Evaluating the Utility of Working Memory Training Programmes for Children

A thesis submitted to the University of Manchester for the degree of Doctor of Educational and Child Psychology in the Faculty of Humanities.

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Were any WM improvements observed for typically developing 8-9 year old children as a result of MeeMo intervention?

Were any literacy or numeracy improvements observed for typically developing 8-9 year old children as a result of MeeMo intervention?

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Paper 2 References
Glossary

AMT – Access Numeracy Test

AWMA – Automated Working Memory Assessment

CEF – Central Executive Function

CHC – Cattell-Horn-Carroll theory of intelligence

Cogmed – A computer based working memory training programme

MeeMo – A paired whole class working memory training programme

T1 – First data collection point

T2 – Second data collection point

T3 – Third data collection point

TOSCRF-2 – Test of Silent Contextual Reading Fluency – 2nd Edition

VbWM – Verbal Working Memory

VbSTM – Verbal Short Term Memory

VSWM – Visuo-Spatial Working Memory

VSSTM – Visuo-Spatial Short Term Memory

WM – Working Memory

XP1 – Pre-experimental period

XP2 – Experimental period
Thesis Abstract

The University of Manchester

Lee Randall

Doctorate of Educational and Child Psychology

Evaluating the Utility of Working Memory Training Programmes for Children.¹

13/05/2016

The literature suggests working memory can have a significant effect on children’s academic success. A number of working memory training programmes have been developed as tools for helping children to boost their working memory and learning ability. The reliability and validity of this body of evidence has been challenged recently with questions raised as to whether such programmes actually do boost working memory or show any subsequent impact upon learning.

The thesis contains an evaluative systematic review examining eight studies from the last decade that explore the effects of working memory training on working memory, literacy and numeracy. The review found significant near and far transfer effects for improvements to working memory with differences in the pattern of these improvements. The assertion that working memory training leads to improvements in other areas such as literacy and numeracy is also challenged.

The thesis also contains an examination of the efficacy of a paired whole class working memory intervention in delivering improvements in the working memory, literacy and numeracy skills of primary aged school children. The pre-experimental design tested the impact of the intervention on the working memory, literacy and numeracy of a sample of forty-one Year 4 children. The data demonstrated a significant positive immediate effect of the programme on verbal working memory recall and processing and visual-spatial working memory processing and recall. No significant immediate effects of the programme were found on numeracy or literacy.

Finally a critical appraisal of concepts of evidence based practice and a review of the literature regarding the dissemination of research and notions of research impact is presented. The implications of the current research for professional practice is explored in terms of the care that must be taken by educational professionals in offering up working memory training programmes as solutions to academic underachievement in children.

¹ This project was funded through England’s Department for Education (DfE) National College for Teaching and Learning (NCTL) ITEP award 2012-2015.
Declaration

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

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Paper 1 - Evaluating the Impact of Working Memory Training Programmes on Children – A Systematic Literature Review

Abstract

Background: An increasing body of evidence suggests that working memory can have a significant effect on the academic success of children in school (Gathercole & Alloway, 2008). As such a number of working memory training programmes have been developed and marketed commercially to schools and parents as tools for helping children to boost their working memory and as a result, their learning ability.

Aim: The reliability and validity of this body of evidence has been challenged in recent years with questions raised as to whether such programmes actually do boost working memory or show any subsequent impact upon learning (Apter, 2012). This paper aims to examine eight studies published within the last ten years that explore the effects of commercially available working memory training on working memory and various other factors including ADHD, literacy and numeracy.

Rationale/Approach: Drawing on systematic literature review methodology and using study quality assessment frameworks, the paper examines the evidence for the impact of working memory training programmes upon working memory and other neuro-behavioural and neuro-cognitive factors relevant to teaching and learning.

Findings/Conclusions: The studies examined used samples from a range of ages (5-12 years) and with varied demographic, behavioural and cognitive characteristics. The review indicated that although significant near and far transfer effects for improvements to working memory were found, there were some differences in the pattern of these improvements, with different studies finding different sub-components of working memory benefiting over others. The review also found that the evidence that working memory training leads to improvements in other areas such as literacy and numeracy is inconclusive at best, and that further research will be required for us to better understand the mechanism through which working memory training may improve working memory and academic performance in children.

2 Prepared in accordance with guidelines for publication in Educational and Child Psychology – See Appendix 8 for author guidelines.
Introduction

A distinction between Short Term Memory (STM) and Long Term Memory (LTM) had been well established in the literature before 1974 (e.g. Warrington & Baddeley, 1970). STM was generally regarded as an indivisible unitary store, interacting with LTM in a very rigid and inflexible manner, (Melton, 1963; Peterson & Peterson, 1959). However, Baddeley and Hitch’s (1974) model of Working Memory (WM) challenged this view, postulating that WM contained within it distinct limited capacity components of STM, namely Visual-Spatial (VSSTM) and Verbal Short Term Memory (VbSTM) components. Furthermore they suggested that these subcomponents were governed by a central executive (CE), which was assumed to be capable of directing attentional focus and decision making, functionally creating Visual-Spatial (VSWM) and Verbal Working Memory (VbWM). However the model was still deemed to be incomplete as it did not contain within it any storage capacity beyond the very limited STM subcomponents and no real mechanism for interacting with LTM (Baddeley & Hitch, 2000). Therefore a fourth component of the model was added; namely the Episodic Buffer (Baddeley, 2000). The Episodic Buffer (EB) acts as a limited capacity buffer store, not only between the components of WM, but also linking WM to perception and LTM. This meant that the components of WM could interact dynamically with LTM under the governance of the CE. It is through this mechanism that we acquire our long term memories or ‘permanent’ knowledge.

Understanding WM is important for educators and psychologists alike because children in education are frequently having to perform tasks which require its the use (Gathercole & Alloway, 2008). From the complex to the mundane, the tasks children perform in school require them to take in new information and link it to old information, think flexibly and creatively, retain and manipulate information, filter out distracting stimuli, direct their attention appropriately and more (Gathercole & Alloway, 2008). If we assume therefore that WM is fundamental to children’s everyday experience of education, it seems logical to suggest that children with poorer WM may struggle to function effectively and make progress within the school environment.

Indeed, the literature makes a very strong case for there being a significant link between a child’s capacity to perform well academically and their WM (e.g. Gathercole, Pickering,
Ambridge, & Wearing, 2004; Leather & Henry, 1994; Swanson, Kehler, & Jerman, 2010). For example as early as the age of three to five, children with poorer WM make significantly poorer progress towards their early learning goals when compared to peers with better WM (T P Alloway et al., 2005; Nevo & Breznitz, 2011). In terms of specific academic subjects, WM skills have been shown to be significantly related to the severity of learning difficulties in literacy and mathematics.

For those involved in improving educational outcomes for children (especially those who may hold a ‘scientist practitioner’ purview, such as educational psychologists), it might seem reasonable to wonder if there are ways in which we could improve children’s WM and in doing so, see some commensurate improvement in other areas of cognitive functioning, behavioural presentation or academic performance. In their meta-analysis on the effectiveness of WM training on children and adults, Melby-Lervåg and Hulme, (2013) found that “memory training programs appear to produce short-term, specific training effects that do not generalize... these findings cast doubt on both the clinical relevance of working memory training programs and their utility as methods of enhancing cognitive functioning in typically developing children (p.272)”. This was evidently discouraging news for those who might wish to think that WM training could be used to help children make accelerated progress in school.

However, as Melby-Lervag and Hulme (2013) acknowledge in their paper, there were a number of limitations with their analysis, including the variation in age between study participants and other moderator variables such as the research design, time spent training and the type of control group; as such these variables were coded for and factored into the analysis. Yet arguably the most problematic moderator variable in the analysis was the variability of the WM training conducted in these studies, with many researchers conducting their own bespoke WM training in the operationalisation of their studies as opposed to using an easily replicable WM training programme such as Cogmed (Cogmed, 2015). This could be seen as problematic, as the results of studies using bespoke, diversely designed and implemented working memory training could very well be expected to be rather diverse. In fact the evidence that variations in the design and implementation of WM training can yield vastly different results is shown to be quite robust. Dunning, Holmes, and
Gathercole, (2013) for example, demonstrated that adaptive WM training (i.e., training that scales its difficulty to the trainee’s ability in order to facilitate progress) showed significantly greater impact in terms of improving WM than non-adaptive training with exactly the same content. In short, the evidence suggested it is very difficult to assess the efficacy of working memory training as a whole in a meta-analysis when the studies used have such variation in the design and implementation of said training.

Indeed, two more recent meta-analyses with a narrower focus and hence, greater homogeneity of experimental design in the studies selected (Peijnenborgh, Hurks, Aldenkamp, Vles, & Hendriksen, 2015; Spencer-Smith & Klingberg, 2015) suggest that WM training may actually have effects that not only generalise to areas outside of the training tasks, but also last for a sustained period. Both also specifically mention Cogmed as yielding promising results that warrant further investigation. It is therefore possible that working memory training programmes can be more effective than the work of Melby-Lervag and Hulme (2013) suggests, but only if they are designed and implemented in particular ways. It could consequently be argued that the most valuable research in this area focuses on WM training programmes that are robustly researched and replicable, in order to ascertain the nature and size of their impact upon those who undertake them. In this way we may be better able to ascertain how and why certain programmes may be more or less effective at improving different aspects of cognitive and behavioural functioning than others. This could also lead to a greater understanding of WM, how it manifests in our behaviour and capabilities, and how we might design future WM training which is directly applicable in educational settings and can be monitored through school target tracking.

That said, prominent researchers in the field such as Gathercole, Dunning, and Holmes, (2012) and Shipstead, Hicks, and Engle, (2012) advised caution and a sceptical stance when approaching the evidence and claims for the efficacy of WM training. Claims of the efficacy of such programmes in improving educational outcomes for children are, in their view promising, but by no means conclusive. At the same time however it is important ”not to throw the baby out with the bathwater” (Gathercole et al., 2012, p. 202) in terms of suggesting that all WM training programmes provide little generalisable or long term benefit.
In light of the above and the Royal Society’s recent report drawing attention to the growing presence of ‘brain-based methods’ in UK schools (The Royal Society, 2011), the intention for this systematic literature review was to assess research papers that aimed to ascertain the impact that specific working memory training programmes, which are delivered in a specific, replicable and prescribed way, may or may not have had on school aged children. In that way it was hoped that a clearer view of the current research evidence for specific programmes could be elucidated, and future directions for research in the area ascertained, enabling those working with children in an educational capacity to gain a greater understanding of the evidence for and against the use of WM training programmes in schools.

**Systematic Literature Review Questions**

1. What impact (if any) do WM training programmes have upon children’s WM?
2. Do WM training programmes have any impact on children in areas other than WM?
3. What explanations are given for the impact of WM training programmes?

**Method**

**Data Sources and Literature Search Strategy**

Electronic databases (University of Manchester Library; Psych Info; Web of Science; ERIC; Pubmed; Google Scholar; EThOS) were searched for published articles and theses investigating WM training programmes. The search terms used were:-

Working AND Memory AND (Training OR Intervention OR Programme) AND (Children).

Reference harvesting of included papers was also used to improve the rigour of the search. The SLR was structured using the PRISMA framework (Moher, Liberati, & Altman, 2009).

**Inclusion Criteria**

Studies were screened against the following inclusion criteria:-

1. Study evaluates impact of a WM training programme on WM.
1. WM measures are robust and interrogate at least two aspects of WM (e.g. Verbal and Visuo-Spatial Working Memory).

2. Study is primary research.

3. Study uses a complete WM training programme that is delivered in a specific, replicable and prescribed way.

4. Study is conducted with children aged under 16 years.

5. Study is published in English.

6. Study is a peer reviewed paper or an unpublished but matriculated thesis.

7. Study is quantitative.

8. Study Quality Assessment
   The robust evaluative framework applied to assess the quality of the studies was adapted from the set of frameworks created by Bond, Woods, Humphrey, Symes, & Green, (2013) in their SLR of Solution Focussed Brief Therapy interventions in schools. As the studies considered for the current SLR were evaluative quantitative studies, only the framework pertaining to evaluative quantitative studies was adapted and used. The framework is designed to assess each study for the quality of methodology and data analysis employed, as well as how well the implications of results are discussed and ethical considerations. In addition to this another paper (Young & Solomon, 2009) was used in order to add quality criteria to this already robust framework so that it would more specifically reflect the cohort studies analysed and the questions posed in this review; specifically these additions pertained to follow up (or downstream) impacts of the intervention being considered and impact on areas other than the primary area of interest (WM). It consists of a checklist of 9 study features falling into the above categories of assessment, for which the study can score either 1 or 0 (except for one case in which it is 2, 1 or 0), yielding a maximum possible study quality score of 10. Studies scoring between 8 and 10 would be considered high quality; those scoring 6 or 7 would be considered medium quality and those scoring 5 or below would be considered low quality (Gough, 2007).
Data Extraction and Synthesis

Information collected from the studies included: the study design, sample size, demographic sample characteristics, statistics used to interpret results, ethical considerations, research findings and implications considered. Data were synthesised from both qualitative and quantitative perspectives in terms of evaluating study quality, the findings and implications.

Once again the work of Young and Solomon (2009) was used to appraise the research methodologies of the cohort studies analysed in the review, with particular reference to how confounding variables were controlled and factored in to the data synthesis in the studies.

Details of Included and Excluded Studies

Electronic searches of title and abstract generated 81 hits in total. Of these studies 42 were excluded as they were not studies of WMT programmes that are commercially available; 16 because they were not evaluative studies of WMT; 7 were not studies written in English; 5 were not studies focused exclusively on children aged under 16 years; and 3 were excluded as the tests of WM used in them were not suitably robust. Eight papers remained for review after all exclusion criteria were applied.

