

Attitude Determines Altitude

The Effects of Nurturing a Growth Mindset in Primary School Children

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1. Abstract

Recent scientific evidence demonstrates the powerful impact and incredible potential of growth mindset interventions on student motivation, engagement and academic performance. This research study examined the effects of nurturing a growth mindset on the academic performance and overall mindset level of primary school children. An experimental analysis using a qualitative and quantitative within-subjects and between subjects design was utilised during a 12-week intervention period. Sixty three 5th and 6th class pupils, aged 10-12 years, completed activities and standardised tests designed to assess their maths and mindset levels both at baseline and after the intervention was completed. Post intervention academic performance in maths and the participants' overall mindset level increased significantly for the experimental group. There was also a significant difference in the academic achievement levels of the experimental group compared to the control group. The results demonstrate the benefits of nurturing a growth mindset during the formative years of a child's development. Future research, through a longitudinal study, is needed to assess the broader effects of a growth mindset.

2. Introduction

Research has shown that there is more to academic success than cognitive ability and classroom instruction. The mindset that one holds and beliefs about intelligence can have a significant influence on students' experience in school and their overall academic performance (Dweck, 1999, 2006, 2008; Yeager, Paunesku, Walton & Dweck, 2013). Teaching students that intelligence can grow with hard work, effort and perseverance is the centrepiece of the growth mindset which has the potential to achieve higher attainment levels. Nevertheless, it has been commented that, as a society, we value natural, effortless accomplishment over achievement through effort (Gladwell, 2008). We are intolerant of failure and praise the result at the expense of the process (Dweck, 2012). These conflicting positions can have a significant impact on students' motivation, engagement and subsequent performance but with the right support and guidance, this can be addressed in a positive and constructive way.

A person's mindset can be defined as the set of beliefs that person has about themselves (Burns, 1982; Dweck, 1999). Those who believe that their intelligence and qualities are set and innate are said to have a fixed mindset, while those who believe that one's basic qualities, skills and intelligence are things that can be cultivated through effort and perseverance are described as having a growth mindset (Dweck, 2006, 2008; Cohen & Garcia, 2012; Yeager, Paunesku, Walton & Dweck, 2013). The key to the growth mindset is the belief that intelligence is malleable and as such can be developed. While those with a fixed mindset generally shy away from challenge as they believe it can expose perceived weaknesses, those with a growth mindset believe in progress not perfection and see challenge as an opportunity for learning and stretching oneself. The current research study, the first of its kind in Ireland, focused on 10-12 year old primary school students with the aim of

demonstrating that nurturing a growth mindset can positively influence young children and enable them to understand and fulfil their potential.

2.1 Results Should Not Be The Only Focus

The problem of a fixed mindset's sole focus on results can be seen in the reaction in Ireland to the Organisation for Economic Co-operation and Development's (OECD) PISA results in 2010. PISA, the Programme for International Student Assessment, aims to measure how well students are prepared to meet the challenges they may encounter in future life, including education, and assesses students in the three domains of reading, mathematics and science. The assessments represent over 80% of the world's economy (34 OECD member countries and 31 additional partner countries) and is considered the broadest and most representative assessment of student performance globally (OECD, 2010). In Ireland, over 5,000 students across 182 schools participate in the PISA project, giving a weighted student response rate of 84.1%.

The 2010 PISA results were significant for a number of reasons, most notably for the national furore that was expressed in the national press (Flynn, 2010) upon publication of the results for Ireland and our comparison with other countries. Ireland placed 17th out of 34 countries in reading, 26th out of 34 in mathematics and 14th out of 34 in science. Ireland was assessed as average in reading ability, below average in mathematics and slightly above average in science. These results represented a significant drop from previous PISA studies where Ireland ranked 5th in reading, 16th in mathematics and 14th in science (Department of Education and Skills, 2010). The results also brought an avalanche of comment from industry and education alike. The Irish Business and Employers Confederation (IBEC) referred to the results as particularly disappointing and a wake-up call for the country while, then Labour Education spokesperson, Ruairi Quinn remarked that the results were "a shocking indication of how our education system fails to perform at the most basic levels" (Flynn, 2010).

The outcome of the analysis of the PISA findings informed the National Strategy for Literacy and Numeracy and mandated an increase in the percentage of high-performing pupils by 5 percentage points as well as a decrease in the percentage of low-performing pupils, also by 5 percentage points, all of this to be achieved by 2020 (DES, 2011). It seems from this example that the general consensus was that the solution to declining results was to be an increased focus on the results themselves. While no one would argue against the merits of targeting an improvement in the average scores across the PISA domains, research suggests that this narrow focus on results may in fact contribute to the problem and further exacerbate the growing issue in our education system and indeed across society of valuing the score and result over the effort, hard-work and perseverance that goes into achieving the result – treating the symptom rather than the cause (Dweck, 2006; Cohen & Garcia, 2012; Dickerson, Wilkins, & Zimbardo, 2013; Yeager, Paunesku, Walton & Dweck, 2013).

2.2 A New Paradigm

The core components of a new paradigm in learning should take the best from current practice, such as the person-centric approach, nurturing the individual in all dimensions of their life and laying the foundations for future fulfilment (NCCA, 1999). It should also incorporate the research findings from pioneers in the fields of educational and developmental psychology. Research from Carol Dweck, Angela Duckworth, Greg Walton, David Yeager and Philip Zimbardo amongst others points to the significant benefits of developing a growth mindset as a way of enhancing the engagement, learning and development of not only school children but also people in organisations today and helping them to achieve success and fulfil their potential.

Whether one is looking at declining national academic results, third level graduate rates or the score for a particular individual in a class or in an organisation, the fundamental question remains the same: Why is it that some people realise their potential while others who are equally as talented fail to do so? The answer may lie in the mindset we hold and our internal belief system about where intelligence comes from (Dweck, 1999, 2006; Dickerson, Wilkins & Zimbardo, 2013; Von Culin, Tsukayama & Duckworth, 2014). The mindset one holds can powerfully affect whether students learn and grow in school. Students who develop a growth mindset have been shown to be more motivated to learn, work harder, are less discouraged by challenges and use more effective strategies for learning (Cury, Elliott, Da Fonseca, & Moller, 2006). They also achieve higher academic performance in comparison with students who hold a fixed mindset (Walton & Cohen, 2011; Chen, 2014; Choi, 2014).

Nurturing a growth mindset is important as it shifts the focus from results to learning and in the process reframes the meaning of effort. Those with a growth mindset certainly appreciate ability but believe that it is effort that ignites that ability and turns it into accomplishment (Dweck, 2008; Blazer, 2012). It also changes the meaning of failure and mistakes by teaching individuals that they do not define you but rather offer an opportunity for learning (Schwartz, 2014). The importance of developing a growth mindset across the spectrum of academic institutions, organisations and society in general has never been greater and is reinforced by the changing landscape of life in Ireland and indeed globally. While our education system arms graduates with the cognitive skills needed for entry into the workplace, it is the non-cognitive factors such as attitude, mindset, effort, grit and perseverance that enable them to grow and flourish (Farrington, Roderick, Allensworth, Nagaoka, Keyes, Johnson & Beechum, 2012) – skills and competencies that are developed through nurturing a growth mindset during the formative years.

It has been documented that the strongest predictor of successful progression through higher education is prior learning experience and educational attainment (Chantler, Mooney, O'Connor & Patterson, 2010). If students have the opportunity to develop a growth mindset during the early years of their development in primary school alongside the traditional curriculum and cognitive instruction, research suggests they can build the key skills of problem-solving and creativity and most importantly the power of determination, perseverance, effort and hard work (Berger, 2011). They also develop a deeper level of motivation and engagement with the curriculum material and learning experience and this can improve their overall attitude towards learning. These are the fundamentals of the growth mindset that arm children with the life skills that enable them to focus their attention and stay the course in the face of difficulty and challenges.

2.3 Research and Literature Review

Traditional studies and interventions on the growth mindset have focused on secondary school and university settings. However, recent research suggests that the earlier in the process that one can implement a growth mindset intervention, the better the opportunity to bring together the social-psychological and educational elements which can effect powerful changes in cyclical, recursive processes involved in the success of individuals over time (Ricci, 2013; Dickerson, Gundersen, Wilkins & Zimbardo, 2013). From a developmental perspective, primary school age children, specifically 10-12 year old pupils, reach the stage where they are able to process and understand more complex cognitive constructs such as differentiating between effort and ability and goal setting (Berger, 2011; Snowman & Biehler, 2006) and as such are able to understand the principles of the growth mindset and integrate them into their learning experience.

There is much research to support the theory that an individual's mindset significantly influences their attitude to learning and school, their learning experience, their engagement with the process and ultimately their academic performance (Dweck, 1999, 2006; Kornilova, Kornilova & Chumakova, 2009; Walton & Yeager, 2011). Based on a social cognitive construct, Dweck's work posits that thought processes play a key role in motivation and action and this originates through interaction with others in a social context. From an early age, children evaluate their own abilities and create their own personal theory of intelligence. They compare themselves to others and incorporate the feedback of significant others such as teachers and parents (Bandura, 1986; Mischel & Shoda, 1995).

An example of this is where a child who has a difficulty with Maths compared to other children may decide that they are not smart, a belief that then affects their attitude, motivation and subsequent engagement with the subject. They become fixed in their view of their ability and see it as unchangeable (Boaler, 2013). They adopt performance goals and look for situations that provide approval and avoid situations that may result in failure of any kind.

Growth mindset individuals, in contrast, adopt learning goals and focus on development and mastering challenging tasks (Hong, Chiu, Dweck, Lin & Wan, 1999). They hold the belief that one's intelligence has the potential to grow in response to effort and perseverance (Dweck, Walton & Cohen, 2011). They understand that an academic challenge or a test is not a threat to their ability but rather an opportunity for learning (Sirois, 2014). They also understand that intelligence is malleable and that any deficiency is simply due to not having the knowledge yet (Good, Aronson & Inzlicht, 2003). They believe that they can grow their intelligence and are likely to be more motivated and more likely to persist in the face of challenges. This inner belief is very powerful because what students believe about intelligence has been shown to be more strongly associated with academic performance than actual measured intelligence scores (Sternberg, 2005).

Current educational assessments focus on standardised tests such as the Drumcondra maths and reading tests and intelligence tests such as the New Non-Reading Intelligence Test but these tests produce a score which can reinforce a fixed mindset as they do not comment on the non-cognitive factors involved in the learning process. Students very often measure themselves against a test score and subsequent deviations from this number can have a detrimental effect on student's perception of their ability and intelligence.

A growth mindset intervention can enhance this process by enabling a teacher to incorporate a model that instils a focus on the process of learning and rewards the non-cognitive skills of effort, attitude and grit. This removes the labels, commonly seen in a fixed mindset, that are often placed on children which they internalise as a measure of value or worth in the eyes of significant others such as their parents.

There are a significant number of studies in the literature that detail the positive effects that a growth mindset has on student performance, motivation, engagement and overall academic achievement levels (Aronson, Fried & Good, 2002; Dweck, 2006; Kornilova et al. 2009; Steinmayr & Spinath, 2009). In the U.S., Dweck and associates (2006) found that when the growth mindset was nurtured in students, they embraced the learning process and when faced with challenges or mistakes, students persevered to a higher degree than students who held a fixed mindset. In a separate study on the growth mindset, conducted by Blackwell, Trzesniewski & Dweck (2007), seventh grade high school students participated in weekly workshops where they learned about the neuroplasticity of the brain and to think of the brain as a muscle that gets stronger as it gets exercised through learning and challenges. This study found that students' mindset had a direct influence on their assessment scores, even a full academic later. Of particular interest in this study was the fact that the growth mindset training only lasted two hours in total and yet had a significant impact on student attitudes, behaviour and achievement. This highlights the ability to incorporate growth mindset interventions into the current teaching approach.

Two additional studies in the U.K., conducted by Romero, Paunesku, & Dweck (2010) and Paunesku, Goldman & Dweck (2011), also demonstrate the positive effects of a growth mindset intervention on academic performance. The studies in Crittenden Middle School and East Renfrewshire School measured scores on maths and reading tests pre- and post-intervention. The average maths score in the growth mindset class was 99 (on a scale of 70-130) compared to 97 for the those in the control class. A similar result was demonstrated in reading scores with the mindset class outperforming the control class (101 Vs. 98). Pupils in the mindset class also reported higher life satisfaction and wellbeing scores post-intervention. In a similar study in the U.S., Paunesku, Romero, Walton & Yeager (2012) conducted a growth mindset intervention in 13 east coast high schools with 1,594 participants and demonstrated an overall increase in the average GPA score of 0.18 points.

