Predictors and preventative mechanisms for the reduction of mathematics anxiety in adult learners.

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Abstract
This study investigates Mathematics Anxiety amongst adult learners by examining Teacher Influences and Learner Motivational Beliefs’ as predictive agents. It further investigates Mindfulness Training as a reduction mechanism for Mathematics Anxiety amongst teachers and adult learners. To address the hypotheses, various databases were searched for research materials using the University of Bolton electronic library, Discover@Bolton, PsychINFO, ProQuest Central, and Google Scholar. In-depth literature analyses revealed that Teacher Influences predict Mathematics Anxiety amongst learners, secondly, that Learner Motivational Beliefs predict Mathematics Anxiety. In addition, that Mindfulness Training reduces teachers’ anxiety, burnout, and stress, and enhances Learner Motivational Beliefs. Future recommendations were made considering limitations.

Introduction
This study is aimed at addressing a gap in knowledge regarding Mathematics Anxiety (MA) amongst adult learners by investigating Teacher Influences (TI) and Learner Motivational Beliefs (LMB) as predictive agents. If hypotheses one and two are met, it will further investigate a reduction mechanism for MA amongst teachers and adult learners.

It is generally accepted that mathematics is an important skill for everyone (Hodgen & Marks, 2013; Burghes, 2011) and that a numerate society is a prosperous one (Burghes, 2011). Moreover, mathematical skills are key in securing employment (Rekdal, 1984; Hodgen & Marks, 2013) and correlates better social economic status (see Lein, Jitendra, Starosta, Dupuis, Hughes-Reid & Star, 2016). However, studies have shown that there is a huge number of adults in the UK with poor numeracy skills (see Marden, Thomas, Sheppard, Knott, Lueddeke & Kerr, 2012). Mathematics anxiety (MA) has been highlighted as a major culprit to poor mathematics skill; which can reduce self-confidence (Tobias, 1993; Chinn, 2012). MA is a debilitating and undesirable emotional response concerning mathematics (Hill, Mammasrella, Devine, Caviola, Passolunghi & Szücs, 2016). How can those adults gain mathematics skills to enhance their functionality? Learner Motivational Beliefs (Eccles & Wigfield, 2002; Musu-Gillette, Wigfield, Harring & Eccles, 2015; Mertalldou & Vlachou, 2007) and Teacher Influences (Geist, 2010) may well be answers to the question.

Literature review

Teacher Influences
In this study, teacher influences (TI) are measured by stress, burnout, and anxiety. Geist (2010) stated that prior experiences shape adult perception of mathematics and that inadequate teaching styles were responsible for MA. Although, Donelle, Hoffman-Goetz & Arocha (2007) may have commented that considerable damage had been done at this stage, however, in the author’s opinion, appropriate interventions can significantly reduce MA. Jackson & Leffingwell (1999) investigated how MA can be created or exacerbated by teacher behaviour, and their findings revealed that, teacher behaviour was a major predictor of MA. Another study that investigated female teachers’ MA and the effects on girls’ math achievement, found that, the higher the MA teachers had, the lower the girls’ achievements in mathematics and the more anxious they become (see Beilock, Gunderson, Ramirez & Levine, 2010). Geist (2015) also supported that teachers who have MA transfers it to their learners.

Learner Motivational Beliefs
Learner Motivational beliefs (LMB) are related to internal/external locus of control orientations, self-efficacy for learning and performance, and control of learning beliefs (Kesici & Erdogan, 2009). LMB have been linked with self-regulation (Camahalan, 2006); that is, higher LMB predict higher self-regulation. Some studies have shown positive relationship between LMB and academic success (Kesici & Erdogan, 2009; Mertalldou & Vlachou, 2007; Yukseturk & Bulut, 2007). In addition, Fulk, Brigham and Lohman (1998) demonstrated that, adverse LMB may exacerbate mathematical failure and increase anxiety (Morgan & Fuchs, 2007). Kesici & Erdogan (2009) recommended that learners should get their motivational beliefs organised to decrease MA.

Mindfulness Training
Mindfulness Training (MT) is a technique of teaching effective strategies for anxiety and stress reduction, cessation, or management (Grossman, Niemann, Schmidt, & Walach, 2004; Roeser, Skinner, Beers & Jennings, 2012). This study aims to investigate the effectiveness of MT in reducing teachers’ burnout, stress and anxiety, and the
enhancement of LMB which then improves teaching and learning (Roeser, Skinner, Beers, & Jennings, 2012).

Hypotheses:
Hypotheses for this study are: H1: Teacher Influences will predict Mathematics Anxiety amongst adult Learners. H2: Learner Motivational Beliefs will predict Mathematics Anxiety. If Teacher Influences predict Mathematics Anxiety, then a third hypothesis will follow. H3: Mindfulness Training will reduce teacher anxiety and stress and enhance LMB.

Methodology
To address the hypotheses and capture relevant research literatures, various databases were searched for primary research materials using the University of Bolton electronic library, Discover@Bolton, PsychINFO, ProQuest Central, and Google Scholar.

Findings and Discussion
In-depth literature analyses revealed that Teacher Influences predict Mathematics Anxiety in learners, secondly, that Learner Motivational Beliefs predict Mathematics Anxiety. Moreover, that Mindfulness Training reduces teachers’ anxiety, burnout, and stress, and enhances Learner Motivational Beliefs.

Addressing hypothesis one, this study supports that TI will predict MA amongst adult learners. Other studies reinforce this; for example, in a study that analysed MA in female learners, Ramirez, Gunderson, Levine and Beilock (2013) found that, female TI strongly predicted MA amongst female learners. Additionally, Geist (2015) agreed that MA can be transferred from teachers to learners.

Addressing hypothesis two, this study supports that LMB predict MA. This is like other findings that revealed that, those with low motivational beliefs are more likely to have MA (Morgan & Fuchs, 2007). Thus, Kesici & Erdogan (2009) supported that motivational beliefs can be enhanced if mathematics anxiety is to be eliminated.

Since it has been demonstrated that TI and LMB predict MA, hypothesis three will further be addressed. This study supports that Mindfulness Training (MT) will have a significant major effect on reducing teachers’ stress, burnout, and anxiety, and enhance LMB. In Gawrysiak et al. (2016) study of dimensions of distress tolerance, they found mindfulness-based trainings to be effective and concluded that MT reduces anxiety related conditions and stress. Although, in Roeser et al. (2013) study, there was no significant effect of MT on teachers’ anxiety, stress, or burnout, however, many other findings have demonstrated that teacher burnout, stress and anxiety dramatically reduce, following MT intervention (see Gold et al., 2010).

Limitations and Recommendations:
One limitation of this study is the absence of primary data for statistical analysis. The study relied on literature review to make judgements and recommendations. Hence, it is recommended that future study utilises quantitative methodology to capture in-depth information of all variables. In addition, although, the effectiveness of MT has been demonstrated with learners of mathematics, however, there is no clarity whether MT has been tested on adult learners. Hence, it is recommended that future study examines MT on adults learning mathematics.

References