Results

Overall Weight of Evidence and Appraisal of Studies

The table below (Table 1) shows the study quality score for each study included in the review along with a brief description of their main characteristics.
<table>
<thead>
<tr>
<th>Author and Study Quality Score</th>
<th>Study Design, Comparator Group and Focus</th>
<th>Effect Sizes of Significant Results</th>
<th>Methodology Employed</th>
<th>Ethics</th>
<th>Findings and Implications (outcome measures reliability and validity; impact on WM and other areas; downstream impact considered)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Chacko et al., 2014)</td>
<td>Random group design with placebo and focus on WM, literacy, numeracy and ADHD.</td>
<td>VbSTM d=0.28 VSSTM d=1.17</td>
<td>85 Children aged 7-11 with ADHD randomly assigned into groups using either an adaptive Cogmed Working Memory Training (CWMT) or placebo (non-adaptive) CWMT. Pre and post tests performed.</td>
<td>Children in placebo condition at least given access to some form of WMT.</td>
<td>Benefit to both VbSTM and VSSTM of active condition was demonstrated in comparison to placebo group. However no benefit in this group was seen for ADHD measures, academic measures, or measures of WM. Similarities between WM training and tests could have led to training to task rather than a WM improvement. Active condition children also had a lot more supportive adult interactions than placebo. Suggests some improvement for STM through training but findings not robust as there are many confounds.</td>
</tr>
<tr>
<td>Study</td>
<td>Design</td>
<td>Focus</td>
<td>Sample</td>
<td>Results</td>
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<tr>
<td>(Dahlin, 2010)</td>
<td>Random group design with control group and focus on WM and literacy.</td>
<td>Reading Comprehension</td>
<td>57 children aged 9-12 with literacy difficulties randomly assigned into either a Robomemo group or a control group. Children assessed pre-intervention (T1), post-intervention (T2) and 6 months later (T3). Control group WM not tested at post-test, instead compared to comparator group from Klingberg, 2005).</td>
<td>Children in control group received nothing.</td>
<td>WM correlated with reading comprehension ability in both groups with Robomemo group significantly improving in both post-test. No improvement in word decoding, orthography tests or response inhibition tests in either group. Large differences in size of control and Robomemo group is a problem here. WM could be seen as mediating factor in reading comprehension and WM training shown to improve WM in this group.</td>
</tr>
<tr>
<td>(Dahlin, 2013)</td>
<td>Random group design with control group and focus on Basic Number Skills</td>
<td>Basic Number Skills</td>
<td>42 children aged 9-12 with ADHD randomly assigned to CWMT or control group. Children assessed</td>
<td>Children in control group received</td>
<td>Gender differences found in that boys numeracy (involving WM) in test group improved significantly more than control group at T2 and T3, whereas the girls did not.</td>
</tr>
<tr>
<td>WM, numeracy and ADHD.</td>
<td>d=0.69</td>
<td>pre-intervention (T1), post-intervention (T2) and 6 months later (T3).</td>
<td>nothing.</td>
<td>However, very small number of girls in study in comparison to boys could lead to bias and unrepresentativeness throwing off the results. No differences found in quick addition and subtraction tasks which require less from WM. VbSTM and WM were not affected by training whereas VSWM and STM were. Suggests that training does not work for VbSTM and VbWM but does for CEF which is theorised to play a greater role in VSWM and VSSTM.</td>
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<tr>
<td>VSSTM T2</td>
<td>d=0.65</td>
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<tr>
<td>T3</td>
<td></td>
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<td>VSSTM T3</td>
<td>d=1.19</td>
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<td>T3</td>
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<tr>
<td>VSSTM T3</td>
<td>d=1.05</td>
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<tr>
<td>VSWM T2</td>
<td>d=0.92</td>
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<td>T3</td>
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<tr>
<td>VSWM T3</td>
<td>d=0.93</td>
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(Dunning et al., 2013)

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<thead>
<tr>
<th>Random group design with control group and focus on WM, literacy,</th>
<th>VSSTM T2</th>
<th>94 children aged 7-9 identified as having WM ability at or below the 15&lt;sup&gt;th&lt;/sup&gt; percentile were randomly assigned into 3 groups:</th>
<th>Children in control group received nothing.</th>
<th>Adaptive group showed improvement in VSSTM, VSWM and VbWM at T2 though not in VbSTM. VbWM showed sustained improvement at T3. Suggests that VbSTM is specialised WM component linked to</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSSTM T2</td>
<td>d=0.87</td>
<td></td>
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<tr>
<td>VbWM T2</td>
<td>d=0.67</td>
<td></td>
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<tr>
<td>Numeracy, IQ and everyday classroom tasks that are demanding on WM.</td>
<td>VBWM T2 d=0.99 T3 effect size unavailable</td>
<td>Adaptive CWMT, Non-Adaptive CWMT and control. All Children assessed pre-intervention (T1), post-intervention (T2) and 34 also assessed 6 months later (T3).</td>
<td>Vocabulary acquisition and less reliant on CEF. No literacy or numeracy improvements shown or improvements in WM demanding classroom tasks. Suggests lack of generalisation from training to other areas.</td>
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<tr>
<td>Random group design with control group and focus on WM, literacy, numeracy, IQ and everyday classroom tasks that are demanding on WM.</td>
<td>VSSTM T2 d=1.20 T3 d=0.83 VSTM T2 d=1.03 T3 d=0.85 VbWM T2 d=1.55 T3</td>
<td>42 children between ages of 8-11 identified as having poor WM. Children randomly assigned to CWMT adaptive or CWMT non-adaptive groups. All Children assessed pre-intervention (T1), post-intervention (T2) and 6 months later (T3).</td>
<td>Adaptive group showed improvement in VSSTM, VSTM and VbWM at T2 and this was sustained through to T3. VSTM showed no significant improvement in adaptive compared to non-adaptive group. Adaptive training was not found to provide a significant boost to IQ or literacy; however it did improve numeracy at T3 although not at T2 suggesting perhaps an improved ability to acquire and use mathematical knowledge conferred by the CMWT adaptive training.</td>
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</table>

(Holmes, Gathercole, & Dunning, 2009)

9/10
(Holmes & Gathercole, 2013)  

**8/10**

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<tbody>
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<td></td>
<td>d=1.16</td>
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<tr>
<td>Trial 1 – Opportunity sample design with focus on WM.</td>
<td>Trial 1 – 22 mixed ability 8-9 year olds assigned to a CMWT group and given pre-intervention (T1), post-intervention (T2) WM test.</td>
<td>Trial 1 – Showed significant gains in WM for all children across all WM domains tested (though VbSTM had lowest effect size). Children with worst WM made biggest gains. However, no control group and could just be training to task as no analysis of generalisation.</td>
</tr>
<tr>
<td>Trial 2 – Matched pairs design with a control group and focus on academic achievement in literacy and numeracy.</td>
<td>Trial 2 – 50 9-11 year olds with lowest academic performance in school placed in CWMT group. Pupils in the same school from previous years cohort were matched with them for age, gender and performance to serve as a control group. National Curriculum levels were used as performance</td>
<td>Trial 2 – Yr 5 CWMT group made significantly larger improvements than control in numeracy but not literacy. Yr 6 CWMT group made significantly larger improvements than control in numeracy and literacy. Suggests CWMT may lead to improved learning capacity in literacy and numeracy.</td>
</tr>
<tr>
<td></td>
<td>Trial 1 VbSTM d=0.37 VSSTM d=1.00 VbWM d=1.34 VSWM d=0.98 Trial 2 Y5 Num d=1.15 Y6 Num d=0.60 Y6 Lit d=0.67</td>
<td></td>
</tr>
<tr>
<td>(Klingberg et al., 2005)</td>
<td>Random group design with control group and focus on WM, non-verbal reasoning and response inhibition.</td>
<td>44 children with ADHD aged 7-12 years were randomly assigned to Robomemo or placebo (non-adaptive) group. Children assessed pre-intervention (T1), post-intervention (T2) and 3 months later (T3).</td>
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<tr>
<td>(St Clair Thompson, Stevens, Hunt, &amp; Bolder, 2010)</td>
<td>Opportunity sample design with focus on WM, literacy, IQ, numeracy and everyday classroom tasks that are demanding on</td>
<td>254 children of 5-8 years old from 5 double from entry school took part in the study. In each school, 2 same year group classes were used; 1 was given Memory Booster WMT intervention and other was control condition.</td>
</tr>
<tr>
<td>WM.</td>
<td>Children assessed pre-intervention (T1), post-intervention (T2).</td>
<td>Booster works of different parts of WM than CWMT. However measures tapping VbWM and CEF did show largest training effect so perhaps we should expect to see the largest effects on CEF and WM as opposed to STM components. Children also demonstrated improvements in classroom tasks and no improvement in literacy or numeracy.</td>
</tr>
</tbody>
</table>
Overview of the Quality of the Studies Assessed

One study was rated as medium quality (St Clair Thompson et al., 2010) whilst all of the others were rated as high quality (Chacko et al., 2014; Dahlin, 2010, 2013; Dunning et al., 2013; Holmes et al., 2009; Holmes & Gathercole, 2013; Klingberg et al., 2005). No studies were rated as low quality.

Working Memory Training Used

Five of the studies (Chacko et al., 2014; Dahlin, 2013; Dunning et al., 2013; Holmes et al., 2009; Holmes & Gathercole, 2013) used Cogmed Working Memory Training (CWMT) as their working memory training programme. CWMT lasts for 20-25 sessions in which trainees use a computer interface to engage in rotating tasks that work on the individual components of WM (VbSTM, VSSTM, VbWM and VSWM); an individual will undertake 120 trials per session. The programme is adaptive in that it calibrates the difficulty of the tasks dynamically based on an individual’s performance in such a way that the individual is always challenged without finding the tasks too trivial or difficult. It is not designed to necessarily work on developing strategies to better make use of WM; rather it seeks to improve the trainee’s WM at a more fundamental level, increasing capacity to learn new skills (Cogmed, 2015). CWMT comes in 3 versions designed for preschool children (JM), school age children (RM) and adolescents and adults (QM); the studies above all used the RM version of the programme.

Two studies (Dahlin, 2010; Klingberg et al., 2005) used Robomemo, which is an earlier version of CWMT and operates to the same principals and structure. It is worth noting at this juncture that both Dahlin and Klingberg have links to the development and proliferation of the Cogmed programme and that Cogmed may have played some commissioning role in the work produced by the two authors. One study (St Clair Thompson et al., 2010) used Memory Booster, which is again a computer based WM training programme. However Memory Booster differs to CWMT in that individuals using the programme are given specific strategy instructions which they can use to complete the tasks. When a task is completed the user is given a more complex task for which a more complex strategy should be used to
overcome it. The programme is also adaptive, giving more items to remember in each individual task depending on the proficiency of the user.

Study Design

Six of the studies used a randomised group design (Chacko et al., 2014; Dahlin, 2010, 2013; Dunning et al., 2013; Holmes et al., 2009; Klingberg et al., 2005) in which children were randomly assigned to experimental groups and some form of control group. The operationalisation of control groups differed significantly from study to study however. Two studies compared the experimental group to a standard control group who received no extra intervention (Dahlin, 2010, 2013). This could be seen as problematic as any difference between the experimental and control groups could have been due to the extra adult attention the experimental group were receiving as opposed to any effect of the WM training they received. To mitigate this particular confound, three of the studies (Chacko et al., 2014; Holmes et al., 2009; Klingberg et al., 2005) had a control group in which children played a game similar to the WM training of the experimental group for just as much time with just as much adult input, the difference being that this version was non-adaptive (i.e., the difficulty remained simple and did not scale with the child’s ability in order to provide challenge) and as such was unlikely to ‘train’ the child’s WM. One study (Dunning et al., 2013) actually split children into three groups - an adaptive training group, a non-adaptive training group and a standard control group - in order to examine any impact of the ‘side-benefits’ provided by the non-adaptive training as compared to control.

Of the remaining two studies one (St Clair Thompson et al., 2010) employed an opportunity sampling group design by simply using existing primary school classes to form either the experimental group or a standard control condition. Not only does this present with the control group problems discussed above, but the lack of randomisation means that the groups used are at greater risk of being more heterogeneous, compromising the studies’ reliability.

In the final study (Holmes & Gathercole, 2013), two trials were conducted for which opportunity sampling group design was again used (with its inherent problems as discussed above). In the first a repeated measures design was used to assess the before and after WM skills of one group of children. This eliminates any confounding participant variables but
does mean that practice effects and maturation could play a part in any improvements in
the second round of testing. In the second trial, where a matched pairs design was used, 50
primary school children were matched with 50 children similar in terms of age, gender and
academic ability from the previous school cohort. Not only does this design mitigate
participant variables, it also eliminates practice effects and maturation as confounding
variables; however, as the previous year’s cohort received no intervention at all, the
problems with standard control groups discussed above do apply.

Interestingly, Holmes and Gathercole, (2013) was the only study of the eight in which school
staff were trained to use the WM training programme and deliver it to the children as
opposed to the researchers delivering it. In many of the other studies, expert psychological
feedback and advice was given on the child’s progress once per week; this did not occur in
the Holmes and Gathercole (2013) study. It could be argued therefore that the Holmes and
Gathercole (2013) study is the most ecologically valid of the studies, given that it is most
closely approximates how WM training programmes are likely to be used in schools
(Cogmed, 2015).

Sample Characteristics
In terms of age range the youngest participants used were 5 years of age and the oldest 12.
Participants were also all taken from primary school populations. As for sample sizes, they
ranged from the smallest of 22 (Holmes & Gathercole, 2013 - Trial 1) to the largest of 254,
(St Clair Thompson et al., 2010). There was a significant problem with representativeness for
two of the studies with particular reference to the control groups. Both studies by Dahlin
(2010, 2013) had very small control groups (15) in comparison to the experimental groups
(42). Not only does the small size of the control groups mean that the results they yield
could be wildly skewed by only a small number of statistical outliers, but the difference in
size compared to the experimental group is problematic in that assigning some of the
experimental group to the control could have easily mitigated this problem somewhat. No
explanation as to the reasoning behind the disparity in group size is offered in either study.
Two other studies also had small sample sizes (Holmes et al., 2009; Klingberg et al., 2005)
but the group sizes were relatively even (within 2 participants of each other).
Three studies used children who were diagnosed or being assessed for ADHD (Chacko et al., 2014; Dahlin, 2013; Klingberg et al., 2005). Two studies (Dunning et al., 2013; Holmes et al., 2009) used children who had poor working memory scores (below the 15th percentile). Dahlin, (2010) used a cohort of children who were identified by their schools as having literacy difficulties. St Clair Thompson et al., (2010) used a cohort of mixed ability children. Holmes and Gathercole, (2013) used a cohort of typically developing children for their first trial and used children classed as ‘performing poorly academically’ by their school for their second trial.