Research suggests that the role, and the mindset, of the teacher is critically important in the education and learning experience of every student (Dweck, 2008). This role is even more important when it comes to nurturing the growth mindset. Traditional beliefs among educators held that praising student's intelligence builds confidence and motivation but new research in this area found that this places students in a fixed frame of mind and ultimately lowered confidence and resiliency (Mueller & Dweck, 1998). In contrast, students who were praised for their effort and perseverance sought out more challenging tasks and demonstrated considerable persistence in the execution of these tasks (Kamins & Dweck, 1999). Praise about a score teaches the person that the score is what you value, whereas praise about the process teaches what needs to be done to achieve success.

2.4 The Current Growth Mindset Study and Hypotheses

Given the wealth of literature and research on the growth mindset that exists today, it is clear that the benefits to students are significant. These include improved academic performance and importantly an increased enjoyment of the learning experience (Dweck, 2006). Nurturing a growth mindset helps develop students who are more motivated to learn, are more engaged and demonstrate more persistence and grit when faced with difficulty and challenges. These competencies are extensible and can help to build important life skills.

Compelling evidence has shown that small social-psychological interventions can make a dramatic difference in not only academic performance but also how students learn, how they engage and how they experience school life (Gladwell, 2000; Ross & Nisbett, 1991). A growth mindset intervention, in particular, has been shown to be extremely beneficial in these areas, even many years after the intervention was delivered (Elliot & Dweck, 2005; Blackwell, Trzesniewski, & Dweck 2007; Yeager & Walton, 2011).

One of the aims of this study is to develop an intervention that addresses a number of gaps in the current research on this topic, namely the mindset training of the educators and the subsequent incorporation of their feedback into the intervention process. The goal is to develop a mindset intervention that can be systematically integrated into classroom teaching and can benefit students in the course of not only their academic lives but also in other areas of their lives. Although numerous areas of mindset intervention have been researched to date, few if any have included the growth mindset training of the teachers or have been translated into a form that teachers can effectively use in the classroom (Dickerson, Wilkins & Zimbardo, 2013). The study will have benefits both for students and for those who develop and employ educational methodologies.

Students will gain valuable insights into meta-cognition (how we learn), character (Tough, 2011) and a higher level of self-awareness which should translate into higher levels of attainment and more effective independent learning (Lohman, 2002). Teachers will gain insights into motivational practices which will enhance their teaching (Blue, 2012). It is the aim of this study to build on the research to date and provide a model that will transform students from passive acquirers of knowledge and skills to active collaborators in their education and initiate a process that will enable students to take the material from this intervention and apply it in many subsequent areas to fully realise their potential.

There have been many interventions that have focused on the field of academia and have incorporated research findings that help students create lasting positive change and ultimately have a more fulfilling educational experience (Walton & Yeager, 2011; Yeager, Walton & Cohen, 2013). Research suggests that these interventions can transform the student experience and it is hypothesised that this can result in better academic performance in the longer term (Dweck, 2012; Yeager & Dweck, 2012; Duckworth, 2013).

The purpose of this research study is to test this hypothesis in an Irish educational setting to determine firstly, whether mindsets can be changed and secondly, whether academic performance can be improved through the application of growth mindset principles. It is hypothesised that there will be a significant increase in the growth mindset of participants in the experimental group. It is also hypothesised that there will be significant improvements between the pre and post intervention performance levels for mathematics for those students who receive the growth mindset intervention. The third hypothesis predicts that there will be a significant difference in the performance levels in mathematics between students exposed to and trained in the growth mindset and those receiving standard education practices only.

3. Method

3.1 Participants

63 primary school pupils from 5th and 6th class participated in this research study. The participant group comprised both males and females aged between 10 and 12 years of age. Convenience sampling was used as the pupils were selected based upon availability to the researcher. All participants, and their parents, were informed that participation in the study was completely voluntary and that the results would be anonymous. After a presentation of the research proposal, including privacy and confidentiality policies, to the school principal, the teachers and the parents of all pupils, letters of consent were obtained granting full written permission for pupil participation in the study (see appendices A & B). A letter of approval on behalf of the school was also obtained (see appendix C).

3.2 Design

This research study utilised a mixed model design to investigate the effects of the growth mindset intervention and consisted of both within-subjects and between-subjects approaches. The within-subjects assessment compared the mindset and maths levels at two distinct time points; at the outset of the intervention in September and at the end in December. The between-subjects assessment compared the mindset results between the experimental group (those pupils receiving the growth mindset intervention) and the control group (pupils receiving standard whole class teaching without the mindset intervention). For the purposes of this experiment the independent variables (IV) are the application of the growth mindset intervention with the experimental group versus the control group at time points 1 and 2. The dependent variable (DV) is the pupil performance on a series of social-psychological questionnaires and academic tests (the Mindset Questionnaire and the

Drumcondra Primary Mathematics Tests, Revised – Levels 4 and 5 A/B – See appendices D & E).

3.3 Materials

The materials supporting this research study were structured in two main sections. The first section was developed to conduct the critical preparatory elements of a) presenting the research proposal to the school principal and staff, b) presenting the study to the parents of the pupils, c) obtaining the required written approvals from the appropriate sources and d) conducting the mindset training with the participating teachers. This body of work consisted of Microsoft PowerPoint presentations to the participating school staff and to the parents of the pupils before the beginning of the intervention and a detailed research thesis information pack and participation consent form.

The second section consisted of the primary intervention materials including the mindset questionnaire, the Drumcondra Primary Mathematics Test, the participant mindset presentation and supporting videos, the intervention worksheets and materials for the initial classroom mindset session, the participant daily mindset journals and the weekly intervention check-in meetings and research log with the teachers.

3.3.1 *Mindset Questionnaire*

A mindset questionnaire was used to assess the participants' mindset levels at the beginning of the research study and again at the end of the study upon completion of the mindset intervention. The mindset questionnaire (Dweck & Zimbardo, 2006) consists of 15 questions, 7 of which are growth mindset questions and 8 are fixed mindset questions. Each question is rated on a scale of 1 – 5 with 1 corresponding to strongly disagree and 5 corresponding to strongly agree. Participants were told there were no right or wrong answers

and instructed to circle the number that most appropriately reflected their opinion. See appendix D for the mindset questionnaire.

3.3.2 *Drumcondra Primary Mathematics Test - Revised*

The Drumcondra Primary Mathematics Test – DPMT-R (Educational Research Centre, 2007) is a group-administered, standardised test of achievement in mathematics, designed for pupils in Irish primary schools. Each level of the DPMT-R has 2 test forms, A and B (see appendix E): one of which was selected for the beginning of the intervention and the other for the end of the intervention. Levels 3 – 6 of the DPMT-R assess the content strands and skills that are outlined in the Primary School Mathematics Curriculum (DES/NCCA, 1999a, 1999b). The content strands are Number, Algebra, Shape & Space, Measures and Data. The skills are Applying & Problem Solving, Integrating & Connecting, Reasoning, Implementing and Understanding & Recalling. Given the breadth and depth of these tests, they are ideally suited to the cognitive knowledge and social-psychological testing elements of the mindset intervention.

The DPMT-R test takes approximately 2 hours and 15 minutes to complete with pupils hand writing their answers in the test booklet provided. All materials required to complete the test were also provided including pencils, rulers, erasers, protractors and calculators.

Reliability is a measure of the consistency of an individual's score on a test taken over more than one occasion. For the DPMT-R, the Kuder-Richardson Formula 20 (KR_{20}) was used to obtain an estimate of internal consistency. KR_{20} coefficients are a measure of the extent to which the questions in each test form a coherent whole, reflecting the degree to which different parts of the test or different questions are measuring the same attribute. The

DPMT-R coefficients, estimated by KR_{20} and calculated from data obtained from standardisation studies, range from .93 to .95 across both forms, A and B and across both levels, 4 and 5, utilised in this mindset research study (ERC, 2007).

3.3.3 *Mindset Intervention Training & Worksheets*

A core part of the growth mindset intervention is building a culture that fosters the belief that intelligence is malleable and can be cultivated and grown with the right approach, processes, tools and support. It is critical that those delivering and driving the mindset intervention on a daily basis adopt a mindset with an underlying belief that with effort, motivation, engagement, perseverance and the right teaching strategies, all pupils can fulfil their potential and achieve success. Beginning with parents and teachers, the growth mindset intervention was presented through a series of awareness presentations and training sessions specifically developed for the 5th and 6th class teachers delivering the core elements of the mindset intervention in the classroom. A dedicated parents' night was scheduled to present the research study and the core elements of the mindset intervention and provide an opportunity for questions and feedback.

Teacher training and input has traditionally been lacking in the majority of mindset research to date (Dickerson, Wilkins & Zimbardo, 2013). It was a central aim of this research study to incorporate the teacher and school input to ensure a mindset intervention was developed that could be aligned to and integrated with the current teaching approach. Faced with an already packed curriculum, teachers need the ability to weave the core elements into current teaching approaches as a system that can enhance their teaching strategies. This was achieved through a briefing session with the teachers during which they had the opportunity to provide their feedback. This was incorporated into the final training material and

subsequent growth mindset worksheets used to deliver the intervention to the experimental group at the beginning of the study.

The growth mindset training material included a full agenda for the ‘Mindset Day’ in the school and covered pre-intervention mindset assessments, key presentations and supporting resources to explain what one’s mindset is and why it is so important, the mindset activities and details of how the intervention would work over the 12-week duration.

The mindset training also included a specific section on the brain – its function, how it is structured and how it grows. Understanding the idea of neuroplasticity is an important part of the growth mindset and plays a key role in teaching students about the malleability of intelligence, specifically how it grows with effort, perseverance and hard work (Gladwell, 2008). Jason Moser and his colleagues at Michigan State University (as cited by Hymer & Gershon, 2014) expanded on this idea in 2011 by identifying a neural mechanism that helps explain why having a growth mindset helps one cope better with mistakes: a growth mindset is associated with *Pe amplitude* – a brain signal that reflects conscious attention to errors and improved subsequent performance. When learners with growth mindsets encounter mistakes, their electrical brain activity is far greater than those with fixed mindsets.

The supporting resources for the delivery of the mindset activities included instructional videos to demonstrate the power of practice and perseverance and the importance of failure, brain templates to enable the participants to write down everything they know about the brain, art materials such as Styrofoam balls, plasticine and pipe cleaners

to make models of a neuron and a future plan template to document the key learnings from training.

3.3.4 Participant Mindset Journals

Throughout the growth mindset research study, feedback played a major role in creating, maintaining and changing mindsets. As the mindset focus moves from results to challenge, effort and perseverance, so must our traditional feedback. Growth mindset activities need active, timely and quality feedback to reinforce the core concepts and maintain engagement. This was achieved in the research study through the use of mindset journals. These were A6 notebooks handed out to every participant during the mindset training to record the key ideas and learnings. Each participant was encouraged to keep a daily log in their mindset journal of the mindset topic of the day, their personal learning and how they would use this in their academic and personal lives. Each participating pupil was also encouraged to share the contents of the journal with their parents to further reinforce the ideas from the growth mindset at home. Examples from the participant's journal entries are provided in appendix H.

3.3.5 Mindset Intervention Weekly Teacher Check-ins – Research Log

As the growth mindset intervention developed, it was important to keep a research log and track progress through weekly check-ins with the participating teachers. This enabled the incorporation of feedback from the teachers into the intervention as well as recording what worked well and what could be improved for future iterations of the mindset intervention.

Feedback was gathered through weekly 30 minute meetings in the school every Friday afternoon and the details were recorded in a weekly intervention tracking document.

3.4 Procedure

Due to the age group of the participants in the research study, a statutory declaration was signed and full ethical approval was received from Dublin Business School. With this in place, a research briefing session was held with the school (Principal, Deputy Principal and teachers) and a presentation was made to the parents of the pupils participating in the study. This presentation detailed the nature of the research, the content of the mindset intervention and the timelines involved. An information pack was made available to all parents. Informed consent was requested and subsequently provided in written format by all parents.

A pre-requisite of the mindset intervention was the training for the 5th and 6th class teachers. This training covered the theory and research underpinning the mindset intervention, why it is important in an educational setting, the details of the mindset intervention in the school and proposed steps and the role of the teacher. This training was critical due to the importance of the role of teacher throughout the study and their impact on its success.

