.

Porges S.W. (2009). The polyvagal theory: new insights into adaptive reactions of the autonomic nervous system. *Cleveland Clinic Journal of Medicine*, *76*(2), S86–S90. doi:10.3949/ccjm.76.s2.17

Richardson, F.C., & Suinn, R.M. (1972). The mathematics anxiety rating scale. *Journal of Counselling Psychology*, 19. pp551-554.

Rubinsten & Tannock (2010). Mathematics anxiety in children with developmental dyscalculia. *Behavioral and Brain Functions.* 6:46
http://www.behavioralandbrainfunctions.com/content/6/1/46 Accessed 20 June 2019.

Saunders, P.A., Tractenberg, R.E., Chaterji, R., Amri, H., Harazduk, N., Gordon, J.S. & Haramati, A. (2007). Promoting self-awareness and reflection through an experiential mind-body skills course for first year medical students. *Medical Teacher*, *29*(8), 778-784.

Smith, J.C., Ellenberger, H.H., Ballanyi, K., Richter, D.W., & Feldman, J.L. (1991). Pre-Bötzinger complex: a brainstem region that may generate respiratory rhythm in mammals. *Science: 254*(5032), p726–729. *New York,* doi:10.1126/science.1683005.

Spangenberg (2018). Opinions about mathematics anxiety: how to reduce it. In. Proceedings of ISTE International Conference on Mathematics, Science and Technology Education, 22 – 25 October 2018. (pp.107-113). University of South Africa, Unisa Press. ISBN. 978-1-77615-047-2

Stanovich, K.E.; West, R.F.; Toplak, M.E. (2011): The complexity of developmental predictions from dual process models. *Developmental Review* 31 (2-3), pp. 103–118. DOI: 10.1016/j.dr.2011.07.003.

Sherman, B.F. & Wither, D.P. (2003) Mathematics anxiety and mathematics achievement. *Mathematics Education Research Journal*. 15: (2)138-150.

Schwab, K. (2017). *The fourth industrial revolution*: Currency.

Van der Kolk, B.A. (1994). The body keeps the score: Memory and the evolving psychobiology of posttraumatic stress. *Harvard Review of Psychiatry*, *1*(5), 253-265.

Walker, S.P. (2015): Thinking, straight or true? Human Ecology Education. UK. Available online at http://simonpwalker.com/#/research-publications/4587873262. Accessed 25 June 2019.

Walker, S.P & Walker, J. (2015) Mental health risks of the Motorway Model of Education. Online, https://steeringcognition.org/wp-content/uploads/2015/06/Mental-health-risks-of-the-Motorway-Model-1.2-1.pdf. Accessed June 2019.

Walker, S.P & Walker, J. (2016). The Motorway Model Driving pupils fast but not teaching them to steer. http://steeringparents.org/parents/wp-content/uploads/2017/01/The-Motorway-Model-driving-fast-but-not-teaching-to-steer.pdf Accessed 24 June 2019.

Wilson, D. (2018). Structured Image framework Theory (SIFT): A neurologically based diagrammatic structure enabling the therapist to describe emotionally distressing situations within known brain functions. *International Journal of Neuropsychotherapy*, 6(2), p93-104. DOI;10.12744/ijnpt.2018.0093-0104

Zan, R., Brown, L., Evans, J., & Hannula, M. S. (2006). Affect in mathematics education: An introduction. *Educational Studies in Mathematics*, *63*(2), 113-121.