**Measures and analysis**

All of the studies used inferential statistics to test their hypotheses. All of the studies except for one also calculated effect sizes; ironically the study that did not calculate an effect size was the study with the largest sample size (St Clair Thompson et al., 2010). All of the studies used a pre- and post-measures design (i.e., taking measures immediately before and after intervention). Furthermore, five of the studies (Dahlin, 2010, 2013; Dunning et al., 2013; Holmes et al., 2009; Klingberg et al., 2005) conducted further follow up on the same measures 3-6 months after the intervention had taken place. All of the studies measured WM; however they differed in the tools they used to do so. Different studies also measured other behavioural or cognitive faculties such as literacy or ADHD signifying behaviours. Table 2 (below) shows the measures used and what they were used to measure.
<table>
<thead>
<tr>
<th>Study</th>
<th>Measures Taken - Measurement Tools Used</th>
</tr>
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</table>
| (Chacko et al., 2014) | WM – Automated Working Memory Assessment Battery (AWMA)  
ADHD – Parent and teacher report of ADHD indicative behaviours using the Disruptive Behaviours Disorders Scale  
Motor Activity – Accelerometers attached to child’s waist and non-dominant ankle; movements per minute recorded  
Impulsivity – The A-X Continuous Performance Test  
Numeracy, literacy and comprehension – The Wide Range Achievement Test –IV (WRAT 4). |
VSWM – Wechsler Adult Intelligence Scale - Revised as a Neuropsychological Instrument (WASI-NI) span board test  
Response Inhibition – Stroop Test  
Literacy – Non word reading and spelling verification tests  
Comprehension – IEA Reading Literacy Study texts used |
| (Dahlin, 2013) | VbWM – WISC 3 digit span test  
VSWM – WAIS-NI span board test  
Numeracy – Basic Number Skills Test; addition and subtraction verification tests |
| (Dunning et al., 2013) | WM – AWMA and a following classroom instructions task.  
IQ – WASI-NI  
Literacy – Sentence counting; rhyme detection; Neale Analysis of Reading; Wechsler Objective Reading Dimensions (WORD)  
Numeracy – Wechsler Objective Numerical Dimensions (WOND) |
| (Holmes et al., 2009) | WM – AWMA and a following classroom instructions task.  
IQ – WASI-NI  
Literacy – WORD  
Numeracy – WOND |
| (Holmes & Gathercole, 2009) | WM – AWMA  
Academic Outcomes – Department of Education National Curriculum |
<table>
<thead>
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<th>2013)</th>
<th>Levels</th>
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<tbody>
<tr>
<td>(Klingberg et al., 2005)</td>
<td>VbWM – WISC 3 digit span test</td>
</tr>
<tr>
<td></td>
<td>VSWM – WAIS-NI span board test</td>
</tr>
<tr>
<td></td>
<td>Response Inhibition – Stroop Test</td>
</tr>
<tr>
<td></td>
<td>Non-verbal Reasoning – Ravens Coloured Matrices</td>
</tr>
<tr>
<td></td>
<td>ADHD – Connors Rating Scale for Parents; Diagnostic Statistical Manual – IV (DSM-IV) 18 point rating scale for ADHD.</td>
</tr>
<tr>
<td>(St Clair Thompson et al., 2010)</td>
<td>WM – Working Memory Test Battery (WMTB) and a following classroom instructions task.</td>
</tr>
<tr>
<td></td>
<td>Literacy – NFER group reading test 2</td>
</tr>
<tr>
<td></td>
<td>Numeracy – NFER mental maths 8.</td>
</tr>
</tbody>
</table>

1

2 Table 2: Measurement tools
Ethical Considerations

In the studies considered it is unlikely that participants would have been placed under any undue stress in terms of the interventions they undertook. The interventions were all designed to encourage children and give them a sense of fulfilment and achievement even if they did not achieve particularly high scores on the tasks. Participants also undertook the interventions at school or at home and therefore, in a safe familiar environment with familiar adults. The studies did require the children to be tested, usually more than once on a number of measures and this could have provoked some test anxiety in the children. However, it is likely that the children involved are used to being tested in school, which may have mitigated any anxiety they felt around testing.

The biggest ethical issue for all of the studies except for one (Holmes et al., 2009) was that they all featured a control group that received either no intervention at all or a version of the intervention the researchers believed was unlikely to be beneficial. This is an issue as any professional psychologist working with children is bound by the ethics of their respective professional bodies and academic institution. In the UK, for example, the British Psychological Society (BPS) states that psychologists must work in the best interests of the children with whom they come in contact (British Psychological Society, 2009). In each study except for Holmes et al. (2009), a significant proportion of the children they worked with (i.e., those in the control groups) did not get access to an intervention that the authors thought was likely to be beneficial to them; this is clearly not working in the best interests of these children. Holmes et al. (2009) surmounted this problem simply by offering the intervention to their control group after the study had finished, leading one to question why the other studies did not also do this.

What impact (if any) do WM training programmes have upon children’s WM?

The studies all detected a significant positive near transfer effect of WM training on the WM of children. However, there were some differences in the pattern of these effects between studies. Klingberg et al. (2005) found a significant improvement in the VSWM of children
undertaking training, but treated the smaller improvements in other areas of WM found more cautiously. Conversely Holmes and Gathercole (2013) found improvements in all areas of WM for children undertaking WM training, though VbSTM showed by far the smallest improvement. Dahlin (2010) also found significant training improvements for the two areas of WM she measured (VBWM and VSWM). Of the eight, three studies stand out as being in broad agreement in terms of their findings on WM (Dahlin, 2013; Dunning et al., 2013; Holmes et al., 2009); they found that WM training improved all areas of WM except for VbSTM. Two studies however garnered different results: Chacko et al., (2014) found a significant effect of training on VbSTM and VSSTM but not for VbWM or VSWM, and St Clair Thompson et al. (2010) showed significant training improvements in VbSTM and VbWM but not for VSSTM.

All of the studies with a follow-up test condition 3-6 months post intervention (Dahlin, 2010, 2013; Dunning et al., 2013; Holmes et al., 2009; Klingberg et al., 2005) found that the WM training effect was sustained at follow up, demonstrating far-transfer effects for WM training. Dahlin (2013) also found that the WM training had a positive effect in boys but not in girls; however given the small number of girls in the sample (11) and the even smaller number in the control condition (4), this result could well be due to confounding participant variables. In terms of effect sizes reported in all studies, predominantly large or medium effect sizes (Cohen, 1992) were reported on significant findings, with the largest effect size of WM training reported as being d=1.55 on VbWM by Holmes, Dunning and Gathercole (2009).

Do WM training programmes have any impact on children in areas other than WM?

None of the studies reporting on ADHD behaviours (Chacko et al., 2014; Dahlin, 2013; Klingberg et al., 2005) reported any significant effect of WM training on ADHD behaviours. Also none of the studies reporting on IQ (Dunning et al., 2013; Holmes et al., 2009) found any significant effect of WM training though Klingberg et al., (2005) reported a significant positive effect of WM training on non-verbal reasoning.

In terms of literacy five studies (Chacko et al., 2014; Dahlin, 2010; Dunning et al., 2013; Holmes et al., 2009; St Clair Thompson et al., 2010) found no significant effect of WM training.
However, Dahlin, (2010) did find that there was a significant positive effect of WM training on children’s comprehension which she suggested was a task more dependent upon WM than standard literacy tasks such as spelling and single word reading. Results for the impact of WM training on numeracy were more mixed with two studies finding a significant positive impact (Holmes et al., 2009; Holmes & Gathercole, 2013) and three finding no impact (Chacko et al., 2014; Dunning et al., 2013; St Clair Thompson et al., 2010). Dahlin (2013), however, produced a more nuanced result with no impact of WM training on basic numeracy task speed for adding or subtraction, but a significant positive impact (both immediately and 6 months later) on the Basic Numeracy Screening Test, which relies less on automatic recall of number facts and more on cognitive processes such as attention and planning, which are more reliant on WM (Baddeley, 2012).

What explanations are given for the impact of WM training programmes?

Dahlin (2013), Dunning et al. (2013) and Holmes et al. (2009) postulated that the reason for their pattern of results was that VSSTM, VbWM and VSWM are all systems that are supported by CEF (c.f. Alloway, Gathercole, & Pickering, 2006), whereas VbSTM is seen as a distinct subcomponent of WM suggested to support language learning and not closely governed by CEF (Baddeley, Gathercole, & Papagno, 1998). They suggest that WM training therefore works at the level of CEF and as such should have greater effect on subsystems governed by CEF, hence their findings.

It is clear, however, that whilst there is a broad agreement in the studies that WM training helps children to improve their WM (at least temporarily), there is some considerable disagreement about how exactly the improvements manifest themselves. One possible explanation for the disparity is that the studies were conducted on quite a wide array of differing subgroups of children. Not only did the ages of the participants vary significantly in different studies, but some studies used children with ADHD, whilst others used typically developing children or those identified as having poor WM. As a result it may be that the findings of certain studies such as Chacko et al. (2014), which were quite at odds with the findings of some other studies, can be generalised only to children with ADHD. Another could
be that different WM training programmes work to improve different components of WM. For example St Clair Thompson et al., (2010) used a different WMT programme to Dahlin (2013), Dunning et al. (2013) and Holmes et al. (2009). So perhaps their different results simply mean that their respective WM training programmes work on different subcomponents of WM.

Discussion

All of the studies clearly show that for WM training to work, it needs to be adaptive and scale the difficulty of the tasks to the user’s global cognitive ability level in order to provide a consistent challenge. However, although the overall tenor of the studies is positive in terms of the impact WM training can have on children’s WM ability as well as some other areas, we must treat the results with caution; particularly because this SLR is a review of a subset of relevant papers on the impact of WM training programmes with children, rather than a meta-analysis of WM training programmes as a whole.

Firstly, though some studies show promising positive effects of WM training over the medium term (up to a year) on WM and numeracy, there is no clear evidence yet demonstrating that such improvements are anything other than temporary. Longitudinal studies involving varying degrees of WM training conducted over a number of years would be required to establish this. Secondly, there are some obvious differences in the pattern of results in terms of WM subcomponents and the evidence that WM training leads to improvements in other areas is inconclusive at best (Apter, 2012). The relatively small sample sizes in most of the studies means that it is difficult to generalise the results of these studies too widely and the similarities between some of the tests used to collect data and the WM training tasks could mean that children are simply being trained to do well at very specific tasks, rather than improving their WM ability in a way that could generalise to other areas (Shipstead, Redick, & Engle, 2010).

An interesting issue that has not yet been resolved in the existing literature it the *core vs. strategy training* debate. Cogmed claim that CWMT works on improving the core WM ability of
individuals as opposed to giving them strategies to help use their existing WM more efficiently (Cogmed, 2015). However, it could be that through the training, individuals spontaneously develop strategies to help them make progress; in this case the individuals would be using more effective strategies to perform better in WM tasks as opposed to accruing greater WM capacity. Indeed much of the literature on this subject suggests that it is WM strategies that improve performance on WM tasks rather than capacity (Autin & Croizet, 2012; Swanson, Kehler, & Jerman, 2010). This presents another problem facing those seeking to promote WM training as a means of improving the academic performance of children, because until we understand better the mechanism through which WM training may improve WM and academic performance in children, we cannot be clear about how we might optimally design WM training to benefit them. If we are to hypothesise that WM training might be of benefit to all children, it seems only logical that future work on WM training should be conducted on heterogeneous groups of children, representative of the demographic, behavioural and cognitive characteristics of the modern classroom.

One final point to mention here is that all of the studies used a computer based WM training programme. The fact that this seems to be the only ‘delivery system’ by which empirically researched WM training is operationalised could, in and of itself, be problematic, as any inherent weaknesses in such a delivery model - for example the lack of ‘truly’ adaptive human mediation limiting metacognition about WM strategies (Carretti, Borella, Zavagnin, & De Beni, 2011; Rumble, 2014; Skelton, 2012) - could lead to the efficacy of WM training being limited simply by the way it is delivered. Such a problem would likely be insurmountable for a computer based WM training programme and could in fact be contributing to the inconclusive nature of the research into the impact of WM training programmes to date. This would suggest that the development and empirical testing of WM training programmes delivered in other ways could be a fertile and productive area for further research.
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Paper 2 – Evaluating the Impact of the MeeMo Working Memory Training Programme on the Working Memory and Academic Performance of 8-9 Year Old Children

Abstract

Background: The capacity of working memory training programmes to improve working memory and subsequently academic performance is a much debated issue. One noticeable feature of the programmes examined in the literature is that they all deliver working memory training by requiring children to interact solely with a computer programme.

Aims and Participants: This study examined the efficacy of a paired whole class working memory intervention called MeeMo, in delivering improvements in the working memory, literacy and numeracy skills of primary aged school children. The study involved a sample of forty-one 8-9 year old children with diverse academic abilities attending two Year 4 classes in two different schools.

Methodology: In the studies pre-experimental design the children’s working memory, literacy and numeracy skills were assessed using standardised measures. They were then assessed after 8 weeks during which the children did not receive MeeMo intervention, and again after another 8 weeks during which the children did receive MeeMo intervention. The difference in the performance metrics across the two 8 week periods were then calculated and compared.

Results: The data demonstrated a large positive immediate effect of the programme on verbal working memory recall (d=1.05) and processing (d=1.07) and visual-spatial working memory processing (d=1.17) with a small to medium immediate effect on visual-spatial recall (d=0.43). No significant immediate effects of the programme were found on numeracy or literacy.

Discussion: The evidence suggests that MeeMo has an immediate short term positive impact on processing and recall in the VbWM and VSWM systems of 8-9 year old children. Though no immediate effects of the programme were found for literacy and numeracy, this does not discount the possibility of the programme having long term effects on these skills.

\[^3\] Prepared in accordance with guidelines for publication in Child Neuropsychology – See Appendix 9 for author guidelines. Please note that abstract prepared in accordance with online submission guidelines of 250 word limit and not the outdated (but most recent available) guidelines in the appendix.
**Introduction**

The literature suggests that Working Memory (WM) is a key determinant of an individual’s ability to carry out a wide array of cognitive tasks (Morrison & Chein, 2011) and plays a crucial role in learning and maintaining focussed behaviour (Holmes et al., 2009). WM can be seen as a mental workspace in which information in the service of ongoing and multimodal cognitive activity such as language comprehension or problem solving is maintained and manipulated, (Kane et al., 2004). Crucially, it is postulated that the dynamic interaction of domain-specific storage with domain-general central executive function (CEF) gives the WM model the power to address the role of active memory in real world cognition, (e.g. Daneman & Merikle, 1996).

Therefore, when considering the WM model as illustrated thus far, we might assume that WM plays an important role in our everyday lives. The ability to think quickly and creatively (fluid intelligence), processing of external stimuli in a meaningful way, comprehension and processing of verbal and written language, problem solving; it could be argued that all of these important abilities and more are mediated to a greater or lesser extent by our WM (Baddeley, 2012). In terms of information processing WM is responsible for the processing of new information in short term memory, the retrieval of stored information from long term memory, the combination and manipulation of old and new data and more, (Baddeley, 2012). The CEF component is not only crucial in governing these information processing functions but is also involved in directing our attention, inhibiting responses, self-regulation and other vital attentional processes, (Hofmann, Schmeichel, & Baddeley, 2012).

Children in education are constantly having to perform tasks which require the use of their WM (Gathercole & Alloway, 2008). From the complex to the mundane, tasks children perform in school require them to take in new information and link it to old information, think flexibly and creatively, retain and manipulate information, filter out distracting stimuli, direct their attention appropriately and more (Gathercole & Alloway, 2008). As we might expect from this, children with poorer WM tend to perform poorly academically in school. The literature also suggests that reading comprehension and writing skills can be significantly predicted by WM skills, (Leather & Henry, 1994; Swanson, Kehler, & Jerman, 2010; Swanson, 1999) and WM skills
have also been found to be an accurate predictor of National Curriculum Levels from primary through to secondary school (Gathercole et al., 2004; Gathercole, Pickering, & Brown, 2003; Gathercole & Pickering, 2000; Jarvis & Gathercole, 2003). Alloway and Alloway (2010) investigated whether WM as measured by the Automated Working Memory Assessment or AWMA (Alloway, 2007) was a better predictor than IQ of later academic attainment in children as measured by the Wechsler Pre-School and Primary Scale of Intelligence (WPPSI- Wechsler, 1990) and the Wechsler intelligence scale for children (WISC- Wechsler, 2004). They tested 98 six year old children using the AWMA and WPPSI and retested the children again aged 11 with the AWMA and WISC. At age 11 they were also tested for literacy and mathematical abilities. The researchers found that WM was a more powerful predictor of later academic success at the start of formal education than IQ. They also go on to argue that this may suggest that WM is more closely associated with the capacity to learn than IQ.