The growth mindset intervention took place over a 12-week period from mid-September to mid-December. These dates were specifically chosen to align with the beginning of the academic year and also to align with the testing process already in place in the school. Prior to the commencement of the intervention, pre-assessments were completed by the participants to determine their baseline mindset and maths levels before the intervention began. At the end of the intervention the participants were again tested using the mindset and maths assessments.

3.4.1 *Assessment Procedures*

The mindset assessment involved the participants completing the 15-question mindset questionnaire (See appendix D). The teacher administered the questionnaire and stated that there were no right or wrong answers. The teacher read each statement aloud so that weak readers were supported. The answers were recorded in the mindset questionnaire booklet which the teacher collected at the end and handed to the researcher.

The mathematics assessment was conducted by using the Drumcondra Primary Mathematics Test (DPMT) (See appendix E). The assessment format was familiar to the teachers as it is a standard test used commonly in Irish primary schools. Once again, the answers were recorded in the test booklet provided and the teacher collected these at the end of the test and handed them to the researcher.

3.4.2 *The Growth Mindset Intervention*

The growth mindset intervention commenced with a full day presentation to the pupils on how humans learn, changes that take place in the brain when we learn, the theory behind the fixed and growth mindset, evidence of these mindsets in other people (e.g. familiar sports people) and the importance of one's mindset to learning. The growth mindset principles were consolidated within the normal teaching approaches through classroom displays, the introduction of the daily mindset journals, teacher praise and feedback, both formal and informal, and reinforcement of the key messages in appropriate contexts (class tests, activities, discussions and mindset journal updates).

The mindset journals were a critical component of the intervention for a number of reasons. Firstly, they enabled the teacher to track pupils' mindsets throughout the intervention period. Secondly, they functioned as a focussing aid: pupils were constantly on the lookout for occasions when a fixed or growth mindset came to the fore as they knew they would have to record an entry in their journal every day. Finally, they served as a record for pupils themselves to observe and reflect on their mindsets in different situations. This process of keeping a journal provided a highly informative feedback loop for all stakeholders – pupils, teachers and the researcher.

3.4.3 Ethical Concerns

A number of ethical considerations presented themselves during this research study, all of which were planned for and addressed in the intervention design and the briefing process. Firstly, the participants were primary school pupils and therefore it was necessary to obtain informed consent. This, in addition to a formal letter from the school principal granting permission, was obtained and is included in the appendix section. A detailed research information pack was provided to all parents for reference.

Secondly, there was the ethical issue of one group receiving the 'growth mindset' intervention while the other group did not and the potential impacts of this. This was addressed by conducting the intervention with the control group participants in term 2 of the academic year – January to March, 2015. A full briefing session took place with the principal, teachers and parents to present the intervention plan and address this concern. It is envisaged that the positive outcomes can inform the education and teaching approaches in the school and beyond.

4. Results

4.1 Hypothesis 1 – Experimental Group Mindset Level

The initial hypothesis of this research study predicted that there would be a significant increase in the growth mindset in the experimental group after receiving the growth mindset intervention. Before the intervention began and again at the end of the intervention, each participant in the experimental group completed the mindset questionnaire to assess their mindset level. A paired samples t-test was conducted to compare the mean values for participants in the experimental group pre and post intervention and showed that the mean mindset score pre-intervention was 53.19 ($SD = 4.52$). The post-intervention mean mindset score increased to 60.68 ($SD = 6.01$). The 95% confidence limits shows that the population mean difference of the variables lies between -9.39 and -5.57. The paired samples t-test showed that there was a significant difference between the pre and post intervention mindset score for the group who received the growth mindset intervention ($t(30) = 8.00, p < .001$). This supports the initial research hypothesis.

Table 1: Paired samples t-test (Detailing the differences in mindset level for the experimental group before and after the growth mindset intervention).

Variable	Time Point	Mean	SD	<i>t</i>	<i>p</i>
Mindset Score	Pre-intervention	53.19	4.52	-8.00	.000*
	Post-intervention	60.68	6.01		

* Note: *p* significant at .001 level

4.2 Hypothesis 2 – Experimental Group Maths Performance

The second hypothesis stated that there would be significant improvements between the pre and post intervention performance levels in mathematics for those students who receive the growth mindset intervention. A paired samples t-test was used to compare the mean values for participants in the experimental and control groups. The mean score in the experimental group for maths before the intervention was 45 ($SD = 18.21$). However, the maths score after the intervention increased significantly to 50.55 ($SD = 15.54$). As can be seen in table 2, the statistical analysis demonstrated that there was a significant difference within the group who received the growth mindset intervention ($t(30) = -5.41, p = <.001$). The null hypothesis can be rejected as there was a significant improvement in the maths scores for those who participated in the growth mindset intervention. When compared with the control group, the paired sample t-test demonstrated that there was no significant difference in maths score pre and post intervention for those receiving the standard teaching approach only ($t(30) = -1.34, p = .190$).

Table 2: Paired samples t-test (Detailing the differences in maths skills for the experimental and control groups before and after the growth mindset intervention).

Group	Variable	Time Point	Mean	SD	<i>t</i>	p
Experimental	Maths Score	Pre-intervention	45.00	18.21	-5.41	.000*
		Post-intervention	50.55	15.54		
Control	Maths Score	Pre-intervention	54.10	12.71	-1.34	.190
		Post-intervention	55.39	12.89		

* Note: *p* significant at .001 level

4.3 Hypothesis 3 – Between-Groups Maths Performance and Mindset Level (Pre & Post Intervention)

The third hypothesis stated that there would be a significant difference in the performance level in mathematics and mindset between students exposed to and trained in the growth mindset and those receiving standard education practices. The experimental group received the growth mindset intervention in addition to the standard teaching approach and the control group received the standard teaching approach only. To test the hypothesis that the pupils who received the growth mindset intervention would perform better, an independent samples t-test was performed to compare the scores for participants in the two groups.

Firstly, the pupils in the experimental mindset group ($M = 6.65$, $SD = 5.63$) were found to have achieved a significantly higher increase in maths score than those pupils who did not receive the intervention ($M = .30$, $SD = 5.72$). An independent samples t-test was conducted to compare the change in the scores in maths for the experimental and control groups. Additionally, the assumption of homogeneity of variances was tested and satisfied via Levene's F test, $F(61) = .68$, $p = .412$. The independent samples t-test found that there was a statistically significant difference between the change in maths score for the experimental group and the control group ($t(61) = 4.46$, $p < .001$). Therefore the null can be rejected.

Table 3: *Independent samples t-test (Detailing the changes in maths score across the experimental and control groups).*

Variable	Group	Mean	SD	t	df	p
Maths Score Change	Experimental	6.65	5.63	4.64	61	.000*
	Control	.30	5.72			

* *Note: p* significant at .001 level

Secondly, the pupils receiving the growth mindset intervention ($M = 6.84$, $SD = 5.71$) were found to have increased their mindset level significantly compared to those pupils that received standard teaching only ($M = 1.09$, $SD = 3.35$). Once again, an independent samples t-test was conducted to test the hypothesis that those receiving the mindset intervention would increase their mindset level. The results from this test found that there was a statistically significant difference in the mindset level change between the experimental group and the control group. Thus, pupils in the experimental mindset group achieved a greater increase in their growth mindset compared to pupils in the group who did not receive the intervention.

Table 4: *Independent samples t-test (Detailing the changes in mindset level across the experimental and control groups).*

Variable	Group	Mean	SD	<i>t</i>	<i>df</i>	<i>p</i>
Mindset Score Change	Experimental	6.84	5.71	4.86	61	.000*
	Control	1.09	3.35			

* *Note: p* significant at .001 level

In addition to the inferential analysis, the researcher was also able to determine a number of additional academic specific statistics such as the Standard Score, Sten Score and the Percentile Rank (DES/NCCA, 2007) for the participating students. These categories are used by educators to compare attainment levels against national norms. Once the raw test score is obtained, all of the other scores listed above are conversions of the raw score. In this research study, raw scores were calculated as the total number of correct answers in the maths test. There are 75 questions in the test and if a participant answers 55 correctly then their Total Raw Score is 55. Through standardisation, comparisons are made when Raw Scores are converted to Standard Scores, Sten Scores and Percentile Ranks.

Standard Scores were obtained by transforming the distribution of raw scores to fit a normal distribution with a mean of 100 and a standard deviation of 15. A pupil's score, when expressed as a standard score, provides an indication of their performance relative to the performance of other pupils who took the test. The descriptors detailed in table 4 below are used to interpret and communicate the standard scores achieved by pupils.

Table 5: *Standard Score Table*

Standard Score Range	Descriptor	Coverage
115 and above	Well above average	Top one-sixth of pupils
108 – 114	High average	One-sixth of pupils
93 – 107	Average	Middle one-third of pupils
85 – 92	Low average	One-sixth of pupils
84 and below	Well below average	Bottom one-sixth of pupils

An analysis of the maths test scores for both the experimental and control group pre and post intervention showed that the group receiving the growth mindset intervention outperformed the group receiving standard teaching only in every category – Raw Score, Standard Score, Sten Score and Percentile Rank.

The average raw score for the experimental group increased from 45 before the intervention to 51 after the intervention – an increase of 13%. Assessing the standard score, the results show that the average standard score increased by 6%, rising from 105 pre-intervention to 112 post-intervention. Comparing these two category results with the control group’s results provides even more insight. The raw score for the control group increased by 2%, going from 54 to 55. However, the standard score for the control group decreased by 1%, dropping from 108 to 107. Of particular interest is the change in the average standard score across the two groups, pre- and post-intervention. The experimental group began 3 points behind the control group (105 vs. 108) but ended up 4 points ahead after the intervention (112 vs. 107).

This positive trend continues when assessing the Sten Scores. Sten Scores are transformations of Standard Scores. They are distributed over equal-interval score points from 1 – 10. Table 5 below details the descriptors of the Sten Score.

Table 6: *Sten Score Table*

Sten Score Range	Descriptor	Coverage
8 – 10	Well above average	Top one-sixth of pupils
7	High average	One-sixth of pupils
5 – 6	Average	Middle one-third of pupils
4	Low average	One-sixth of pupils
1 – 3	Well below average	Bottom one-sixth of pupils

Sten scores have the advantage of being based on the principles of Standard Scores and encourage users to think in terms of bands of scores rather than absolute points. This aligns perfectly with a growth mindset as the Sten Score aids the communication of test results to parents and others. At the beginning of this research study the average Sten Score for the experimental group was 6, placing it in the ‘Average’ score range. After the growth mindset intervention was delivered and the experimental group was tested again, the average Sten Score increased from 6 to 7. This moved the class up into the ‘High Average’ range.

When assessing the Percentile Rank and comparing the results across the groups, the positive trend continues to be demonstrated. A pupil’s Percentile Rank indicates their standing in relation to other pupils in the norm group. A pupil achieving a Percentile Rank of 66 did as well as, or better than, 66% of the pupils in the norm group and, by inference, the population which the norm group represents. The pre-intervention average Percentile Rank for the experimental group was 60 and post-intervention, this increased to 71, an 18% increase. In contrast, the Percentile Rank for the control group decreased from 67 to 66.

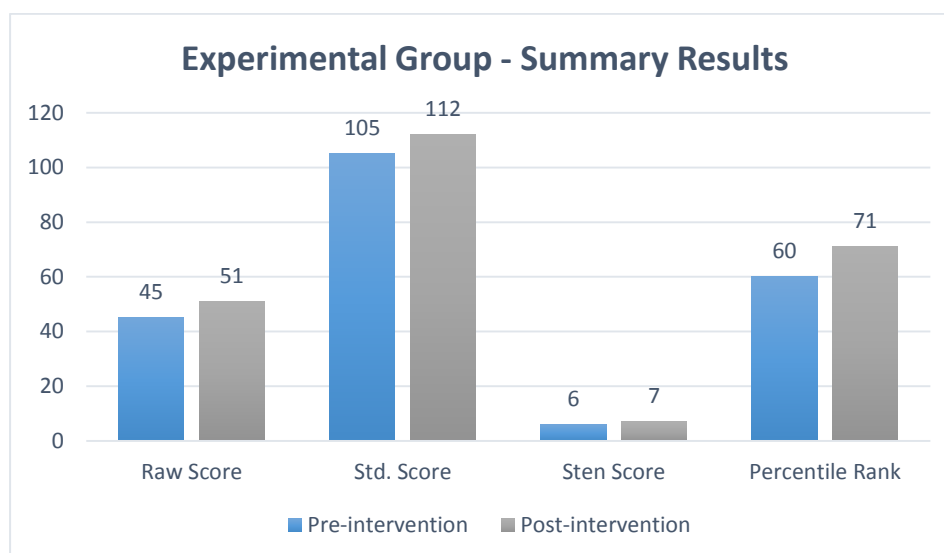


Figure 1

Bar chart summarising the key academic results for the experimental group.

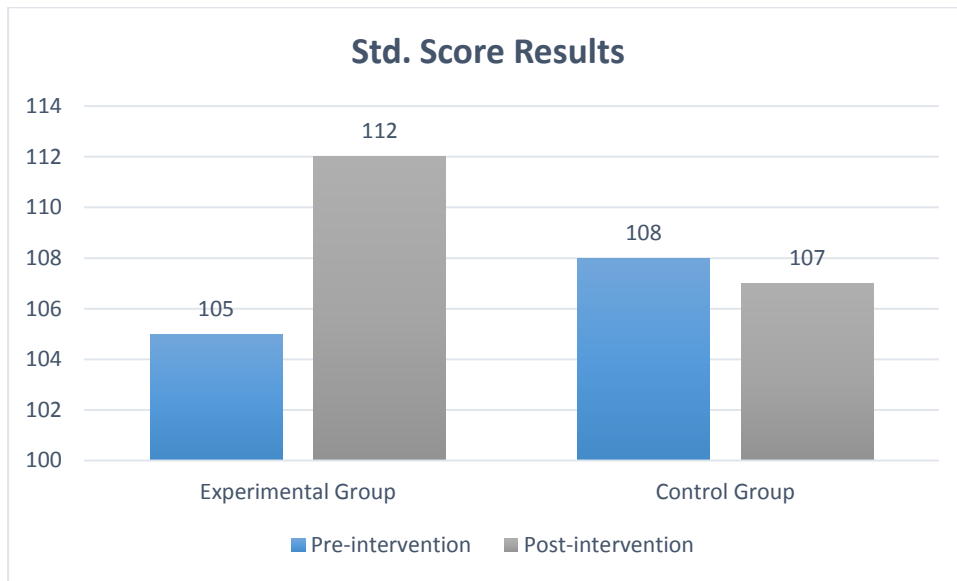


Figure 2

Standard score results comparison across the experimental and control groups.

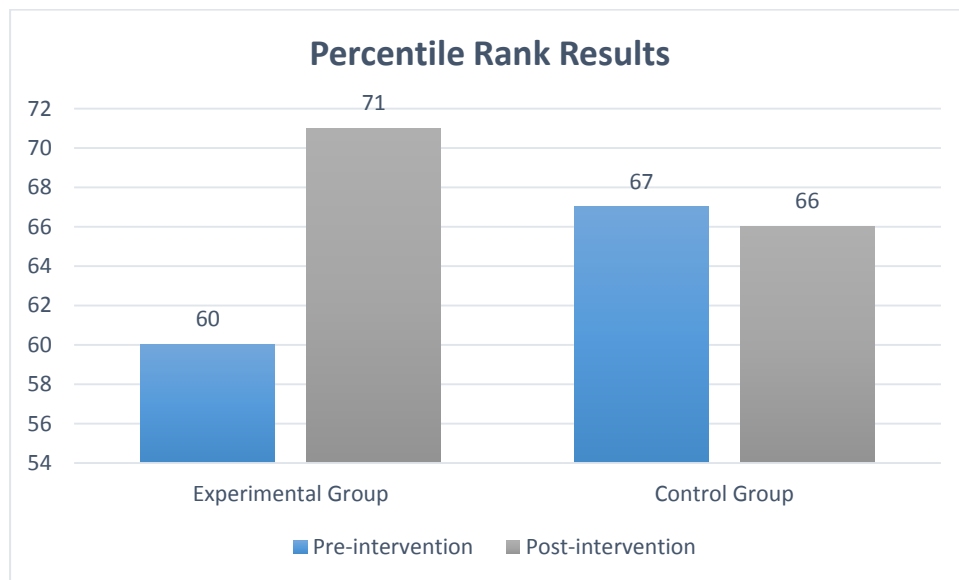


Figure 3

Percentile rank comparison across the experimental and control groups.

In addition to the quantitative results detailed above, the output of the research study also yielded a number of qualitative results that further support the underlying mindset theory and reinforce the significant positive statistical results achieved. One of the key growth mindset characteristics is grit and a goal of the research was to ascertain if this increased as a result of the intervention. The maths test completion rate was used to determine if there was an increase in this variable and this was defined as the number of participants who attempted all questions on the test. The results showed an increase in the percentage of participants who completed every question on the test. Only 50% of those in the experimental group attempted every question pre-intervention but this number increased to 78% post-intervention. Compared to the control group, this represents a 56% increase. An additional measure was the type of weekly test chosen by the pupils during the intervention. For each test, standard and challenging versions were made available and the results showed that 93% of the pupils chose the more challenging test.

Throughout the intervention the provision of feedback from the participants was key to success particularly as they learned about the core principles of effort and perseverance in the face of challenges and mistakes. Mindset journals were used by each participant to record their daily and weekly learnings as they applied the mindset ideas. Given that this was a new teaching approach, the journals enabled the recording of feedback and learning while also serving as a way of communicating progress to teachers and parents and involving them in reinforcing the key messages that underpin the growth mindset. The participants' self-reported thoughts during the intervention highlight the learning process and their comments demonstrate the power of the growth mindset: *"I don't know what it is about this mindset thing but I hope more schools get this because it does improve your mind a lot"* (Pupil #7).

The role of the teacher during the study cannot be overstated. Indeed, the mindset of the teachers themselves plays a hugely significant part in motivating the pupils and instilling the belief that intelligence and talent are dynamic attributes that can be developed (Wayne & Youngs, 2003; Siegel, 2013). Research has shown that when teachers believe in fixed intelligence, the pupils they identify as having high ability are the only ones who tend to perform well in class but when teachers hold a growth mindset, a much broader range of pupils do well (Rheinberg, Vollmeyer & Rollet, 2000; Brooks & Goldstein, 2008). Throughout the intervention the teacher reinforced the growth mindset principles through the portrayal of challenges, effort and mistakes as highly valued and through feedback and praise, they strengthened the impact of the process over results. This can be seen in the written exam feedback from the teacher during the intervention. Such examples include the following, *“Well done for taking on a more challenging test. I really like the different ways you tried to solve the problem. You stuck at it until you found a way to do it. A great demonstration of the growth mindset!”*.

Weekly progress check-in meetings between the researcher and the teacher provided additional intervention feedback and updates throughout the research study. These meetings provided the opportunity to evaluate what was working well and what could be improved as well as valuable information for future research. This qualitative feedback was documented in detail with the teacher reporting significant changes and improvements in classroom engagement and increased pupil motivation and focus across all subjects. The pupils demonstrated an understanding of the core growth mindset principles through their application in classroom and homework activities and this expanded to other activities such as physical education (PE) with noticeable changes in the pupil’s enthusiasm, determination and approach.

5. Discussion

The teaching practices, methodologies and approaches that schools employ to increase motivation, engagement and achievement are critical to student success. While previous research into the effectiveness of mindset interventions has yielded positive results in secondary school and university age groups globally, the research in this study is the first to empirically investigate the effects of nurturing a growth mindset in a younger cohort of primary school children in Ireland. Specifically, the current study sought to determine if the implementation of a growth mindset intervention would result in significantly higher levels of academic performance and a positive increase in students overall mindset levels.

It was predicted that the growth mindset intervention would enhance the engagement and the learning experience of the experimental group students which would in turn result in an increase in maths performance compared to students in the control group. Furthermore, and in line with previous literature, it was predicted that there would be an increase in the overall growth mindset level in the experimental group. The results from the study support earlier research on this topic, some of which has been described in detail in the introduction and in particular the research conducted by Dweck (2006), Cury, Elliott, Da Fonseca & Moller, (2006), Yeager & Walton (2011), Skipper & Douglas (2012) and Paunesku (2013). These studies examined the effects of mindset interventions on maths and science performance and also, equally important, the role of educators and how their interaction and feedback can be critically important in the development and success of students. The results from the current research study indicate that a growth mindset can influence motivation and effort behaviours and academic performance in a statistically significant manner. In line with expectations, students who received the growth mindset intervention displayed greater

improvements in academic performance than students who received standard teaching practices alone.

In addition to the positive academic performance, the students who received the growth mindset intervention demonstrated significant increases in social-psychological competencies. Feedback from the teachers described improvements in effort and engagement in class along with a positive approach to challenges and a willingness to embrace failures. These non-cognitive factors lie at the heart of the growth mindset and firmly highlight the positive impact it can make in the classroom environment. These results also support previous research and theory by Dweck & Leggatt (1988), Haimovitz, Wormington & Corpus (2011) and Farrington (2013) who achieved similar results to the current study and demonstrated that students who are more engaged and motivated are more likely to have learning goals as opposed to performance goals, are more likely to persevere until a task is completed and ultimately achieve higher average scores.

The results support the hypotheses that change in one's mindset can be affected in a positive way and also that academic performance can be improved through the application of growth mindset principles. The performance of the experimental group in maths particularly, where they overcame a three point deficit in the average standard score compared to the control group at the beginning of the intervention (105 vs. 108), and finished five points ahead (112 vs. 107) is testament to the power and the potential of the mindset intervention. Indeed, the ability of a growth mindset intervention to decrease or even close achievement gaps was demonstrated in research conducted by Dar-Nimrod & Heine (2006). In that study, female students were divided into two groups – one told that maths ability genetically favoured males (a fixed mindset) and the other told that males and females had the same maths abilities and potential for achievement (a growth mindset). In subsequent tests, the

students who were told that males were genetically better at maths performed worse than the group given the growth mindset explanation.

In addition, a seminal research study conducted by Good, Rattan & Dweck (2012) also researched the idea of bridging achievement gaps through a growth mindset intervention. Their study looked at the influence of mindset on female attitudes to maths, their sense of belonging in that course module and notably, their desire to pursue maths in the future. In line with the current research study, those with a growth mindset scored better than those with a fixed mindset and when compared to their male counterparts, scored equally as well. Importantly, their research also found that females who held a growth mindset were less susceptible to the negative effects of stereotypes. This has important implications for addressing gender gaps in some areas of education and the participation of females in STEM subjects and courses in the future.

A number of additional significant outcomes of this research study were presented: the effectiveness of simple social-psychological interventions, the importance of non-cognitive factors such as attitude to learning, engagement, motivation and perseverance and arguably most important, the role and the impact of the teacher in the overall process.

For interventions such as the one detailed in this study to be successful, they must be designed in such a way as to be easily incorporated into the existing teaching approaches. This is supported by research that has shown that simple social-psychological interventions can make a significant difference in academic performance and effort in the classroom (Yeager & Walton, 2011; Ricci 20113). Subsequent research by Aronson et al. (2002) and Blackwell et al. (2007) went further to demonstrate not only the increase in student grades but also how the intervention had lasting effects on achievement and non-cognitive factors such

as motivation and perseverance. The results and outcomes of the current study support previous research in terms of achievement and also present the opportunity for future research to track the lasting effects of the growth mindset intervention on a broader scale through longitudinal studies.

One of the key findings from the study was the impact of the teachers on the student experience, their academic performance and the overall success of the intervention. This impact is heavily influenced by the mindset that the teachers themselves hold. The results from the current research study supports previous research by Rheinberg, Vollmeyer & Rollet (2000) who found that teachers with a growth mindset showed a progression in their students from a moderate band of scores to a higher band over the course of one school year. The current research achieved similar results which saw the average Sten Score for the experimental group increase from 6 to 7, moving the students from the average band up into the high average range.

The mindset that the teachers hold also plays a significant role in influencing their teaching practices and their expectations of students (Brooks & Goldstein, 2008). A core element of the current study focused on praise and feedback for the students participating in the intervention through the daily interactions and activities and the student mindset journals. Qualitative feedback from the teachers supports previous theory and research by Kamins & Dweck (1999) and Good, Rattan & Dweck (2007) who demonstrated that praising students for their intelligence places them in a fixed mindset and lowers self-confidence whereas praise for effort and perseverance develops a growth mindset and helps build a classroom environment where challenge is welcomed as an opportunity to grow.

In a 2009 study on academic achievement, Hattie found that teacher feedback made the most difference to student performance. Teachers with a growth mindset believe in the potential of each student and are skilfully able to affirm students' knowledge, progress and effort so that they are motivated to engage, set appropriate goals and persist in the face of challenges. Examples of qualitative teacher feedback within this study can be found in appendix I.