The findings across a diverse range of studies in this area demonstrated a similar relationship between WM and academic achievement, (e.g Alloway & Passolunghi, 2011; Gathercole, Alloway, Willis, & Adams, 2006; Leather & Henry, 1994; Nation, Adams, Bowyer-Crane, & Snowling, 1999; Nevo & Breznitz, 2011; H. Lee Swanson, 2004). Findings have also remained fairly consistent regardless of children’s race, nationality, gender or socio-economic background. The above studies also used either the Working Memory Test Battery for Children (Pickering & Gathercole, 2001) or the Automated Working Memory Assessment (Alloway, 2007), both of which are WM tests based on the well-researched multi-component model of WM (Baddeley, 2012) and the Cattell-Horn-Carroll (CHC) model of intelligence (Sternberg & Kaufman, 1998). The evidence for the validity of these assessments is also quite robust (Alloway & Alloway, 2010; Alloway, Gathercole, Kirkwood, & Elliott, 2008); which along with their wide usage and solid theoretical basis, adds further credence to the findings of the above studies.

It is clear that the research strongly indicates that WM plays a fundamental role in a child’s experience of and ability to succeed academically in school. For example if we examine something as fundamental to learning in school as reading skills, de Jong (1998) found that children classed as having a specific learning difficulty in literacy lack capacity for simultaneous
processing and storage of information. These skills are essential in acquiring phonological awareness and mapping phonemes to graphemes at an early age, (Alloway et al., 2005) as well as in using phonological and orthographical knowledge to decode more complex words as the child gets older, (Gathercole et al., 2006). Furthermore, such children seem to find attentional switching (a function of the CE) difficult (Friedman & Miyake, 2004). As this is an essential skill in the complex span tasks required to become a fluent reader and more specifically a ‘good comprehender’, we can again see a strong theoretical link between WM and reading.

It could reasonably be assumed therefore that if one were to help children to improve their WM, we could expect some commensurate improvement in their academic ability. However, although the overall tenor of the literature is positive in terms of the impact WM training can have on children’s WM ability, (e.g. Chacko et al., 2014; Holmes & Gathercole, 2013; Klingberg et al., 2005) we must treat the results with caution. The studies within the literature differ quite significantly in some cases in their conclusions about which WM subcomponents are most significantly affected by WM training. For example Klingberg et al., (2005) found that WM training significantly improved VSWM but not VbWM; whereas Holmes et al., (2009) found that the same WM training programme (Cogmed) had a larger positive effect on VbWM (d=1.55) than it did on VSWM (d=1.03) Also, the evidence that WM training leads to improvements in other areas such as improved attention for children with ADHD or better literacy or numeracy performance is inconclusive at best (Apter, 2012)

Many studies on the effect of WM training on literacy skills in children (Chacko et al., 2014; Dahlin, 2010; Dunning et al., 2013; Holmes et al., 2009; St Clair Thompson et al., 2010) have found no significant effect of WM training. However Dahlin, (2010) did find that there was a significant positive effect of WM training on children’s comprehension which she suggests is a task that is more dependent upon WM than standard literacy tasks such as spelling and single word reading. Results for the impact of WM training on numeracy are also mixed with some studies finding a significant positive impact, (Holmes et al., 2009; Holmes & Gathercole, 2013) and some no impact at all, (Chacko et al., 2014; Dunning et al., 2013; St Clair Thompson et al., 2010).
Notably, all of the studies used a computer based WM training programme. The fact that this seems to be the only ‘delivery system’ by which empirically researched WM training is operationalised could, in and of itself be problematic as any inherent weaknesses in such a delivery model, (e.g. sub optimal adaptive feedback) could lead to the efficacy of WM training being limited simply by the way it is delivered. Such a problem would be insurmountable for a computer based WM training programme and could in fact be contributing to the inconclusive nature of the research into the impact of WM training programmes.

Alternatively, a WM training programme designed along the lines of a more interactive play based intervention where children are interacting with each other as opposed to a computer could have some advantages over computer based WM training programmes. For example Lego Therapy, (LeGoff, 2004) has shown that children with autism children undertaking the programme make significant progress in their social and communication skills, (LeGoff, Gomez, Krauss, & Baron-Cohen, 2014; Owens, Granader, Humphrey, & Baron-Cohen, 2008). Of course the programme is specifically designed to help children with autism to do this and as such, this should not seem surprising.

However the anecdotal evidence from those who have been developing and delivering Lego Therapy since it’s inception raises two points relevant to this study (LeGoff, Cuesta, Krauss, & Baron-Cohen, 2014). Firstly that one of the mechanisms proposed for the improvements in the children is the metacognition children engage in based on their conversations about the programme during and after intervention sessions, leads to better strategies for engaging in programme tasks. Secondly, the fact that children take ownership of the programme and begin ‘running it themselves’ after becoming familiar with it (as opposed to an adult or a computer being ‘in charge’) is suggested to help the children to generalise the skills learned in the intervention to other contexts. If therefore WM training for children could be conducted in a more interactive and play based manner, we could see the above factors leading to greater WM improvements in children in more varied contexts.

In response to the lack of research on WM training programmes with an alternative ‘delivery method’, the present study will seek to examine the efficacy of a different kind of WM training
programme. Skelton’s (2012) MeeMo programme is a paired whole class WM training programme delivered in a different way to computer based WM programmes. Instead of working with a computer, over a 6 week period children work in pairs to win cards by answering a series of working memory questions within an allotted time. There is a different activity for each day of the week each of which requires a child to use their working memory in a slightly different way. MeeMo is designed to train children to think, remember and apply their working memory skills in different, ecologically valid ways. Each child chooses their own level of challenge and records their progress in a MeeMo Progress Book, (Skelton, 2012).

MeeMo is designed so that it can be delivered and introduced to children by teachers with no specialist knowledge or skill set required. After a short settling in period children should be able to undertake MeeMo with only the minimal amount of adult supervision, (Rumble, 2014). In his thesis evaluation of the programme immediately after its initial development Skelton (2012) assessed one class of twenty four 8-9 year old children from a school different to that in which the programme was initially developed to test the efficacy of MeeMo in improving WM for the children. His analysis demonstrated some encouraging results in terms of effecting immediate and sustained improvements (over an 8 week period) in children’s WM, especially, their verbal STM. There were also encouraging signs from the research that children enjoyed using it and that teachers were positive about its efficacy and use in the classroom. It is important at this juncture to not however that this study is not a full or partial replication of Skelton’s as different methodology is being employed, additional potential impacts of MeeMo are being assessed and this is an evaluation of the now commercially available and updated version of MeeMo compared to the immediately post development version of MeeMo used by Skelton (2012).

**Aims / Objectives**

Whilst the early signs are encouraging, the ability of MeeMo to boost children’s WM and make a significant educational impact is, as of yet, relatively untested. The current research will as such, seek to investigate the impact of MeeMo on the performance of a mixed ability group of Year 4 pupils on a standardised battery of untrained WM tasks (Alloway, 2007) and on
measures of numeracy (McCarty, 2008) and literacy (Hammill, Wiederholt, & Allen, 2014). The research questions (RQ’s) for the current paper are therefore as follows:

RQ1: What WM improvements are observed for typically developing 8-9 year old children undertaking a 6 week MeeMo intervention?

RQ2: What literacy and numeracy improvements are observed for typically developing 8-9 year old children undertaking a 6 week MeeMo intervention?

In answering these questions the researcher aims to:

- Add to the research base on the use of WM training programmes in schools.
- Explore the efficacy of MeeMo in helping children to improve their WM skills.
- Explore the efficacy of MeeMo in terms of helping children to improve their literacy and numeracy skills.
- Provide a basis from which more specific investigations of MeeMo can be operationalised.

Methodology

Design and Procedure

The study was designed to assess the efficacy of MeeMo in terms of its impact upon children’s WM skills and academic performance empirically using a pre-experimental design. The participants undertook a pre experimental phase were they received no intervention and an experimental phase were they received MeeMo intervention. Their WM, literacy and numeracy skills were assessed at the beginning and end of each phase. In order to increase the ecological validity of the intervention, MeeMo was implemented by the class teachers of the participants. The difference in scores between T1 and T2 provided a measure of the participant’s progress in their WM, literacy and numeracy skills following a period with no WM intervention. The difference in scores between T2 and T3 provided a measure of the participant’s progress in their WM, literacy and numeracy skills following a period of MeeMo WM training intervention.
In this study the independent variable is the presence or absence of a 6 week MeeMo intervention whilst the dependent variables are the participants scores on assessments of literacy, numeracy and working memory detailed below.

<table>
<thead>
<tr>
<th>Dates</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/02/2015 – 20/02/2015 (First Assessment Period - T1)</td>
<td>Pre study measures of WM, literacy and numeracy taken</td>
</tr>
<tr>
<td>23/02/2015 – 03/04/2015 (Pre-Experimental Phase – XP1)</td>
<td>No MeeMo intervention</td>
</tr>
<tr>
<td>13/04/2015 – 17/04/2015 (Second Assessment Period - T2)</td>
<td>Mid study measures of WM, literacy and numeracy taken</td>
</tr>
<tr>
<td>20/04/2015 – 29/05/2015 (Experimental Phase – XP2)</td>
<td>Six week MeeMo intervention</td>
</tr>
<tr>
<td>06/06/2015 – 10/06/2015 (Third Assessment Period - T3)</td>
<td>Post study measures of WM, literacy and numeracy taken</td>
</tr>
</tbody>
</table>

*Table 3. Experimental Design Table*

**Participants**

An opportunity sample was used in recruiting two Year 4 classes from two UK primary schools for the research; all participants were 8 or 9 years of age. The first class (group A) numbered 26 children initially whilst the second class (group B) numbered 21 initially. Data are reported for 24 children from group A and 17 children from group B as 6 children in total were lost from the cohort due to attrition giving a total of 41 reported participants. Average attendance of participants during the test implementation period was 96% with no particularly long absences for a single participant or patterns of absence. Children unable to fully access the intervention for any reason would also have been excluded from the study. (See Appendices 1 and 2 for teacher and parental consent forms).

The participants in Group A attended an inner city primary school in the North West of England. They were a mixed ability class containing 1 child with English as an additional language and 4
children considered to have special educational needs. The participants in Group B attended an inner city primary school in the North West of England. They were a mixed ability class containing 2 children with English as an additional language and 3 children considered to have special educational needs. Socio-economic background of the participants parents was mixed (Classifications and Harmonisations Unit, 2010) and their performance in literacy and numeracy was broadly in line with national average.

Though two separate groups of children were tested it was decided that for the purposes of data analysis the participants would be treated as one group. The first reason for this is that individually the groups were too small to detect even a large effect size, the minimum required being 30, (Cohen, 1992; Cohen, Manion, & Morrison, 2009); as such the groups needed to be combined to ensure that effect sizes could be calculated. Secondly the demographic, geographical and academic characteristics of the two classes were very similar, as were the dynamics of the classroom and teaching styles of the staff in both classrooms. As such comparisons between the two groups could not lead us to drawing any interesting conclusions on these measures. It was decided therefore that the advantages of being able to calculate more robust inferential statistics outweighed the disadvantages of losing between group comparisons.

**MeeMo WM Training**

The MeeMo WM training programme is operationalised in the manner described in the introduction (please see Appendix 3 for a description of MeeMo). The author introduced the MeeMo programme to the two teachers who implemented it and trained them on how to use it with their respective classes. The author was available for consultation regarding MeeMo via phone or e-mail to the teachers throughout the study. The author also checked in on the class periodically during the experimental period and observed MeeMo being undertaken at least 3 times in each class to ensure programme fidelity.

**Factors Affecting Choice of Assessment**

As is clear from the variety of methodologies used in the studies assessed in paper 1 there are many ways in which WM can be assessed. However for the purposes of this study it was
important to use an assessment that examined not only Verbal and Visual-spatial WM recall robustly and in isolation, but also Verbal and Visual-spatial WM processing. Measures of WM such as the digit span forwards and backwards task from the WISC-IV (Wechsler, 2004) measure only Verbal STM and WM recall. As such the Automated Working Memory Assessment (AWMA - Alloway, 2007) was selected for use in this study as it was (in the author’s evaluation) the best viable assessment tool the author could obtain to accomplish this; the AWMA is further explored below.

Due to the AWMA subtests the author was required to use to obtain the data required for the study, collecting the data would mean assessing each individual child in the study individually for a period of approximately 15-20 minutes on three separate occasions. This creates three factors to consider when choosing the other two assessments; firstly the time required of the author to administer these assessments meant that there would be less time to administer the other assessments. Secondly, the stress load on the participants would be considerable if they were to undergo similar levels of individual testing away from their daily school routine and classmates in the assessment of their literacy and numeracy. Thirdly, assessing individual children one by one throughout the day can create some considerable learning and logistical disruption to the school and class and children.

As a result of the above factors the author sought to use assessments of numeracy and literacy that could be administered to whole classes, were relatively short and caused minimal disruption to the class whilst still providing data on a range of aspects of literacy and numeracy skills. Both the Access Mathematics Test (AMT - McCarty, 2008) and the Test of Silent Contextual Reading Fluency 2nd edition, (TOSCRF 2 - Hammill et al., 2014) were judged by the author to be the best available tools to collect the data needed whilst adhering to the above parameters; they are both discussed in more detail below.

**WM Assessment**

To assess the children’s WM ability the AWMA was selected as it is widely used in WM research, (e.g. Chacko et al., 2014; Holmes et al., 2009; St Clair Thompson et al., 2010) has demonstrable reliability and validity as a measure of WM (Alloway et al., 2008) and it measures
multiple aspects of WM in accordance with the Baddeley model of WM (Baddeley & Hitch, 2000; Baddeley, 2003; Repovs & Baddeley, 2006) which allows the researcher to explore how different aspects of WM may have been impacted by MeeMo. It has also been used effectively in many other research projects (e.g., Holmes et al., 2009). The model of WM used in developing the AWMA (Baddeley, 2000) is congruent with the model of WM subscribed to by the author of MeeMo (Skelton, 2012) and the author of the current research; as such using the AWMA is concurrently valid in examining MeeMo as a WM training programme. Standard scores were calculated and used to assess the impact of MeeMo on WM.