Teachers also play a key role in building the right classroom environment and setting the tone with regard to the growth mindset (Skinner & Belmont, 1993). It has been argued that today's educational institutions operate out of a fixed mindset where the emphasis is primarily placed on results. Lindquist & Lindquist (2008) state that teaching methods, curricula and even the physical classrooms are out-dated and not conducive to student learning. One of the keys to equipping students to become lifelong learners is to not only build their capacity but also to build the teachers' capacity (Farrington, 2013). The current study set out to expand the capabilities of the teachers by introducing the growth mindset and demonstrating how nurturing it in the classroom could benefit academic performance and the student experience. A classroom environment that affirms the belief that intelligence can be developed with effort and the right instruction and that collaboration is better than competition has been shown to achieve higher grades (Dweck, Walton & Cohen, 2011; Walton, Cohen, Cwir & Spenser, 2012). In the current study, the classroom environment was built to support the growth mindset intervention through the making of wall posters, mindset thoughts of the day, teacher praise and feedback for effort and the mindset journals. The effects of this environment positively influenced the students academic performance and support the previous theory and research in this area.

5.1 Implications

There are a number of implications resulting from this research study and its findings ranging from broad education policy, teaching practice and curricula to individual implications covering student performance, meta-cognition and the overall learning experience. The results from the current study support previous research and theory relating to academic mindsets and help to build on this foundation by highlighting the positive contribution that can be made through the implementation of growth mindset principles.

From an educational perspective, the results from this study can inform those who set policy and develop the teaching curriculum. Traditional assessment practices have focused on test scores and indeed form the basis for many entry criteria for higher education courses. However, once individuals progress to the next level, factors such as perseverance in the face of challenges and the value of hard work become critical to success. Building knowledge of these factors and how to make students aware of them and develop competence in them into the teaching approaches and curriculum could offer the opportunity to better prepare students for the journey ahead and arm them not only with the core cognitive knowledge but also the life skills that are just as important. The elements of the growth mindset could form part of teacher training and/or be included in on-going professional development activities.

The outcomes from this study also have implications for parents and in particular how they support their child's development. By informing parents about how intelligence can grow and the effective use of praise and feedback, they can become more involved in their child's education and support them in a more effective way. They are also well placed to raise individuals with the competencies and skills required to handle life's challenges.

From an individual perspective, the growth mindset offers many positive outcomes. Research suggests that one's intelligence is malleable (Dweck, 2006) and can grow through active effort. What seems to matter is not just one's ability but rather one's belief about one's own ability (Hymer & Gershon, 2014). A growth mindset can help to reframe one's approach to learning and attitude to intelligence in a positive way. The growth mindset has the potential to effect lasting change and transform students from passive recipients of classroom instruction to active participants in their development. The growth mindset also helps build non-cognitive competencies such as increased motivation and perseverance which are often neglected in favour of more measurable skills. These skills complement the traditional core academic skills and help to develop a broader and more extensive knowledge set. As can be seen in the results from the current research study, the growth mindset can improve academic performance and equally as important it can assist students to develop their meta-cognition. The more the students can learn about how they learn, the better they can become at learning. This has been shown to positively influence not only performance in school but also to help develop more effective individual learners (Lohman, 2002).

Taking a broader perspective on the implications of this research, the outcomes have potential benefits for two key areas in education today namely the course completion rates in higher education and the gender gap with regard to STEM subjects and courses. Given the stated reasons for the less than optimal success and participation rates respectively by Chantler et al. (2014), the growth mindset can play an impactful role in helping to address the performance of students and their persistence in the face of challenges which they invariably face when making the transition from second level to third level education and also when navigating the university environment and completing their chosen courses. Growth in these areas has broader and long term benefits for the country's competitiveness and growth.

5.2 Strengths and Limitations

The outcomes and findings of the present study are the result of a carefully planned and contextualised application of research-derived principles. The intervention benefitted from a structured and methodical design which contributed to the successful delivery and the positive results achieved. Detailed planning over a six month period ensured the mindset intervention, resources and activities were organised and delivered with the age and education level of the participants in mind. The preparation also included in-depth mindset training for the teachers and throughout the intervention the teachers were consulted to gather their feedback and ensure momentum was maintained and progress tracked on a weekly basis. Furthermore, one of the key strengths of this research study was the advocacy and support provided by the principal and staff of the school. Without this support the study would have been impossible and must be a pre-requisite for future studies.

In terms of the limitations of this research study, a number were found which merit discussion. Firstly, the study was conducted in one Dublin based school and while the participants included mixed gender pupils from diverse social and economic backgrounds, the sample may not be representative of the wider population in general. In addition, due to the nature of the mindset intervention and the participant availability limitations, it was difficult to obtain a true random sample. A convenience sample was used consisting of two classes and while the results support the hypotheses, future research should focus on a whole school and inter school approach. Staying with the limitation of the single school approach, this study did not include a diverse cross-section of schools such as DEIS (Delivering Equality in Schools) schools, single gender schools and alternative teaching method schools. Cost and time limitations prevented the inclusion of these schools and again, future research should include them in a more extensive mindset study.

One of the limitations from the assessments carried out pre- and post-intervention concerns the non-cognitive evaluations. Mindset can be a difficult construct to measure and this study used a single questionnaire to assess the levels of fixed and growth mindsets in the participating classes. Upon review, it was found that the inclusion of additional non-cognitive assessment questionnaires would have been beneficial to give a broader and deeper view of participant feedback in this area. An additional questionnaire that could be used is the Motivated Strategies for Learning Questionnaire (MSLQ) which measures students motivational orientations, self-regulation, test anxiety and use of learning strategies, all of which can significantly influence an individuals mindset.

5.3 Future Research

The positive results from this study highlight the benefits and opportunities that a growth mindset can bring and open the door to several important lines of inquiry for future research. The present study could be expanded upon by focusing on specific individuals or subgroups who respond especially well or poorly to the mindset intervention. Future research could also be conducted across different schools, both rural and urban, and across each year within these schools. The current study examined the effects of nurturing a growth mindset in a 5th and 6th class primary school population but future studies could expand this to include 1st class through 6th class and possibly even infant classes. Research suggests that younger age groups are capable of understanding more complex cognitive constructs than previously thought (Berger, 2011) and expanding the current study to include a broader sample would facilitate this research. Future research, in the form of a longitudinal study, could be carried out to track the progress of students from the beginning of their primary school education through to secondary and third level education to determine the effects of a growth mindset over time and across multiple institutions and experiences.

6. Conclusion

The beliefs that individuals hold about themselves influence the way they make their way in life and play a critical role in shaping their attitudes and behaviours. Defining moments and people who are influential in our early development can lay down thought patterns that form and sculpt one's beliefs about intelligence and potential. Research has shown that in many cases these thoughts become fixed and compromise one's ability to fulfil their potential. New research, however, is illustrating that ability and intelligence is anything but fixed and that with the right resources and support, one can develop their intelligence and achieve outcomes previously thought of as beyond their ability.

The ability to change an individual's deeply held beliefs and their mindset is extremely powerful. Nurturing a growth mindset is one way to influence an individual's thought processes and during this research study its potential was examined in an academic setting. The positive results illustrate the power of a growth mindset and point to its application in all aspects of an individual's life not just in their academic life. Research suggests that people with a growth mindset achieve higher levels of academic performance, display lower levels of anxiety, are more creative and have higher self-esteem. These attributes are critical to the development of well-rounded and confident young people and adults. Challenges and opportunities will always be a part of life. What defines us is how we respond to them.

“Nothing in the world can take the place of persistence. Talent will not; nothing is more common than unsuccessful men with talent. Genius will not; the world is full of educated derelicts. Persistence and determination alone are omnipotent. The

phrase 'press on' has solved and always will solve the problems of the human race".

John Calvin Coolidge.

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8. Appendices

8.1 Appendix A – Mindset Presentation to School & Parents



Agenda

- 1 Introduction – Peter Fitzgerald
- 2 Thesis Research Project – The Effects of Implementing a Growth Mindset
- 3 Theory & Research – A Fixed Vs. A Growth Mindset
- 4 Why Mindset Matters in Schools
- 5 The Brain | Neuroplasticity | Growth | Intelligence
- 6 It's Good to Fail – Why Failure is Important for Success
- 7 The Mindset Intervention in Holy Trinity – How It Will Work (Process, Steps, Activities)
- 8 Teachers are Critical – Your Role

Research Project – Fixed Vs. Growth Mindset

- Why do some people realise their potential while others, equally as talented, fail to do so?
- The answer may lie in the mindset we hold and our internal belief system about where intelligence comes from
- 2 types of mindset: Fixed & Growth
 - Fixed Mindset – intelligence and talent are innate
 - Growth Mindset – intelligence can be developed and abilities can expand over time
- The purpose of this research study is 2-fold:
 - To test this hypothesis in an Irish educational setting
 - To develop an intervention that can be systematically integrated into the class curricula and can subsequently benefit students in the course of not only their academic lives but also in other areas of their lives
- It is envisaged that the study will benefit pupils and educators who develop and employ educational methodologies
 - Students will gain valuable insights into how they learn and a higher level of self-awareness which can translate into higher levels of attainment and more effective independent learning
 - Teachers will gain insights into motivational and learning practices which will enhance their teaching

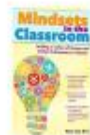
Fixed Vs. Growth Mindset – Theory & Research

Carol Dweck, Ph.D.

- Dr. Carol Dweck is one of the world's leading researchers in the field of motivation and has devoted decades to growth mindset research.
- Her work builds on the power of our beliefs.



Dweck

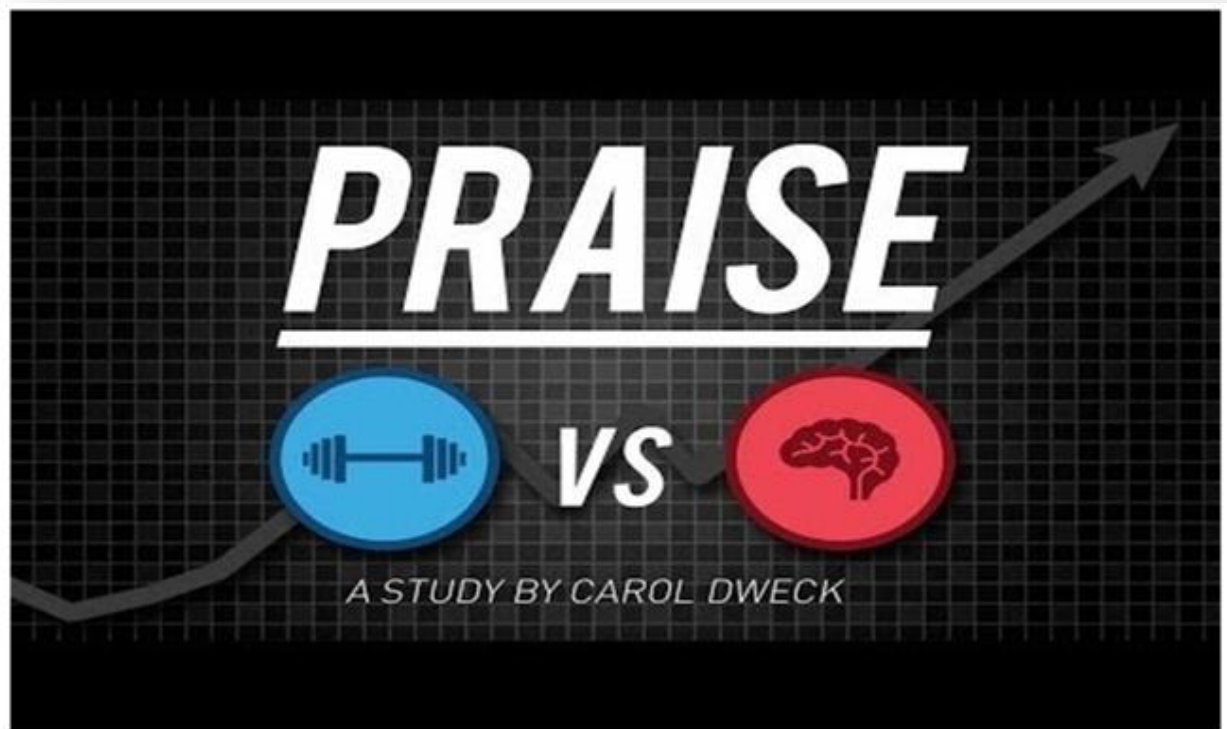


Ricci



Heroic
Imagination
project

Dickerson, Gunderson, Wilkins & Zimbardo



Why Mindset Matters

Our mindset guides our actions and behaviours

A growth mindset helps us to develop children's potential

But sometimes we push in the opposite direction – we label

This influences how children evaluate situations – tasks, challenges

A growth mindset focuses on the process, effort and hard work NOT results

A Little About The Brain

- Part of the shift in thinking about intelligence is due to the technology and recent research into the brain and its functions
- Research negates the notion that intelligence is fixed
- The brain develops with proper stimulus
- Neuroscience research emphasises the concept of neuroplasticity which is the ability of the brain to change, adapt and 're-wire' itself throughout our lives
- We now know so much more about the neurological aspects of the brain that it cannot help but inform the way we approach teaching, learning and motivation
- It directly affects teachers beliefs and expectations about pupil potential and achievement
- When teachers, children and parents learn about the brain and all of its potential and when they witness the impact that it has on learning then mindsets really begin to shift