In terms of the aspects of WM examined by in this study, both verbal and visuo-spatial WM recall were assessed using the AWMA listening recall and spatial recall tests respectively. Verbal and visuo-spatial recall can be considered the extent to which participants can store and manipulate verbal and visual information in their WM (Baddeley, 2003). Additionally, verbal and visuo-spatial WM processing were assessed using the listening recall processing and spatial recall processing tests respectively. Verbal and visuo-spatial processing can be considered the extent to which participants have the ability to undertake a concurrent processing task correctly when under increasing levels of WM load. As children in schools are required to use WM to undertake difficult tasks as well as use simultaneous processing in some learning tasks (Gathercole & Alloway, 2008) it is important to assess both of these aspects of WM. The reliability coefficients for the AWMA subtests used in the research are as follows: listening recall .88; listening recall processing .84; spatial recall .79; spatial recall processing .76.

**Numeracy Assessment**

For the numeracy assessment the AMT was chosen as it is standardised on a UK population, taps multiple components of mathematical understanding that underpin our ability to undertake mathematical operations including counting and understanding number, using number facts, calculating and handling data (Lee et al., 2012). The areas of Numeracy that the AMT covers are all in the Key Stage 2 National Curriculum (Department for Education, 2013b) and the assessment was designed to complement the learning strands outlined in the primary numeracy framework published by the UK Government in 2006 (McCarty, 2008). The AMT did
not provide data on the reliability co-efficient for the test. However it did provide data on the
correlation with performance on both forms of the test and National Curriculum levels
(Department for Education, 2013a, 2013b). The correlation for test 1 was .88 whilst for test 2 it
was .73, both of which can be considered to demonstrate good reliability and the external
validity of the test, (Field, 2013; McCarty, 2008).

**Literacy Assessment**

For the literacy assessment the TOSCRF was chosen as it taps multiple components of literacy
including key micro-skills required for reading such as reading comprehension, single word
identification and reading fluency, (e.g. Snowling, 2013; Wolf & Bowers, 2000). Though this is
an American normed test the researcher was less concerned about the standardised scores the
participants attained compared to a population, and more concerned with the differences
between the scores of individuals from assessment to assessment; as such the researcher does
not consider this to be a problem.

The TOSCRF involves reading fluency, word identification, and reading comprehension abilities
and measures the speed with which a student can identify words in a series of printed
passages, which become progressively more difficult, in which all spaces and punctuation have
been removed. Students are given 3 minutes to draw lines between as many words as possible.
The TOSCRF was correlated against 7 well known criterion reading measures (Allen, Hammill,
Rogers, & Jagielko, 2010) and demonstrated a strong relationship with all tests showing it to be
a test which is highly predictive of reading ability. It has also shown good alternate form, test-
test, and inter-rater reliability, and good overall validity (Allen & Hammill, 2011; McCallum,
Kirk, Fuller, & McCane-Bowling, 2007; Traylor, Price, & Meisinger, 2010). Standard scores were
calculated and used to assess the impact of MeeMo on Literacy. Three forms of the TOSCRF-2
were used in the study, the reliability coefficients for which were as follows: Form A .86; Form B
.89; Form C .87, (Hammill et al., 2014).
Controls and Fidelity Checking

The researcher acknowledges that a drawback of the pre-experimental methodology in a naturalistic setting chosen for this research is the lack of control over extraneous variables (Campbell & Stanley, 1963). A repeated measures design was used to control for potentially confounding participant variables in the study, (Chin & Lee, Bruce, 2008). Alternate forms were used in the TOSCRF-2 assessment to control for practice effects, (Hammill et al., 2014). Alternate forms were also used in the AMT assessment; however the AMT assessment had only 2 alternate forms, so the participants repeated the same test form at T1 and T3. The AMT manual suggests that it is advisable to wait for a year before testing a child on the same form again, (McCarty, 2008) but this was not possible due to the experimental design. As such participants were retested on Form A a second time four months after the first. The AWMA has been used in many studies to assess working memory (see above) and it is reported that no practice effects carry over from test to retest, (Alloway, 2007); as such there were no issues with using AWMA to test the participants 3 times within 6 months.

No feedback was given to the participants regarding their performance on any of the assessments until after all tests had been completed post-T3 to ensure feedback on test performance did not affect performance on future assessments. All assessments were also carried out in the presence of familiar teaching staff and in accordance with the typical exam procedures of the schools involved in order to give the students the best chance of producing optimal performance levels.

Programme fidelity is of course important if one is to expect ‘optimal’ results from any intervention being assessed (Cohen et al., 2009). To this end the researcher worked with teachers before the programme started to help them feel confident that they had the knowledge and skills to implement MeeMo with their class faithfully. The researcher also checked in periodically on the teacher and class, was available via telephone at any point if the teachers encountered difficulties and received a weekly update e-mail from the teachers to say how the experiment was progressing.
At the end of the programme a semi-structured interview was held with both class teachers and a focus group was held with both classes. The data from this were then analysed using thematic analysis (Braun & Clarke, 2006). Though a full qualitative analysis is beyond the scope of this paper the author will now refer to comments made from staff and students to illustrate the implementation of the programme in the study and the experience of the children participating in it for the purposes of fidelity checking. A thematic map and supporting quotes for superordinate themes can be found in Appendices 5 and 6 respectively, with the interview schedule and focus group prompts used in Appendix 7.

Both teachers who implemented MeeMo said that they found the intervention very easy to implement with Teacher A stating that “After a couple of days I felt like I’d got to grips with MeeMo; it’s pretty straightforward really once you’ve given it a go.” Teacher B also noted that “The children pretty much ran the intervention after a couple of weeks which was great to see.”

The teachers also found that both of their classes seemed to enjoy and engage with the intervention. Teacher A stated that “MeeMo became a highlight of the day for the kids and there were never really any (behavioural) issues during the intervention.” Whilst Teacher B stated that “The children became quite competitive at times but in a very friendly way... you would hear them talking about MeeMo and sharing the strategies they were using.”

In terms of the impact of MeeMo neither teacher felt able to comment that they had seen any immediate academic impact on the children. However Teacher A stated that “Socially I think it’s been good for the kids, they’ve been working with peers who they maybe don’t always get to work with and I think the intervention has help to foster a more supportive atmosphere in the class.” Teacher B also stated that “I’ve definitely seen some improved confidence in some of the children. There are some who’ve done much better on MeeMo than their classmates and even themselves might have thought so that seems to have given them a little boost in terms of their confidence and standing in the class; it’s been nice to see”.

As for the children the response to MeeMo was overwhelmingly positive. Children commented that they thought it was fun and not like something they usually do in school. There were also comments that they wanted to carry on doing MeeMo past the six weeks and that they enjoyed
trying to beat their scores from the previous week. One child described how he approached some of the tasks in MeeMo stating “I would like, hear what was being said and then make up a kind of story in my head, that’s about, y’know, like the objects or whatever. Then they would be dead easy to rearrange in my head.” This is evidence of a child developing a memory strategy to undertake the challenge of MeeMo. There were also comments about confidence with one child saying, “I thought it would be really hard at first but then you get used to it and realise that you can actually do it quite well.”

One difficulty with conducting real world research over a significant time period, especially when measuring children’s abilities, is maturation, (Campbell & Stanley, 1963). As such for this study, the participants were tested at regular intervals meaning that XP1 and XP2 were the same length of time. As there would be no reason to suppose that the children would mature any more quickly in XP1 than XP2 or vice versa, maturation effects were controlled for in this way and time as a variable can be considered to be controlled for. Another issue is life events that may occur in participants lives that could cause difficulties in undertaking the intervention or affect test performance; test anxiety is another issue that can also affect test performance (Shackman et al., 2006). The test conditions were therefore made as comfortable and stress reducing as possible for the participants and teachers were asked to report upon any significant life events that occurred for the participants that could have affected the study (none were reported). Finally, any interventions in literacy, numeracy or otherwise that any participant was involved in beyond the standard quality first teaching received by all participants were reported to ensure that any subsequent potential boosts to literacy or numeracy performance could be accounted for by the researcher. Though seven participants in total received additional intervention for literacy and numeracy, this intervention was consistent for all throughout the entire research period, conferring no particular advantage in terms of literacy or numeracy performance to either XP1 or XP2.
Statistics and data analysis

The Shapiro-Wilk test for normality (Shapiro & Wilk, 1965) was used to check if the data met parametric assumptions as the evidence suggests that this is the most appropriate inferential test of its type for sample sizes of below 50 (Coolican, 2009). The data was then analysed using the appropriate statistical test (Field, 2013). The difference in dependent variable scores between T1 and T2 (i.e. XP1) were compared to the difference in scores between T2 and T3 (i.e. XP2). This will show whether the change in the dependent variable scores across the two experimental periods differs significantly as a probabilistic function of the MeeMo WM intervention. Effect sizes for the difference between changes in scores over XP1 compared to XP 2 were also calculated as a means of demonstrating the likely impact of MeeMo on the dependent variables over XP2 compared to no intervention over XP1.

Results

Distribution of data and inferential statistical tools used

Shapiro-Wilk tests of the data collected at all data points indicated that the data in this study for WM, literacy and numeracy met parametric assumptions across the board. As such a 1-tailed t-test was used to test for statistically significant differences between XP1 and XP2 across all of the dependent variables.

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4 Individual WM, numeracy and literacy scores and raw data are included in Appendix 4
<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>T1 Mean Average (SD)</th>
<th>T2 Mean Average (SD)</th>
<th>T3 Mean Average (SD)</th>
<th>Change Across XP1 (SD)</th>
<th>Change Across XP2 (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VbWM Recall</td>
<td>105.29 (10.78)</td>
<td>107.83 (9.49)</td>
<td>117.05 (12.53)</td>
<td>2.54 (5.25)</td>
<td>9.22 (7.48)</td>
</tr>
<tr>
<td>VbWM Processing</td>
<td>104.64 (12.67)</td>
<td>106.14 (11.35)</td>
<td>114.29 (13.39)</td>
<td>1.50 (6.26)</td>
<td>8.15 (6.12)</td>
</tr>
<tr>
<td>VSWM Recall</td>
<td>107.21 (16.48)</td>
<td>108.10 (15.00)</td>
<td>111.33 (15.38)</td>
<td>.89 (5.30)</td>
<td>3.23 (5.72)</td>
</tr>
<tr>
<td>VSWM Processing</td>
<td>107.79 (17.51)</td>
<td>107.45 (16.15)</td>
<td>110.81 (15.72)</td>
<td>-.34 (5.06)</td>
<td>3.36 (5.86)</td>
</tr>
<tr>
<td>Literacy</td>
<td>89.56 (16.03)</td>
<td>96.10 (17.62)</td>
<td>103.20 (18.29)</td>
<td>6.54 (9.38)</td>
<td>7.10 (8.60)</td>
</tr>
<tr>
<td>Numeracy</td>
<td>94.68 (17.34)</td>
<td>92.07 (12.43)</td>
<td>97.07 (15.57)</td>
<td>-2.61 (9.86)</td>
<td>5.00 (8.26)</td>
</tr>
</tbody>
</table>

Table 4: Average standard scores of dependent variables at each data collection point and change of standard scores across XP1 and XP2 with standard deviations.
<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>t-test XP1-XP2 (p=0.05)</th>
<th>Cohen’s d XP1-XP2</th>
</tr>
</thead>
<tbody>
<tr>
<td>VbWM Recall</td>
<td>&lt;.001</td>
<td>1.05</td>
</tr>
<tr>
<td>VbWM Processing</td>
<td>&lt;.001</td>
<td>1.07</td>
</tr>
<tr>
<td>VSWM Recall</td>
<td>.026</td>
<td>.43</td>
</tr>
<tr>
<td>VSWM Processing</td>
<td>.002</td>
<td>1.17</td>
</tr>
<tr>
<td>Literacy</td>
<td>.408</td>
<td>.06</td>
</tr>
<tr>
<td>Numeracy</td>
<td>.003</td>
<td>.82</td>
</tr>
</tbody>
</table>

Table 5: Significance values and effect size calculations for XP1 compared to XP2

Verbal Working Memory

The t-tests indicate that MeeMo had a significant positive effect at the P=.05 level on the participant’s ability to recall and process information using their verbal working memory (VbWM Recall t=.000; VbWM Processing t=.000). MeeMo demonstrated a large effect size on both VbWM recall (d=1.05) and VbWM processing (d=1.07). The positive effect of time across the duration of the experiment (T1-T3) on VbWM scores was also shown to be significant (VbWM Recall t=.000; VbWM Processing t=.000).

Visuo-Spatial Working Memory

The t-tests indicate that MeeMo had a significant positive effect at the P=.05 level on the participant’s ability to recall and process information using their visuo-spatial working memory (VSWM Recall t=.026; VSWM Processing t=.002). Participants showed a very slight regression in VSWM recall scores over XP1 but this was not significant (t=.144) and therefore likely due to random chance rather than any confounding variables. MeeMo demonstrated a small to moderate effect size on VSWM recall (d=.43) and a large effect size on VSWM processing.
(d=1.17). The positive effect of time across the duration of the experiment (T1-T3) on VSWM scores was also shown to be significant (VSWM Recall t=.002; VSWM Processing t=.014).

**Variance in Working Memory Dataset**

Despite a significant general trend towards improvements in WM over the course of XP2 compared to XP1, there was some variance within the data set with some children making no improvement or slight regression over XP2 compared to XP1 and others making broadly similar improvements over both experimental periods. These variations appeared throughout the dataset in that it did not appear that children of any particular starting ability (low, average or high) were more or less likely than children of greater or lesser ability to make more or less WM improvements over XP2 compared to XP1.

**Literacy**

The t-test indicated that MeeMo had no significant immediate effect at the P=.05 level upon the literacy ability of the participants (t=.408) with Cohen’s d indicating a negligible effect size (d=.06). Given that the effect of time on literacy scores between T1 and T3 was shown to be significant (t=.001) this evidence suggests that MeeMo did not have any immediate impact upon the participants literacy ability.

**Numeracy**

The t-test indicated a significant effect of MeeMo on numeracy scores at the P=.05 level (t=.003) with a large effect size of d=.82. However, the data shows that numeracy scores regressed on average over XP1 (t=.049). The issue with these results is that numeracy scores did not improve significantly at the P=.05 level as a function of time between T1 and T3 (t=.051). Given this evidence it could be argued that the significant effect demonstrated over XP2 could be due to confounding variable(s) (such as participants finding the AMT alternate
form more difficult than the standard form) leading to misleadingly low scores at T2 rather than an impact of MeeMo on numeracy; hence there is some doubt as to whether these results demonstrate a significant immediate impact of MeeMo upon numeracy.

Discussion

Were any WM improvements observed for typically developing 8-9 year old children as a result of MeeMo intervention?