Failure | Resilience | Motivation | Success

- Failure is necessary for success
- It is through failure that we learn the most and our mindset determines what we learn (Moser et al., MSU, 2011)
 - Fixed Mindset – little or no attempt to learn from failure, risk to my position, avoid future challenges
 - Growth Mindset – I am still learning, I haven't mastered this 'YET' but with effort and perseverance I will succeed
- Again, learning about how the brain works in these situations helps to internalise failure and make it work for you
 - Through challenge, failure, learning, perseverance and problem solving, our brains grow 10x compared with easier activities and simply succeeding first time – more learning = more neurons and connections
 - Pupils subsequently more motivated to work and persist in the face challenge – life lessons
- Part of the process is for teachers to develop a climate in the classroom where failure is celebrated and pupils learn to reflect and redirect
- Motivation and attribution – our goal is to encourage pupils to internalise the belief that their own actions and behaviours, not external factors, guide them to achievement and success
- In essence, we are building character – Grit, Curiosity, Optimism, Self-Control, Social Intelligence

The Research Study in Holy Trinity

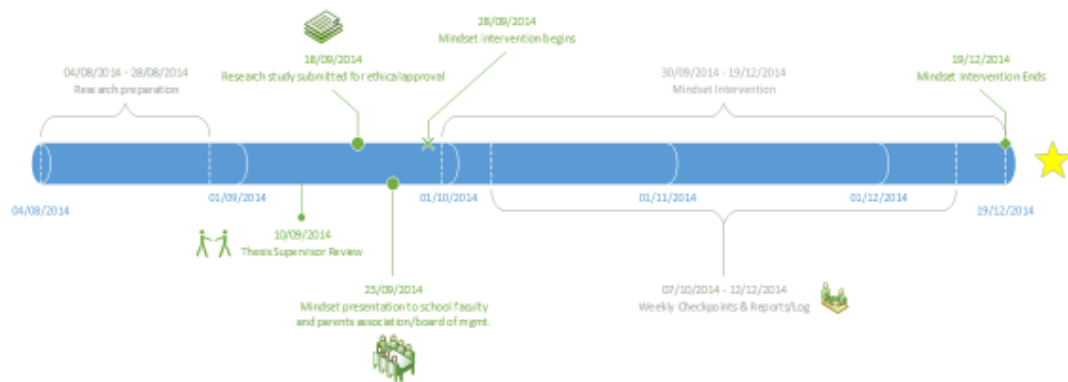
- The purpose of this research study is 2-fold:
 - To test the growth mindset hypothesis in an Irish educational setting
 - To develop an intervention that can be systematically integrated into the class curricula and can subsequently benefit students in the course of not only their academic lives but also in other areas of their lives
- Research study presentation to the faculty in Holy Trinity – obtain approval/permission
 - The study
 - Timetable of activities / milestones
 - Experimental & control groups
 - Methods
 - Ethical considerations: confidentiality, voluntary participation, informed consent, briefing & de-briefing and reporting
- Project briefing with teachers in September
 - Mindset briefing & training
 - How it will work
 - Assessments
 - Processes & methods
 - check-in's

The Research Study in Holy Trinity

Conduct the study from September to December, 2014

- 5th / 6th classes
- Introduce and present the study in the classrooms
- Agenda will cover:
 - Pre-study assessments – 1. Mindset Questionnaire, 2. Maths Test (Drumcondra Numeracy Test)
 - The Fixed Vs. Growth mindsets
 - Pupils help create mindset wall posters
 - Focus on effort | resilience | failure | learning | growth
 - The brain & how we learn
 - Initial “what do you know” activity – Pupils draw out what they know about the brain – Reflect on drawings
 - Show the pupils the physical model of the brain – let them examine it
 - Presentation on the brain, neurons, connections – Pupils make a physical ‘neuron’ using fingers and thread/rope
 - Explain neuroplasticity in simple terms so pupils can understand it and apply it to what they’re learning
 - Researcher led class mindset activities:
 - “What would you do?”
 - “Think of a time”
 - “Decide for yourself”
 - “Learning strategies”
 - “Reflections and getting started”.
 - Teachers use growth mindset practices in class teaching and reinforce effort & perseverance with appropriate praise

The Research Study Timeline



8.2 Appendix B – Research Information Pack & Consent Form

Research Thesis Information Sheet & Consent Form



Peter Fitzgerald

School of psychology, DBS

Research study – Peter Fitzgerald, School of Psychology, DBS

Dear Parents,

My name is Peter Fitzgerald and I'm an undergrad psychology student in Dublin Business School. One of my interest areas is educational psychology and in particular how to support and enhance the student experience throughout primary school. Helping students develop a 'Growth Mindset', for example, shows that intelligence and skills are something that can be developed and expanded over time rather than simply fixed traits. Research studies have shown the benefits of adopting a growth mindset in terms of engagement in the classroom and subsequent academic performance.

Research Topic: Attitude Determines Altitude: The effects of implementing a growth mindset with primary school children.

Researcher: Peter Fitzgerald Student researcher,

Dr. Patricia Frazer Supervisor

Dr. Jonathan Murphy Supervisor

Background and Purpose: In my research I am interested in finding out about what children think about their intelligence and how it is developed. Usually psychologists do this by giving children a questionnaire, and children tick answers to questions which researchers have come up with. However I am interested in doing it differently. I'm looking for more creative and enjoyable ways for children to tell us about themselves. In particular I am interested in working with teachers and children in the classroom environment, finding out what they really think about developing intelligence and exploring ways in which we can use the research to benefit their learning experience. I am conducting this research as part of my final year thesis for the BA (Hons) in Psychology at DBS, and I am working with Dr Patricia Frazer and Dr. Jonathan Murphy, whose contact details are included above.

What happens if my child takes part? I will be visiting your child's school during class time, at a time arranged with the principal. I will ask all participating children in the class to complete a mindset questionnaire and maths test at the outset to gauge their position in relation to a fixed or growth mindset. It is a standard questionnaire and test designed for children, to explore how they think and feel about intelligence. If you decide your child will not take part your child will be present in the classroom but will not complete the test or fill in the questionnaire. They will be asked to read quietly while the others take part.

How will my child's information be protected? The children's answers will remain confidential. When doing tests and questionnaires, each child will be given an ID number. This will be used for any

information relating to the study. The information which links names and numbers will be stored separately in a secure location in DBS until the research is completed. Once the study has been completed your child's name will be removed and all the data will be destroyed.

Voluntary Participation: It is up to you and your child to decide whether your child is going to take part or not. Participation is completely voluntary. Your child is free to withdraw at any time. I will remind the children of this when I meet them.

Important: The consent form! There is a consent form attached to this information sheet. Every child participating on the day must have a consent form which you have signed. Please note that research practice guidelines do not allow me to make any exceptions, and verbal permission cannot replace the signed consent form. It is important to remember to return the signed form to school as without it your child will not be allowed to take part.

Further Information: This research is being conducted to assist researchers with finding out about children's views of themselves and their lives. We very much hope that you will agree to let your child take part in the research. If you require any assistance or have any questions about the research study, please feel free to contact me.

Thank you very much for supporting this research study. Please keep this information for your records.

Parent's Consent Form

Research Topic: Attitude Determines Altitude: The effects of implementing a growth mindset with primary school children.

Researcher: **Peter Fitzgerald** Student researcher

Dr. Patricia Frazer Supervisor

Dr. Rosie Reid Supervisor

Parents Name: _____

Child's Name: _____

I confirm that I have read and understood the Information Leaflet for Parents for the above research study and have received an explanation of the nature, purpose and duration of the study. I understand what my child's involvement will be.

I have had time to consider whether I want my child to take part in this study. Any questions have been answered satisfactorily.

I have explained this study to my child and I am happy that he/she understands what is involved.

I understand that my child's participation is voluntary (that my child and I have a choice as to whether she/he participates) and that my child is free to withdraw at any time if she/he chooses to do so.

I understand that the information collected may be presented and/or published in academic journals and at conferences, but that no child will be identifiable from the information.

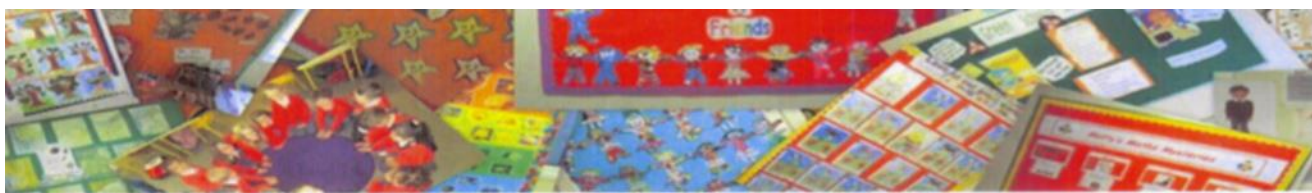
I agree for my child to take part in the above study.

Name of Parent (in block letters)

Date

Signature

8.3 Appendix C – Letter of Approval from Primary School



Mr. James Tobin

Principal
Holy Trinity National School
Leopardstown
Dublin 18.

September 16th, 2014

To whom it may concern:

I understand that Peter Fitzgerald is conducting a research study into the impacts of a fixed and growth mindset in a primary school setting and how this can be used to potentially improve student performance in key academic areas and also their attitude to overall learning.

I can confirm that Peter has discussed this with me personally and presented the research proposal to our school faculty. On behalf of Holy Trinity National School, I have given Peter permission to undertake this research in our school.

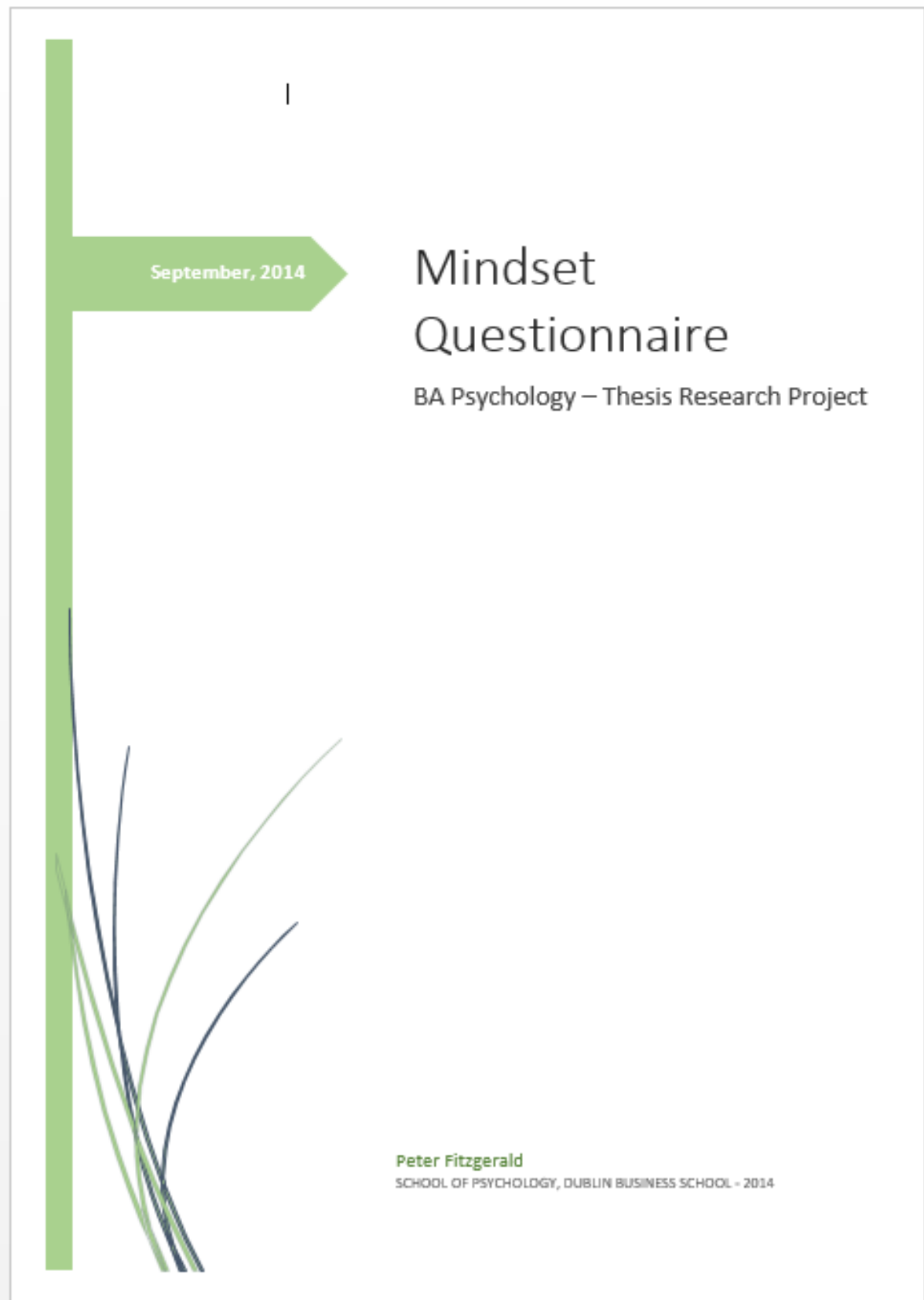
Sincerely,

James Tobin
Principal
Holy Trinity National School



Holy Trinity National School
Glencairn Drive
Leopardstown
Dublin 18
Roll no: 201907
Email: holytrinityns@g.n.s
Ph: (01) 2063500