The evidence suggests that MeeMo had an immediate short term positive impact on processing and recall in the VbWM and VSWM systems of the 8-9 year old children in the study. The size of this impact was large on VbWM processing and recall and VSWM processing whilst the size of the impact on VSWM recall was small to moderate. However, given the small sample size used in this study, the relative homogeneity in social and demographic terms of the participants and the fact that the intervention was conducted in only 2 classes, it is difficult to generalise these findings to the wider population of similarly aged children in schools across the UK.

The pattern of these results is interesting however and bears further discussion. Recent meta-analyses and systematic reviews of WM training have demonstrated broad agreement in the literature that WM training can improve WM in the short term, but considerable disagreement as to the components of working memory that see significant improvement from such training (Melby-Lervåg & Hulme, 2013; Spencer-Smith & Klingberg, 2015). In this case, though we see an impact across all components of WM, it is clear that MeeMo has a much smaller impact upon VSWM recall than VbWM recall.

One possible explanation for this could be the primary modality in which MeeMo is delivered. The format of the programme means that participants receive the information they need to work with in a verbal format. As we know from the literature the systems which govern verbal and visual information in the working memory system can be considered to be quite distinct and separable, (Baddeley, 2012; Tam, Jarrold, Baddeley, & Sabatos-DeVito, 2010; Turner &
Engle, 1989). As such one could argue that the pattern of the training effect on WM is mediated by the way in which WM training is delivered. That is to say if a WM training programme requires participants to primarily use one WM modality (e.g. VbWM), we would expect to see a significantly larger training effect in this modality as opposed to the other modality; in this case VSWM.

However, this explanation then requires us to explain why we should expect to see any improvements in the other modality at all. Given that the domain specific verbal and visual components of WM are governed by the domain general CEF and that CEF is responsible for mediation of WM during WM tasks (Hofmann et al., 2012), one might suggest that the improvements in tasks involving the other modality come from general improvements in the CEF’s ability to mediate the use of WM in general. It could also be that during the tasks undertaken in WM training, participants use strategies from the other modality to support WM in the first modality. For example a participant may use imagery (requiring VSWM) to visualise a verbally delivered list of objects (requiring VbWM to process). This could allow for the training and development of WM modalities during the course of tasks that do not, in the first instance, necessarily involve the use of that modality.

Another interesting aspect of the data is the fact that whilst the impact of MeeMo upon WM recall was considerably different depending upon the modality, its impact upon WM processing tasks was virtually the same in both visual and verbal modalities. This could suggest that whilst WM recall tasks are primarily dependent upon the domain specific WM component required to undertake them (i.e. visual or verbal), WM processing tasks may be more dependent upon domain general components such as the CEF and its ability to mediate WM using metacognitive strategies. Given the findings of Carretti, Borella, Zavagnin, and De Beni, (2011) in their study of the positive impact of metacognitive strategies on the WM performance of older adults, it would certainly be interesting to investigate the impact of MeeMo on the metacognitive strategies of children further.

The scope of this study does not allow us to say whether the WM improvements demonstrated are self-sustaining, how long they might be sustained for, or what amount of repetition (if any
at all) is needed to maintain WM improvements over the longer term. The study also doesn’t
tell us whether the MeeMo programme is more effective than similar WM training programmes
such as Cogmed. Also, the sample demographics and size make it difficult to generalise the
findings outside of the age range of children who took part in the study.

Were any literacy or numeracy improvements observed for typically developing 8-9
year old children as a result of MeeMo intervention?

The evidence in this study suggests that MeeMo has no immediate impact upon the literacy
skills of 8-9 children. Though a significant effect was found for the impact of MeeMo on
numeracy, this result cannot be taken at face value due to the potential for confounding effect
of the AMT alternate form as discussed in the results section above. As a result of this the
author cannot conclude that MeeMo had an immediate impact upon the numeracy skills of 8-9
year old children.

However, this does not mean that MeeMo does not or will not have an impact on the literacy
and numeracy skills of these children later on. As MeeMo has demonstrated the ability to
improve WM and claims to improve children’s capacity to learn (Skelton, 2012), one could
argue that it should not be expected that MeeMo would have an immediate impact upon
numeracy or literacy. In fact what should be expected is that, if MeeMo has boosted children’s
capacity to learn, we should observe them acquiring knowledge and skills at an increased rate
subsequent to the intervention; we might call this a long term effect. To accomplish this one
would simply need to measure the academic progress children make during a period before
MeeMo intervention against the progress they make during a period after MeeMo
intervention; this would certainly be an interesting area for future study.
Limitations

The study had a number of limitations concerning its scope. To begin with the sample size of 42 children from a very specific age range (8-9 year olds) and similar demographic characteristics means that the generalisability of the findings are significantly limited. Also the length of the period of study meant that only immediate effects (as opposed to the long term effects) of MeeMo intervention on WM, numeracy and literacy could be ascertained; this is a significant issue in terms of the academic impact specifically as MeeMo is an intervention that purports to boost capacity to learn. If this is the case we would expect children to improve their learning in literacy and numeracy at an increased rate and capacity subsequent to the intervention’s conclusion. As a result we may detect the effects of an increased capacity and rate of learning in follow up measures of literacy and numeracy but would be unlikely to with immediate assessment of literacy and numeracy as the child will not have received enough new learning for the effect of the increased learning capacity to be detected.

Only one method of assessment was used for literacy and numeracy, this is an issue as it could be the case that the methods used may not have been sensitive enough to detect potential impact of MeeMo on these variables. Using other types of assessment such as academic proxy measures like teacher evaluations or content analysis of children’s schoolwork may have been able to detect more subtle immediate effects of MeeMo on literacy and numeracy. It may have also been useful to obtain and analyse significant qualitative feedback from participants and teaching staff involved in the study to provide a more detailed picture on the experience of delivering and participating in the MeeMo intervention.

The pre-experimental design used was an ethically viable and efficient way of gathering data given the time constraints upon the research. However, it is clear that a quasi-experimental design involving a true control group, placebo group and experimental group conducted across an academic year could have yielded more easily comparable data where short and long term impact of MeeMo could have been assessed. However ethics would have required subsequent access to MeeMo for the control and placebo groups and participant variables would have become a more challenging extraneous variable in this design. Overall this study provides a
good basis from which professionals can begin to understand the impact of MeeMo on Year 4 children and from which researchers can conduct more detailed studies into the efficacy of the programme.

Implications

The recent increased prevalence of ‘brain training’ programmes and the efficacy claims that come with them means that there is now a wide variety of programmes to choose from for those who might wish to help children improve their academic performance in school, (The Royal Society, 2011). The difficulty with this is the sometimes confusing, sometimes scant and often conflicting nature of the evidence for the efficacy of such programmes (Goldacre, 2009). This paper seeks to ensure therefore that MeeMo, as a relatively new programme designed to improve children’s learning, begins to develop a robust evidence base as soon as possible.

This paper does indicate that MeeMo has an immediate short term effect on children’s working memory recall and processing across both visual and verbal modalities. Given the links in the literature demonstrated between WM and children’s attainment (e.g. Alloway, Gathercole, & Elliott, 2010), this paper will allow those in education to use MeeMo with children in their settings with the confidence that through improved WM abilities, MeeMo may indirectly boost children’s capacity to learn. If MeeMo also provides immediate boosts to WM immediately after a session, this could have timetabling implications, though of course further research would be required to establish this.

However, it is clear that from the evidence gathered in this paper that one must be very careful about making claims about MeeMo that go further than that. As discussed above, though we may find that MeeMo has positive downstream impacts upon children’s academic abilities, the evidence suggests that it is unlikely to have significant immediate impacts upon numeracy and literacy. It is the author’s hope therefore that this paper can serve as a ‘beachhead’ upon which more robust and in depth investigations of the efficacy of MeeMo as a programme to improve children’s learning can be made.
The first suggestion for future research would be to assess the long term effects of MeeMo on academic skills and attainment. To do this, one would be best served by using a quasi-experimental design conducted over at least a whole academic year with a control group, (who receive no additional intervention) a placebo group, (who receive a non WM based intervention) and a MeeMo group (who undertake MeeMo at regular intervals throughout the year). In this way one could measure not only downstream effects of MeeMo (i.e. does it increase the rate at which children learn and acquire new academic knowledge and skills) but also find out more about whether WM training element of MeeMo is the ‘active ingredient’ in boosting the learning and not just extra interventions per se (as in the placebo condition).

The second suggestion for future research comes from the differences in effect size between VbWM recall and VSWM recall. It may be interesting to examine the relationship between the primary delivery modality of the WM training programme and the impact it has upon different components of WM. One would for example take a paired whole class primarily verbally delivered programme such as MeeMo and compare its efficacy against a computer based primarily visually delivered programme such as Cogmed. Comparisons between a paired whole class and computer based WM training programme may also allow the author to examine the role of metacognition in the development of robust WM strategies and any impact human mediation vs computer delivery has on this.

The third suggestion would be to examine whether MeeMo is an intervention that needs to be repeated in order to maintain its positive effects on WM. To do this, one could use a quasi-experimental design conducted over at least a whole academic year to assess the academic and WM abilities of a control group, (who receive no WM intervention) a ‘one shot’ group, (who receive a 6 week session of MeeMo at the start of the year and no more) and a continuous group (who receive MeeMo intervention at regular intervals throughout the year). In this way one could clearly see whether one period of MeeMo intervention has a long term impact upon children’s WM abilities or whether its effects are more short term, with repetition required to maintain the effect.
A fourth suggestion would be to examine the learning process within the MeeMo programme to explore issues around where in the programme the most significant WM gains are made (i.e. where does optimal learning occur). This would allow us to understand whether there are any habituation or boredom effects with the programme that could be avoided with a shorter programme or a distributed practice model. It could also indicate whether children are improving in their WM skills right up until the end of the programme, raising questions about whether the programme should be longer, repeated at a later date or whether more challenging items need to be added.

Given the findings of a recent study demonstrating improved WM performance in children when metacognitions about task difficulty are positively reframed (Autin & Croizet, 2012), there could also be some important work to be done around the affective elements of a programme such as MeeMo and to what extent any impact on self-efficacy elicited by MeeMo could be linked to improvements in academic work and on WM tasks. I would also concur with Rumble, (2014) who suggests that there may be some interesting ground to be explored around the effects that the presence or absence of specific WM strategy instruction (such as chunking) has on the efficacy of MeeMo as a WM training programme.

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83 | P a g e
An overview of Evidence Based Practice in relation to the current research

Evidence based practice (EBP) is a concept first developed in medicine which can be seen as a way in which errors in the selection of best available treatments for patients can be minimised through basing such clinical decisions in the best available evidence from the research literature, (Sackett & Rosenberg, 1995). EBP in psychology is defined by the American Psychological Association (APA) as “The integration of the best available research with clinical expertise in the context of patient characteristics, culture and preferences” (Levant et al., 2006, p.273). In practical terms this means that psychological practitioners should be using their professional experience and knowledge of those they are working with in conjunction with the evidence extant in research literature to make decisions about the psychological formulations they make and interventions they use with their clients. The evidence taken into account should not only refer to the efficacy of an intervention (i.e. how well it works in a controlled experimental setting) but also its effectiveness in real world settings.

For educational psychologists (EPs) this can be seen as a useful but perhaps incomplete definition. Reason and Woods, (2002) reference the fact that the social and political context in which a practitioner works must also be taken into account in the use of EBP as these factors may impact upon a practitioner’s ability to implement certain interventions in given contexts. In terms of a working definition of EBP for the purposes of this paper therefore, it would be useful to think of EBP as the integration of all of the elements discussed above.

A significant proportion of the literature around EBP focusses on its utility in real world settings for psychological practitioners, (Barkham, Hardy, & Mellor-Clark, 2010). Since its inception in medicine, EBP has been criticised for subordinating experience, contextual knowledge and clinical judgement to empirical research conducted in unrealistic situations of limited applicability to everyday practice (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996). Similar objections have been raised since the transition of EBP into the world of psychology and
education. For example, EBP has been criticised for restricting the role of decision making in education to questions about efficacy and effectiveness, reducing the role of joint decision making between experienced multi-disciplinary educational practitioners who understand the contexts in which they work, (Biesta, 2007). One could also criticise EBP from a more practical point of view by examining the recent work of Ben Goldacre into the reliability and replicability of published scientific literature. Not only does his work indicate that some published research is flawed and not replicable (Goldacre, 2015a), it further reveals the extent to which certain studies with ‘negative’ results are not published at all, leading to a bias in the literature towards studies demonstrating efficacy and effectiveness and away from studies indicating that certain interventions may not be efficacious (Goldacre, 2015b). When one considers that EBP has been further criticised for being overly reliant on the evidence from experimental trials as opposed to theoretical plausibility (Atwood, 2008), issues such as bias and unreliability in the evidence base can be seen as a significant problem for EBP.

Though we must consider the above criticisms carefully however, one need only look at the issues surrounding the Measles, Mumps and Rubella (MMR) vaccine to see the value in evidence based practice. During the 1990’s and into the early 2000’s, significant numbers of parents prevented their children from having the MMR vaccine due to concerns about the vaccine being causally linked to autism (Deer, 2011). The paper linking MMR to autism (Wakefield et al., 1998) was widely criticised in the academic community for drawing erroneous conclusions from insufficient evidence (Deer, 2011) and was eventually retracted after further evidence in the literature overwhelmingly suggested that MMR had no link whatsoever to Autism and that it was very effective in combatting mumps, measles and rubella in children (Goldacre, 2009). It was proper and judicious use of EBP that allowed doctors to advise parents to take up the vaccine despite the concerns and media scare during the 1990’s and early 2000’s, meaning that although uptake for the MMR vaccine was lower than might have been optimal, it was higher than it might have been without EBP (Godlee, Smith, & Marcovitch, 2011).
Furthermore, Sackett et al., (1996) point out that EBP is the “conscientious, explicit and judicious use of current best evidence in making decisions about the individual care of patients.” (p. 71). This demonstrates that even at its inception, EBP was not designed to unduly subordinate the role of clinical experience and understanding of client needs and real world contexts to experimental evidence. Indeed, we can see by the very existence of a discipline such as implementation science that the ability of interventions based on experimental data to be implemented and used effectively in the real world is seen as an essential part of EBP, (Kelly, 2012). As such the evidence suggests that criticisms about the applicability of research evidence to the real world can be effectively dealt with by using and applying EPB in a careful and diligent manner.

In terms of the potential for the research evidence base being biased, unreliable or incomplete, firstly it is important to reference that the evidence for practices in research contributing to biased and incomplete data have been overwhelmingly found in medicine and in particular, trials sponsored by pharmaceutical companies where researchers have a ‘vested interest’ in reporting only ‘positive’ results, (Goldacre, 2015b). Secondly, there are very few evidence based practitioners who would argue that the evidence base is completely reliable or complete, (Fischer, 2011), hence the fact that the individual knowledge, experience and understandings of the practitioner are considered to be important in good EBP. Rather than guaranteeing an intervention will work for a particular client or group, EBP should be seen as a way of reducing errors that might be made in making recommendations for interventions based on nothing more than judgement and experience, (Lilienfeld, 2011).