8.4 Appendix D – Mindset Questionnaire



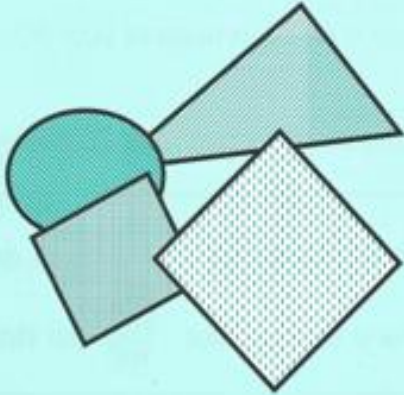
Read the statements below. Take a minute to think whether you agree or disagree if this statement is true for you. If you strongly disagree with the statement, put a circle around the number 1 next to that statement. If you strongly agree with the statement, put a circle around the number 5 next to that statement. If your opinion falls in between, then put a circle around numbers 2, 3 or 4, whichever applies for you. There are no right or wrong answers. It is important that you answer truthfully and all answers are fully confidential.

1	2	3	4	5
Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
• I am smart.				
• People are born with a certain amount of intelligence and no matter what you do, this can't be changed.				
• Intelligence can be changed if a person is taught new skills and strategies.				
• I am responsible for my performance in school.				
• If I don't do well in a test then it is someone else's fault e.g. my teacher's, a distraction, classmates talking, etc.				
• I am good at some subjects and not at others.				
• I wish I was smarter.				
• If I work really hard I can become good at something I used to find difficult.				
• Some people are just born smarter than other people.				
• When I do not perform well at school, it's usually because I haven't given it my best effort.				
• No matter how hard I work, I don't do well on tests.				
• I do well on some tests but not on others.				
• The more effort I put into my school work the better I do.				
• I am a certain kind of person and there is not much that I can do to really change that.				
• People can always change the kind of person they are.				

8.5 Appendix E – Drumcondra Primary Mathematics Test

EDUCATIONAL RESEARCH CENTRE, ST PATRICK'S COLLEGE, DUBLIN 9

DRUMCONDRA PRIMARY MATHEMATICS TEST – REVISED



NAME

DATE OF BIRTH

SCHOOL

TEACHER

TODAY'S DATE

BOY

GIRL

Raw Score (Part A)	
Raw Score (Part B)	
Raw Score (Part C)	
Total Raw Score (A + B + C)	
Standard Score	
Sten Score	
Percentile Rank	

**LEVEL 4
FORM A**

INSTRUCTIONS

Read each question carefully and answer it as well as you can.

If you are not sure about the answer to a question, circle or write the answer you think is best and continue with the next question.

You may use the extra space on each page of your booklet to do your rough work.

I will tell you to stop working on each part after 35 minutes.

You may not use a calculator to do Parts A and B of the test.

You may use a calculator  to do Part C.

SAMPLE QUESTIONS

1. Which is the number seventy?

- A 7
- B 17
- C 70
- D 77

2. What is 20×10 ?

- A 10
- B 20
- C 100
- D 200

3. A bus driver makes 15 stops every hour. How many stops will the driver make in 2 hours?

stops

WAIT UNTIL YOU ARE TOLD TO START

3

8.6 Appendix F – Mindset Intervention Agenda

Mindset Research Study Kick-off (Morning session)	
9:30am – 10:00am	<p>Introduction</p> <p>Peter Fitzgerald, research study, position the day. It's about making you aware of mindsets, how you react to certain situations and how we can explore other ways of reacting to those. Presentation on learning, how we learn, meta-cognition.</p>
10:00am – 10:30am	<p>Our Brain – Neuroplasticity</p> <p>Pupils tell us what they know about the brain, complete brain sketches, together we review what they drew, assess current thinking. Presentation & group activity on the brain – Structure of the brain (neurons & connections), functions, share the physical model of the brain, make a human neuron class activity. Key themes: Brain is elastic, always growing, effort & hard work help it grow. Focus in our study will be on effort and perseverance rather than results.</p>
10:30am – 10:50am	<p>Mindset Activity #1 – “What would you do?”</p> <p>Activity to examine situations, expectations we have of ourselves, subsequent feelings when we're challenged and how these help us succeed or fail over time. <i>Scenario: Pupils receive marks back on a recent test. Although they passed, it's not a good mark. The preparation was just ok and they know they could have done better to prepare. Pupils reflect on this scenario and share thoughts. What would they say to themselves?</i> Pupils work in pairs at their group station and tells us about how they would react</p> <p>Mindset Activity #2 – Examining Failure & Mistakes</p> <p>Explain failure and mistakes in the context of learning – show why failure is key to success in the long run. Show videos of sports people talking about failure and how they responded Ask pupils to reflect on the messages and tell us what they think about the ideas Again, pupils work in pairs at their group station and tells us about their thoughts.</p>

Mindset Research Study (Mid-morning session)

11:00am – 11:30am

Mindset Activity #3 – Understanding Fixed and Growth Mindsets

Present the fixed and growth mindsets.

Some stuff we're just good at and always do well at but others we're bad at. Intelligence is set when we're born. This is a fixed mindset.

You can always learn new things. You can become good at things over time by working hard and investing the right effort. Intelligence can expand and skills can be developed. This is a growth mindset.

This is important because scientists and teachers believe that if you have a growth mindset then you'll be more successful in school and in other parts of your life.

So let's test this – That's why we're looking at this today.

Mindset Activity #4 – Think of a Time

Get the pupils to think of a time when someone believed in them, supported them and/or had a positive influence on them.

Think about that person – who were they? What did they help you to do? How did they make you feel?

Pupils reflect and share thoughts at their station. Pick a number of examples to share with the class.

Researcher and teacher walk around the class observing activities and listening to discussions – Catch the pupils investing in effort and make reference to it in a positive way that also supports our key themes for the day.

Mindset Research Study (Closing session)

11:30am – 12:00am

Mindset Activity #5 – Checkpoint & Plan for the Future

Check-in with pupils and get their thoughts/feedback on what we've learned so far, what concerns do you have, how can we name those and build into our plans for the future?

Help pupils prepare a personal plan

- Focus on growth mindset every time you face a setback or challenge
- Use the worksheet to help pupils document this
- Review in pairs at stations and share examples with the class

Key take aways for pupils:

1. Focus on effort and perseverance – mastery takes time and effort
2. Challenge your fixed mindsets
3. Put a plan in place to keep the momentum going

Prepare self-learning mindset pupil folder

Prepare parent information pack

Mindset Research Study (Post kick-off review with teachers)

2:00pm – 3:00am

Wrap up with teachers

Reflect on the day, what went well and what can we improve upon?

Key take aways for teachers

- 8.1 Focus on process over product.
- 8.2 Praise effort and perseverance.
- 8.3 Encourage risk-taking and dispel fear of failure or making mistakes.
- 8.4 Reinforce the growth mindset concepts.

Weekly check-ins and progress updates

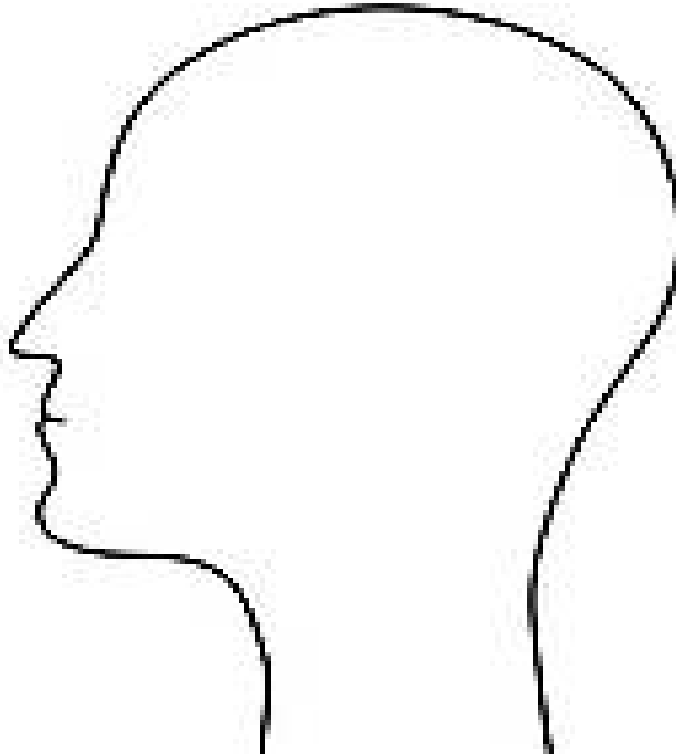
- Weekly check-in meetings with the teachers.
- Teachers provide feedback on the intervention.
 - Implementation in practice
 - What works well, what can be improved
 - Teacher feedback
- Researcher documents all details in the research study log – reviews with supervisor periodically.

8.7 Appendix G – Mindset Worksheets and Templates

Mindset Intervention Worksheet #1 – The Brain

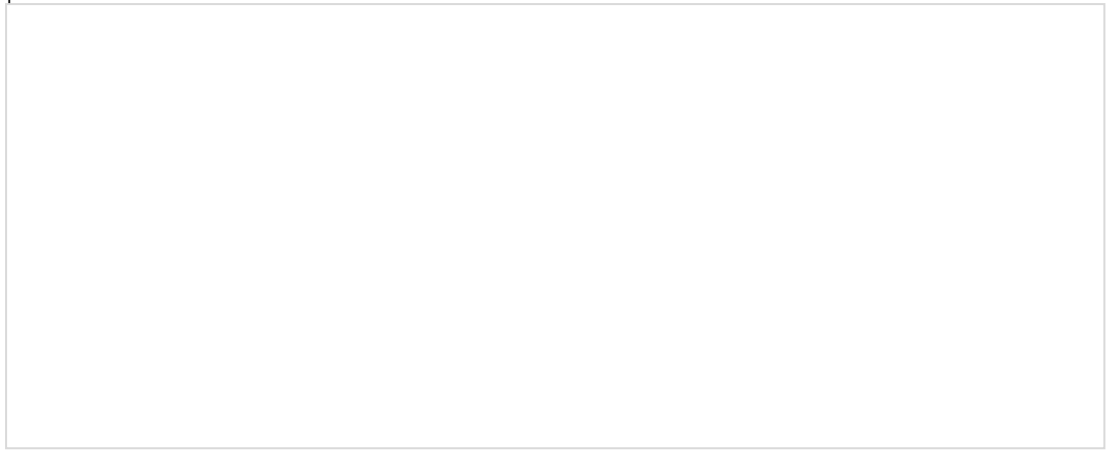
Name:

Draw a picture of what you think the brain looks like.



W

r



r

anything you know about the brain in the box below.

Mindset Intervention Worksheet #2 – Plan for the Future

Working together to prepare a growth mindset plan to remind yourself of thoughts and actions you can take when faced with a challenge or setback.

Whenever I face a challenge or setback...

I will respond by:

I will try not to:

Mindset Intervention Worksheet #3 – Key Things I learned Today

Write down some of the things you learned today or things that interested you the most.

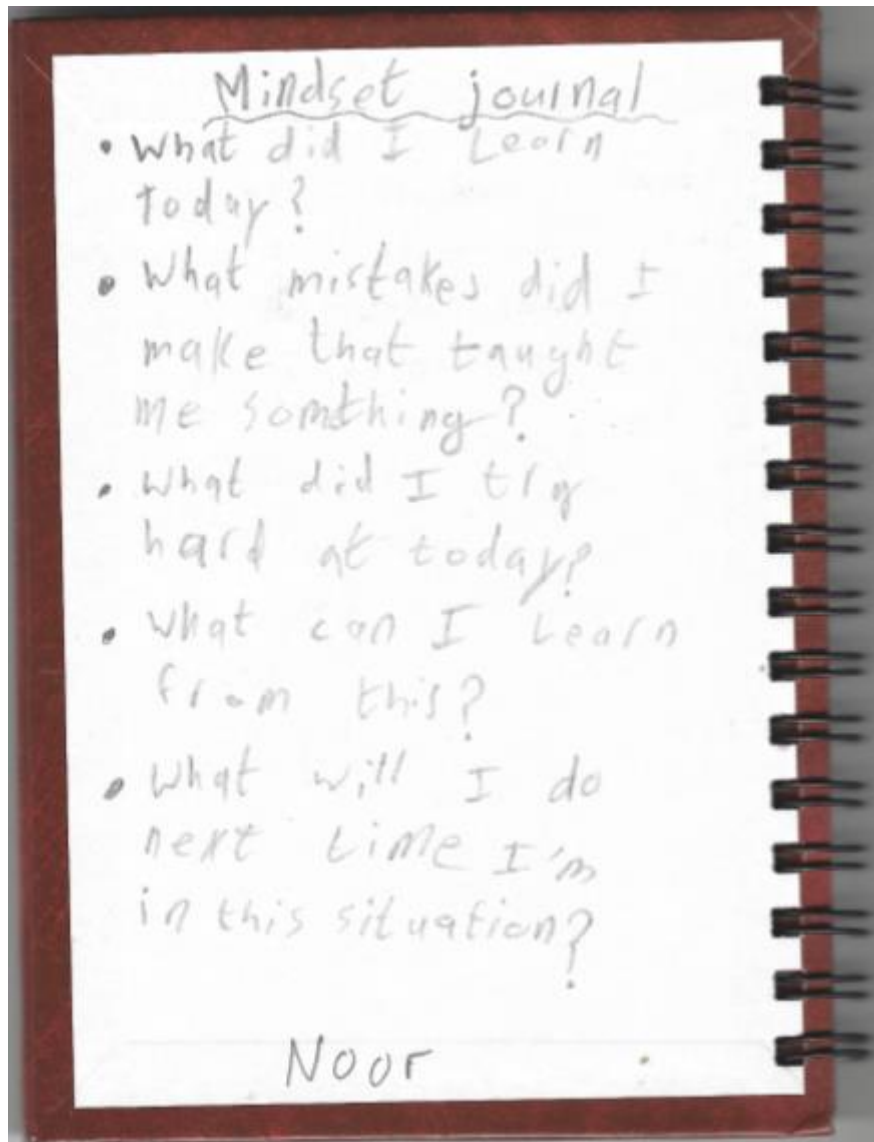
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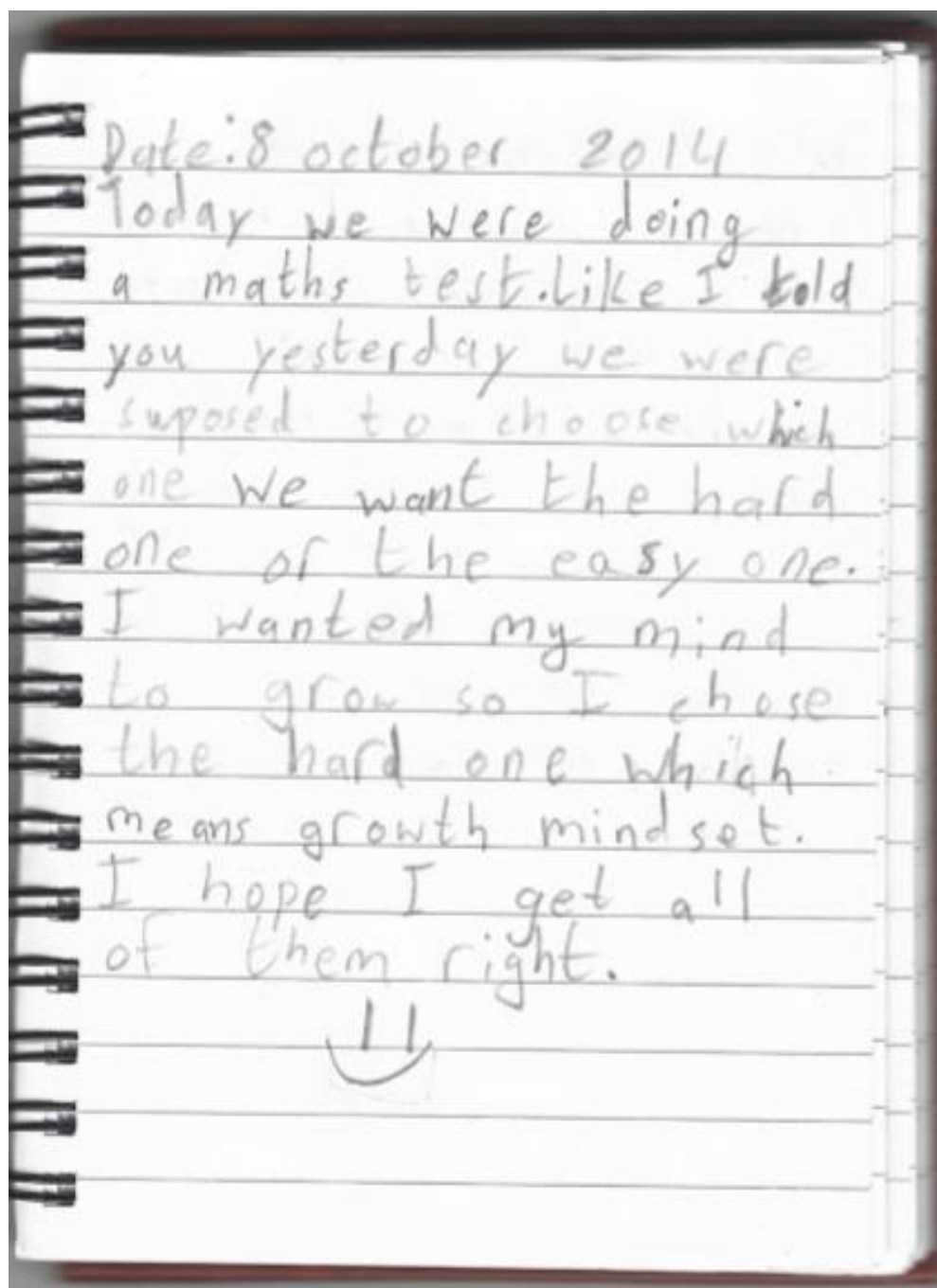
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8.8 Appendix H – Mindset Journal Entries



16th October 2014

In maths, we were
learning about polygons.
I really am finding math
super fun after the mind
mindset talk! We got
to use lollipops and
make the shapes. I don't
know what it is about
this mindset thing, but
I hope more schools get
this because it DOES
improve your mind a lot!



<p>Date: 7th of October</p>	
<p>What challenge have I taken on today?</p>	<p>that means I will have a growth mindset.</p>
<p>Today my teacher asked me if tomorrow I would like to do an easy maths test or a more difficult one. I think I would like ^{one} to do the harder ^{one} because I will enjoy having a challenge and</p>	

8.9 Appendix I – Teacher:Pupil Mindset Feedback

Connor, well done for taking on a challenging test. You have worked very hard throughout this unit and this is reflected in this test.

More than anything, however, I have been impressed by your attitude and your growth mindset. In the beginning, you were very disappointed with your pre-assessment. You could have given up at that point but you didn't. You knuckled down with grit and determination. "Failure is success if we learn from it" - you have shown this to be true.

I commend you for trusting in the process and I am delighted to see you rewarded for the effort you put in. Well done Connor.

14.10.14

9 Oct 2016

$$\begin{array}{r}
 1.5 \\
 \times 1.7 \\
 \hline
 105 \\
 + 150 \\
 \hline
 255 \text{ mins}
 \end{array}$$

Daniel, well done for taking on a more challenging test. From your work in class, I believe you have mastered the correct method for multiplying decimals.

However you can see where there were a couple of cases when you forgot to pop in your decimal point at the end. Do you think you would have spotted this if you had checked your work carefully? Is there anything you would do differently next time?

21.10.14

P.S.

You also demonstrated excellent problem-solving skills during the test in finding alternative ways to figure out some of those tricky word problems. Your perseverance was a sign of a healthy growth mindset. Keep it up!

<p>e $\begin{array}{r} 015 \\ 40 \overline{) 609} \\ \underline{-40} \downarrow \\ 209 \\ \underline{-200} \\ 009 \end{array}$ 15 r. 9 ✓</p>	<p>c $\begin{array}{r} 026 \\ 36 \overline{) 936} \\ \underline{-72} \downarrow \\ 216 \\ \underline{-216} \\ 000 \end{array}$ 26 times greater ✓</p>
<p>f $\begin{array}{r} 013 \\ 56 \overline{) 771} \\ \underline{-56} \downarrow \\ 211 \\ \underline{-168} \\ 043 \end{array}$ 13 r. 43 ✗</p>	<p>d Ans: 82 = $\begin{array}{r} 082 \\ 10 \overline{) 820} \\ \underline{-80} \downarrow \\ 020 \\ \underline{-20} \\ 00 \end{array}$ ✓</p>
<p>7 a $\begin{array}{r} 036 \\ 238 \overline{) 728} \\ \underline{-69} \downarrow \\ 138 \\ \underline{-138} \\ 000 \end{array}$ 36 times ✓</p>	<p>Good work George! Have a look at the few you got wrong and see if you can figure out your mistakes. Remember: mistakes are not failures - they are an opportunity to learn. Keep up the great work! 16.12.14</p>
<p>b $\begin{array}{r} 025 \text{ £25} \\ 20 \overline{) 500} \text{ an hour} \\ \underline{-40} \downarrow \\ 100 \\ \underline{-100} \\ 000 \end{array}$ ✓</p>	

8.10 Appendix J – Mindset Intervention Weekly Check-In



MINDSET INTERVENTION WEEKLY CHECK-IN

WEEK #4: OCT 13-17TH

FEEDBACK FROM THE TEACHER

- Noticeable changes in pupil engagement and interest levels as a result of the application of the mindset principles. Pupils enthusiastic about being part of the research study.
- Pupils volunteer for and try harder/more at challenging tasks & activities. E.g. end of unit maths test – choosing easier or more challenging tests.
- Teacher noticed that some pupils embraced the idea of mistakes as opportunities to learn. With other pupils it took a little longer but definitive progress evidenced.
- Feedback on the use of ability vs. effort praise – Does it make a difference? Teacher found her feedback to the pupils became more positive when focused shifted from results to effort and perseverance. This benefitted lower performing pupils in particular. Difference reflected in increased test scores, again particularly in mid to low performing pupils.

FEEDBACK FRM THE PUPILS

- Mindset journals captured specific feedback.
- High levels of enthusiasm and motivation as a result of being part of this research.
- What areas did they find interesting? Presentation and activities on the brain and plasticity was very well received. Class reported this was very interesting. Helped solidify the core ideas. Sporting analogies also helped land the principles of practice, effort and the value of failure as a learning aid.

WHAT IS WORKING WELL?

- 1. Relating classroom activities to the growth mindset.
- 2. Using role models to relate theory to practice.
- 3. Daily discussion on the growth mindset in the classroom.
- 4. Use of mindset journals to record mindset activities and sustain the implementation of the core principles. Very useful for communicating with parents and providing pupil feedback to the teacher.

WHAT CAN WE IMPROVE?

- 1. Request of the researcher to visit the class again during the mindset intervention to talk about the research so far and listen to pupils' feedback.
- 2. One interesting finding relates to current maths workbooks – workbooks provide boxes for results at the end of each unit/day which brings them back to a focus on score/ability. Potential to negatively impact the growth mindset intervention.
- 3
- 4.