As for the current research which was an evaluation of a commercially available working memory (WM) training programme for children, the issues discussed above are pertinent as the work adds to the evidence base surrounding WM training programmes. When we consider the issues around gaps in the evidence base for school based interventions, (Department for Education, 2011) and the requirements for EPs to work in an evidence based manner, (Health and Care Professionals Council, 2012), we can see the need for research of this kind in
Educational psychology. However, EBP as it pertains specifically to the work of EPs is not without its issues.

As pointed out by Woods, Bond, Humphrey, and Symes, (2011) in their systematic literature review of Solution Focussed Brief Therapy, “research evidence of the effectiveness of an intervention... provides a starting point rather than the final word, for effective and safe practice” (p. 10). This suggests that as real life is so complex and multi-faceted, using EBP is not simply about taking an intervention that research tells us can help a child with problem ‘Y’ and expecting to see impact ‘X’, (Munro, 2011). Rather, it can be seen as a way of guiding a practitioner towards to kinds of interventions that may be of help to a particular person at a particular time in a particular context, (Barkham et al., 2010). Indeed, the very fact that the evidence around interventions such as working memory training is so hotly contested, (e.g. Holmes & Gathercole, 2013; Randall & Tyldesley, 2016; Shipstead, Hicks, & Engle, 2012) suggests that blind adherence to the evidence base in the work of psychological practitioners would be not only very difficult, but perhaps not particularly logical. It may be fair to say therefore that the research conducted by this author in the previous paper adds to a body of evidence around WM training, but does not say anything definitive about something that might or might not work for any individual child with working memory difficulties.

Effective dissemination of research and notions of research impact

Before one can usefully discuss the effective dissemination of research it is important to ask the question of why a specific piece of research should be disseminated and what impact would such dissemination be likely to have. Harmsworth, Turpin, Rees, and Pell, (2001) suggest that dissemination of research should achieve one or more of three primary purposes. Firstly, research might be disseminated to increase awareness of a particular finding or intervention. This is important in educational terms in ensuring educational professionals have access to the best possible information and interventions to guide the decisions they make about the policies and practices in their settings and which interventions they choose to use. Secondly, research
might be disseminated to increase understanding around a particular intervention or issue. It may be that your research shed’s new light on an extant intervention or issue within your field and that the increased understanding of the intervention or issue, may change the way we view or use the intervention. Thirdly, Research might be disseminated for action; that is with the express purpose of changing the way that something is done in a setting. This could be an organisational change such as changing the way that certain challenging behaviours are managed within schools, or to do with specific interventions where the likelihood of them being used or not used in any particular setting is impacted by the research findings.

In discussing the effective dissemination of research in education, one might be forgiven for making the assumption that EPs should play a leading role in ensuring that good EBP is understood and available for use in schools. This is because psychologists receive some of the highest levels of research training in the education sector (Bradley & McSherry, 2009) and one of the key contributions of EPs in schools is to provide school staff with evidence based psychological advice at the individual, group/class and organisational levels, (Farrell et al., 2006). As such one effective way of disseminating educational research to ‘end users’ (schools) might be through effective dissemination of research to EPs.

As science practitioners with high level qualifications in a scientific discipline, (Fallon, Woods, & Rooney, 2010) one might expect that the most effective way to disseminate research to EPs (and consequently schools) would be to publish research findings in relevant academic journals. One potential issue with this however, are the findings of Lilienfeld, Ammirati, and David, (2012), who report that 83% of school psychologists rely upon personal experience to inform intervention practice, 62% use reference books and 47% use journal articles. The finding that less than half of EPs are using primary evidence to inform their decisions about interventions for children should therefore demonstrate to us that it is not adequate to simply disseminate relevant research findings to educational psychologists via publishing in peer reviewed journals and expect that they will be disseminated to schools. Though this is of course a dissemination strategy that must be considered, one must also consider other ways to reach educational professionals and in particular EPs.
However the author will first examine journal publication as a dissemination strategy. As discussed earlier there is a growing clamour in the academic community for as much research as possible to be published and subject to peer review and academic scrutiny, (Goldacre, 2015a, 2015b). It is also stated in the literature that interventions that avoid or do not have published research on which they base their efficacy/effectiveness claims are to be treated with deep scepticism, (Kratochwill, 2012; Lilienfeld et al., 2012). When one also considers that 47% of EPs (a significant proportion) do make use of the research literature, one could argue persuasively that the publishing research in academic journals is an effective way of disseminating research and contributing to the credence given to effective evidence based interventions.

However, simply publishing a paper in a journal is no guarantee that it will be seen by those who one might wish to see it; even by those EPs that do regularly refer to the academic literature. Firstly one must consider which academic journals are thematically congruent for one’s paper as those interested in the area that an author’s research is in will be more likely to read these types of journals (Bradley & McSherry, 2009). Secondly one must consider the target audience and which papers they are more likely to read (Kelly, 2012). If for example one wished to target EPs specifically, publishing in a journal aimed specifically at EPs such as Educational and Child Psychology may mean you reach more of one’s target audience than one would if one published in a more general psychology or education journal; even if that journal is more widely read. Speaking of which, a third point to consider is how widely read and cited the journal one publishes in is as the more widely read the journal is, the more people will read the research and the more likely they will be to cite it which in turn may lead to wider readership. As such the impact factor of a journal should be taken into account when considering where to publish research.

Away from the realm of academic publishing, one dissemination strategy which could be considered is presenting the findings of research at professional conferences and seminars. Listening to an oral presentation is cognitively different than reading a paper and as such certain changes to the way in which the information is presented must be considered, (Miller, 2013). It is important to set out the structure and ‘direction’ of the presentation early on to
ensure the audience understand and ‘buy into’ what one is about to discuss. It is also important to paraphrase, sum up and reiterate key points one wishes to make as, unlike when reading a paper, the audience cannot elect to go back over a piece of information they wish to understand more fully. The use of interactive and visual props and presentation software can also be used to aid understanding in a way that might not be possible in a paper.

One real advantage of this type of dissemination is the ability of the researcher to try and minimise the kinds of misunderstandings that might occur if someone were to misread what they had written in a paper. Similarly, the audience can ask questions and receive immediate feedback to clarify elements of the findings that may not have been well understood. However, the effectiveness this type of dissemination can depend upon the presentation and oratory skills of the presenter, therefore one must consider the style and pace in which the paper is presented and ways in which the presenter can keep the audience engaged in the presentation. Timing is also an important factor to get right as one does not want to cram too much information into too short a time as the message may not be adequately conveyed. Likewise one does not want to present too little information in too great an amount of time as this could lead to audience disengagement, (Miller, 2013); therefore a balance must be struck between the two.

On a more practical level, evidence based practitioners may decide to disseminate research findings directly in the contexts in which they work. Disseminating research evidence to educational practitioners who may not have much research education or experience requires a different approach to disseminating to audiences familiar with the world of research, (Harmsworth et al., 2001). Generally they will be more concerned with the implications the findings of a particular piece of research may have for their context in particular rather than more generalisable aspects of the findings, (Jacobson, Butterill, & Goering, 2003). They will also be likely to want to know about how they might go about implementing an intervention from the research in their setting and the impact that it is likely to have for children in their setting; this can be viewed as an opportunity for researchers to further disseminate their research.
findings by offering training, consultation and ongoing support to settings to ensure that research findings are properly implemented in settings, (Harmsworth et al., 2001)

There are many factors that must be considered when measuring the impact of the implementation of evidence based interventions. Firstly when discussing research impact it is important to understand the notions of efficacy and effectiveness and the differences between them. An intervention that proves efficacious in controlled conditions may not prove effective when implemented in real world scenarios, (Schillinger., 2010). It may therefore be justifiable to disseminate knowledge and recommend implementation of an intervention that is efficacious, but only if adequate measures of effectiveness are also put in place to measure the real world effectiveness of the intervention and the fidelity with which the intervention is operationalised in reality, (Barkham et al., 2010). We must also consider the attributes, skills, knowledge training and ongoing support of the educational professionals who will be delivering an evidence based intervention, (Kelly, 2012) after all, if those delivering a programme are not able to deliver it with adequate fidelity, impact (or lack thereof) found cannot be confidently attributed to the intervention being used. It is also important to consider how the impact of an evidence based intervention will be measured and by whom.

The ‘whom’ element ties back to the discussion about dissemination of research within the EP profession as the current EP training structure is currently providing a fertile ground for new research through doctoral trainee EPs (Association of Educational Psychologists, 2014). Trainee EP’s measuring the impact of evidence based interventions and building upon the findings of previous research in order to examine effectiveness in the real world could be argued to be a very effective way of measuring impact. It is important therefore that research is disseminated widely and effectively in order to ensure as many potential future researchers know about it and have the chance to build upon it and improve our understanding of evidence based interventions and their effectiveness and impact in the real world. We must not discount however the potential for educational practitioners themselves as measurers of research impact. Often those delivering programmes that have been developed through EBP and research can be well placed to offer qualitative feedback on programme effectiveness as it is
delivered ‘in the real world’ and could even implement quantitative measures of programme efficacy under the guidance of researchers, (Barkham et al., 2010).

In terms of ‘how’ one might measure impact there are two well used methodologies for this in EBP; namely benchmarking and case tracking, (Barkham et al., 2010). Camp and Tweet, (1994) describe benchmarking as seeking to improve quality in an intervention by examining processes of other interventions with superior outcomes and/or efficiency. Impact of research can be measured by setting the ‘benchmark’ of the current research in terms of the outcomes of an efficacious intervention and seeing how the outcomes of the current research compare. This can be research in the same domain as the research to be evaluated (internal benchmarking), a similar domain (competitive benchmarking) or even research in different domains that are in some way functionally related (functional benchmarking). Case tracking conversely, involves collating the data from the research available into an intervention, using that data to set a ‘baseline’ in terms of the outcomes of the intervention and then measuring the outcomes for subsequent intervention participants against this baseline to see if the intervention is having the predicted impact for particular individuals, (Barkham et al., 2010).

One final point to make would be with regards to the dissemination of lessons learned about the implementation of quasi-experimental designs in real world research and it’s implications for the future research of EP’s. Through the process of data gathering for Paper 2 the author found that issues such as gaining access to participants, the stress load placed upon participants and negotiating the logistical and time management systems of can significantly affect any researchers ability to collect the data they need. This is because they have a significant impact upon the human resource required to gain the data required and the types of assessments one chooses to gather data in an achievable manner. The author intends these lessons learned to form part of any presentations given in the dissemination of this research.
Implications of the current research

The current research is comprised of a systematic literature review of research on computerised WM training programmes and an evaluation of the impact of a paired whole class WM training programme. Although the implications of both pieces of work will be considered together, it makes sense to examine these implications at a number of different levels; namely the group level (i.e. at the level of the participant sample), the organisational level (i.e. the school, local authority and psychological service) and the professional level (i.e. the wider professional psychological and educational community).

At the level of the participants in the study (comprising of 41 students and 2 teachers), evidence for the impact on them comes primarily from the data collected in the study on MeeMo. The teachers both expressed the view that the children involved in the study enjoyed the intervention they undertook (as did the children themselves), so at the very least the participants found the experience to be a positive one. The teachers also felt that the children had gained something socially from MeeMo in that it had allowed them to work with peers they may not usually work with and that it had allowed some children who are not often seen achieving success to achieve success in front of their peers. One might take from this some hope that the intervention has helped some children to improve their social confidence and self-efficacy; though of course no assumptions can be made about this or its long term continuance.

The data suggested that the children had shown significant levels of improvement in their WM as a result of the MeeMo intervention; there was also evidence from the testimony of the children that some had begun developing and using advanced memory strategies during their time working with MeeMo. However the data also demonstrated no significant immediate impact of MeeMo or the improvement in WM on numeracy or literacy.

This does not mean though, that the intervention will not have a longer term positive impact on academic achievement for the children involved. If this working memory improvement is self-sustaining and we take the evidence from the literature that better WM abilities generally mean higher literacy and numeracy abilities (e.g. Alloway, Gathercole, & Elliott, 2010;
Gathercole, Pickering, Ambridge, & Wearing, 2004; Swanson, Kehler, & Jerman, 2010), we might logically infer that they should acquire knowledge and skills at an increased rate subsequent to the intervention. As such there could be a more long term impact on the children in terms of a boost to their academic abilities. However, it is important to point out that further research (discussed later) would be needed to verify such impact.

At the school level the impact of the research has been discussed with the school head teachers. They were both happy that the children enjoyed the intervention and felt that they had got some positives out of it. One said that in discussion with her teacher, the intervention had allowed school staff to view some of the children in a new light as the intervention had given the children opportunities to display confidence and skills that had hitherto been hidden. She said that she took it as a lesson that the school needs to do more to uncover the ‘hidden talents’ of their children, especially those who are quieter or less able to express themselves verbally.

In terms of the intervention itself the heads were happy that MeeMo seems to have led to improved WM in the children, however they said they would want to see how long such an improvement would be sustained and whether the children would benefit from repeated interventions or not. They also said that they would like to see a tangible academic impact of the intervention but understood how a long term impact would be more likely than an immediate one. Despite this the schools (along with another in the primary consortia) say that they intend to buy a copy of MeeMo between them in the new academic year for use with their Year 3 and 4 children.

In terms of impact on the educational psychology service and local authority in which the research was conducted, the author has been able to present the findings of the research to colleagues at a number of team meetings and has been involved in numerous informal discussions about the implications of the research for advice given to schools, families and children around WM and WM training. This means EPs in the service are better equipped to give accurate advice about the strengths and limitations of WM training as a means of improving WM in children. One colleague noted to me that her increased understanding of the
limitations of WM training has driven her to provide more advice around how children with
WM difficulties can be supported by schools and families as opposed to simply recommending a
child undertakes a WM training programme to help alleviate WM difficulties. It is certainly the
author’s intention to continue to raise this awareness and help EP colleagues and schools
within his local authority to recognise that although there is promise and potential in WM
training programmes, we cannot see them as a ‘panacea’, through which all WM difficulties can
be resolved.

In the wider professional context the author would contend that the current research should
have implications for policy and practice for EPs. The research clearly indicates that although
the evidence for WM training programmes improving WM in the short term is quite strong,
there is little clear evidence to suggest a consistent link between WM improvements made in
WM training and subsequent improvements in academic achievement. Given the links made in
the literature between WM and academic achievement it is as mentioned earlier, conceivable
that WM training could improve academic abilities; therefore the research does not suggest
that EPs should not recommend WM training programmes to schools or children. However it
does suggest that EPs should be very careful and measured in the recommendations they make
as the evidence does not support the notion that WM training will lead to WM improvements
and subsequent academic improvements. It also suggests that perhaps EPs should, when giving
advice to help children with poor WM, focus more on the support systems around the child at
school and home that can help support their WM than on interventions to improve their WM.

The current study poses a number of further questions regarding WM training programmes
that would be very interesting avenues for further research. These are explored in the
Implications section of Paper 2 and as such, will not be repeated here
A strategy for promoting and evaluating the dissemination and impact of the current research

To devise a strategy around dissemination it is prudent to begin by thinking about what one would like such dissemination to achieve, (Bradley & McSherry, 2009). There would be two broad primary aims for the dissemination of the current research. Firstly, dissemination should allow the information to reach as many psychological and educational practitioners working with children as possible in order for them to have access to the best available current evidence around WM training programmes on which to base their work with children and young people. This specifically applies to educational psychologists who have the research and psychological expertise to interpret the implications of the research in a meaningful way and use this information to guide the advice they give to other professionals working with children. Secondly, dissemination should allow the research to reach those who are currently engaged in (or who are considering engaging in) research into working memory training programmes. This will ensure that future researchers are able to benefit from the findings of the current study in that they will be able to build on the findings, consider the opportunities for further study outlined and take the research forward without needlessly replicating what has already been found.

In terms of the impact location the author intends for the area and local authority in which the research was conducted to be the primary impact location of the research; this would be driven by the author and his colleagues in the local educational psychology service. However, if the paper is widely disseminated to EPs elsewhere then one might hope that it could have a similar impact on the professional advice they give and potentially, the research they conduct, widening the scope of the impact of the research.

As discussed earlier in the paper it is important that the increased understanding gained by professionals through the research (especially EPs) continues to drive the advice offered to and interventions conducted with children with WM difficulties. It would be logical to think therefore of EPs as the main ‘impact deliverers’, especially as they are best placed from a
knowledge and skills perspective to translate the learning offered by the research into practical strategies to help the learning of children. However the strategies around supporting children’s WM in schools and the delivery of any WM training will primarily be conducted by educational professionals in schools who should also be seen as significant impact deliverers. It is important therefore that EPs support educational professionals in the delivery of WM support for children by offering consultation, practical support, advice and guidance to them.

To achieve the above the dissemination strategy would first focus on the author as an evidence based practitioner, using the knowledge gained from the research to guide his professional work when it pertains to advising schools and families about WM, WM difficulties and WM training programmes. Secondly, the author would disseminate the information gained from the research in person through formal and informal discussions and correspondence with professional colleagues and presenting research findings at professional meetings and conferences. The author has already presented some of the research findings at professional meetings and intends to present them in full at the North-West CPD conference in 2016.

Thirdly, the author intends to publish the research in a professionally relevant academic journals; i.e. a journal widely read by and specifically aimed at EPs. To that end, the systematic literature review section has already been published in an EP focussed journal, (Randall & Tyldesley, 2016) and the author intends to publish the primary research section in a similar journal. As a consequence of the above the author would also hope that a fourth dissemination stream would arise incidentally through the citing of the journal articles in future research.

The likely outcomes of the above dissemination strategy would likely be an increased awareness and understanding of WM training programmes by educational professionals; especially EPs. One would hope that this would lead to EPs giving good advice around WM support and intervention strategies to fellow professionals and families, helping them to support children in schools with their WM in an evidence based way. It would also likely manage expectations around the efficacy and effectiveness of WM training programmes and help professionals to come to a more informed, evidence based decision about whether they would like to purchase a commercially available WM training programme. This might act as an
‘inoculation’ against any spurious, overblown or unsubstantiated efficacy claims made by companies more concerned with selling their product than honestly presenting its proven effectiveness. One might also expect to see future research citing the current study and addressing some of the issues and areas for further investigation that arise from it. Of course it is important to state here that the above outcomes are open to the vagaries of degree in that the research may only impact in the above ways on a very few individuals or on many.

In terms of moving the above outcomes to impact, there are a number of factors which will likely be important. With regards to the publishing of the work, the breadth and demographic of readership of the journal will influence how many people are likely to read the work. Similarly the readability and style with which the papers are written will also influence whether people read the papers thoroughly and/or to the end, affecting the depth to which the information contained within the paper is internalised. Also, the persuasiveness and thoroughness with which the author is able to convey the meaning behind the research in professional contexts will also affect the level to which fellow professionals ‘buy in’ to the learning garnered from the research which will in turn, affect how they operationalise this knowledge in a professional context.

In terms of measuring the impact of MeeMo as a WM intervention programme, internal benchmarking (Camp & Tweet, 1994) would be the most appropriate way of measuring its impact currently. Case tracking can be dismissed out of hand as there is not sufficient research into MeeMo as a WM programme to generate the data required for robust case tracking (Barkham et al., 2010) and also because case tracking would be a very labour intensive and, frankly impractical way of measuring its impact. Internal benchmarking however would allow those seeking to measure the impact of MeeMo to collate data from other WM training programmes that have been explored in the literature such as Cogmed (e.g. Dahlin, 2013; Redick, Shipstead, Wiemers, Melby-Lervåg, & Hulme, 2015) and measure the outcomes for MeeMo in terms of WM and academic effects against these others.
**Paper 3 References**


Daneman, M., & Merikle, P. M. (1996). Working memory and language comprehension: A meta-

http://doi.org/10.3758/BF03214546


Appendix 1 – Head teacher & Teacher consent forms

Evaluating the Impact of the MeeMo Working Memory Training Programme on the Academic Performance of Typically Developing 8-9 Year Old Children

Head Teacher Information Sheet

Your school is being invited to take part in a research study as part of a doctoral thesis examining the efficacy of a Working Memory Training Programme for children named MeeMo which will form part of a Doctorate in Child & Educational Psychology. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

Who will conduct the research?

Lee Randall – Trainee Educational Psychologist

What is the aim of the research?

The researcher aims to gain an insight into the efficacy of the MeeMo working memory training programme in terms of delivering positive educational benefits for children. The researcher aims to achieve this through conducting a study designed to assess whether the programme has a positive impact on children’s working memory, literacy and numeracy skills.

Why has your school been chosen?

Your school has been chosen as it is a primary school in Liverpool with two mixed ability year 4 classes. The researcher is dedicated to helping improve education in Liverpool and has chosen to bring MeeMo to the city and your school in particular as he believes that the programme could prove to be of great benefit to the children of this city.

What would the school be asked to do if I took part?
The researcher would look to meet with the teachers of the Year 4 classes to be involved by the end of Autumn Term 2014 to prepare them to use MeeMo. One class would then use the MeeMo programme for a 6 week period in Spring Term 2015, the other would use the MeeMo programme for a 6 week period in the Summer Term 2015. The researcher would collect working memory, literacy and numeracy data from the children through the administration of short non-curriculum standardised assessments on 3 separate occasions at the end of Autumn Term 2014, the end of Spring Term 2015 and the end of Summer Term 2015. Parental consent would be sought for the children’s involvement and the collection of all data.

What happens to the data collected?

The data collected will be stored and reported in the doctoral thesis anonymously. All data will be treated to the highest standards of confidentiality in accordance with the guidelines laid out by the British Psychological Society and The University of Manchester. Parents may have access to the data collected on their own children.

How is confidentiality maintained?

All data recorded will only be seen by the researcher in un-anonymised form. Each child’s personal data will only be seen by the researcher, the child’s parents and the school if parental consent is given. Any reported data including names of children, schools and local authority will be anonymised. All data will be stored securely along with any personal information.

What happens if I do not want to take part or if I change my mind?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time without giving a reason and without detriment to yourself.

What is the duration of the research?

The research will be conducted over a two term period from January 2015 – July 2015.

Where will the research be conducted?

The research will be conducted at your school.
Will the outcomes of the research be published?

The outcomes of this study will be reported in the researcher's Doctoral Thesis which may be published in peer reviewed journals after completion in 2016.

Contact for further information

e-mail – leerayrandall@hotmail.co.uk

Phone – 07756 667 987

What if something goes wrong?

If there are any issues regarding this research that you would prefer not to discuss with members of the research team, please contact the Research Practice and Governance Co-ordinator by either writing to 'The Research Practice and Governance Co-ordinator, Research Office, Christie Building, The University of Manchester, Oxford Road, Manchester M13 9PL', by emailing: Research-Governance@manchester.ac.uk, or by telephoning 0161 275 7583 or 275 8093
1. I confirm that I have read the attached information sheet on the above study and have had the opportunity to consider the information and ask questions and had these answered satisfactorily.

2. I understand that my school’s participation in the study is voluntary and that I am free to withdraw at any time without giving a reason.

3. I agree to the use of anonymous quotes

4. I agree that any data collected may be passed to other researchers when anonymised

5. I agree that any data collected may be published in anonymous form in academic books or journals.

Please Initial Box

I agree for my school to take part in the above project
Evaluating the Impact of the *MeeMo Working Memory Training Programme* on the Academic Performance of Typically Developing 8-9 Year Old Children

CONSENT FORM

1. If you are happy for your school to participate please complete and sign the consent form below.

2. Please Initial Box

3. I confirm that I have read the attached information sheet on the above study and have had the opportunity to consider the information and ask questions and had these answered satisfactorily.

4. I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving a reason.
6. I agree to the use of anonymous quotes

4. I agree that any data collected may be passed to other researchers when anonymised

5. I agree that any data collected may be published in anonymous form in academic books or journals.

I agree for my school to take part in the above project

Name of Class Teacher ___________________________ Date ______________ Signature ___________________________

Name of person taking consent ___________________________ Date ______________ Signature ___________________________

Lee Randall ___________________________ 01/11/2014 ___________________________
Appendix 2 – Parental Consent Forms

Evaluating the Impact of the MeeMo Working Memory Training Programme on the Academic Performance of Typically Developing 8-9 Year Old Children

Parent / Carer Information Sheet

Your child’s school is being invited to take part in a research study as part of a doctoral thesis examining a Working Memory Training Programme for children named MeeMo which will form part of a Doctorate in Child & Educational Psychology. Before you decide whether to allow your child to participate in this research it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

Who will conduct the research?

Lee Randall – Trainee Educational Psychologist

What is the aim of the research?

The researcher aims to gain an insight into the efficacy of the MeeMo working memory training programme in terms of delivering positive educational benefits for children. The researcher aims to achieve this through conducting a study designed to assess whether the programme has a positive impact on children’s working memory, literacy and numeracy skills.

Why has your child been chosen?

Your child’s school has been chosen as it is a primary school in Liverpool with two mixed ability Year 4 classes. The researcher is dedicated to helping improve education in Liverpool and has chosen to bring MeeMo to the city and your school in particular as he believes that the programme could prove to be of great benefit to the children of this city. Previous research has indicated that MeeMo is likely to be most beneficial to children between the ages of 7-9 years old which is why your child’s year group has been chosen.
What would your child be asked to do if they took part?

Your child’s class would undertake the MeeMo programme for a 6 week period in either Spring Term 2015, or Summer Term 2015. The researcher would collect working memory, literacy and numeracy data from all the children in the study through the administration of short non-curriculum standardised assessments on 3 separate occasions at the end of Autumn Term 2014, the end of Spring Term 2015 and the end of Summer Term 2015. **For further details on the MeeMo programme please refer to the guide enclosed with this letter.**

What happens to the data collected?

The data collected will be stored and reported in the doctoral thesis anonymously. All data will be treated to the highest standards of confidentiality in accordance with the guidelines laid out by the British Psychological Society and The University of Manchester. Parents may have access to the data collected on their own children. The school may have access to the data collected on the children as long as consent is given by the parents.

How is confidentiality maintained?

All data recorded will only be seen by the researcher in un-anonymised form. Each child’s personal data will only be seen by the researcher, the child’s parents and the school if parental consent is given. Any reported data including names of children, schools and local authority will be anonymised. All data will be stored securely along with any personal information.

What happens if I do not want my child to take part or if I change my mind?

It is up to you to decide whether or not you want your child to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time without giving a reason and without detriment to yourself.

What is the duration of the research?

The research will be conducted over a two term period from January 2015 – July 2015.

Where will the research be conducted?
The research will be conducted at your child’s school.

Will the outcomes of the research be published?

The outcomes of this study will be reported in the researcher’s Doctoral Thesis which may be published in peer reviewed journals after completion in 2016.

Contact for further information

e-mail – leerayrandall@hotmail.co.uk

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Evaluating the Impact of the *MeeMo Working Memory Training Programme* on the Academic Performance of Typically Developing 8-9 Year Old Children

CONSENT FORM

If you are happy for your school to participate please complete and sign the consent form below.

7. I confirm that I have read the attached information sheet on the above study and have had the opportunity to consider the information and ask questions and had these answered satisfactorily.

8. I understand that my child's participation in the study is voluntary and that I am free to withdraw at any time without giving a reason.

9. I agree to the use of anonymous quotes.

4. I agree that any data collected may be passed to other researchers when anonymised.

5. I agree that any data collected may be published in anonymous form in academic books or journals.
6. I give permission for my child's National Curriculum Level's data to be collected and used anonymously in this research.

I agree for my school to take part in the above project

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Appendix 3 – Description of MeeMo Programme

The Aim of MeeMo

Working memory is the capacity to process information. It is arguably the most important cognitive ability children can develop, and is one of the strongest predictors of academic achievement available. In recent years, there have been demonstrations that engaging in specialised training activities can lead to improvements in children’s working memory. MeeMo provides children with a range of activities which are specifically designed to improve their working memory capacity. In doing so, it aims to increase their ability to learn and progress across a wide range of academic areas, including reading, comprehension, and maths (among many other areas).

MeeMo was designed with the user in mind. Its development was grounded in the needs, wants and preferences of teachers and children to ensure that it is something which teachers would find easy and practical to use in the classroom context, and children would find an enjoyable and engaging experience. Teachers have found it easy to set up, run and incorporate into their daily routine, with children often setting up and running MeeMo by themselves. Below notes some of the general principles of MeeMo and how it is used.

Features of MeeMo

There are eight key features of MeeMo:

1) MeeMo is designed to be easily used with whole classes so that every child can benefit and improve their Working Memory.

2) MeeMo is designed as a series of pairs based games to make it an engaging and enjoyable experience for children.
3) MeeMo is centred around using cards, which have a question on the front and the answer on the back.

4) Children work in pairs, taking it in turns (for 6 minutes each) to be either:
   o The ‘Questioner’ holds the cards, asks the questions and checks the answers.
   o The ‘Thinker’ listens to the question and gives the answers.

5) It is used daily over a half-term period, with a session lasting for 15 minutes per day.

6) The ‘Thinker’ collects each card they get right. Children can ask for the question to be repeated as many times as they like. At the end of the session, they count up and track their progress in a personalised Monitoring Booklet.

7) There are five different activities, allowing for a different one to be used on each day of the week.

8) For each activity, there are three difficulty levels (easy, medium and hard), meaning that children can continually work to stretch their individual Working Memory capacity. Children choose for themselves which difficulty level to work on.  

For more information visit [www.risingstars-uk.com/Series/MeeMo](http://www.risingstars-uk.com/Series/MeeMo)

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5 Adapted from MeeMo brochure provided by Rising Stars – UK
### Appendix 4 – Raw data from Paper 2

#### Working Memory Data

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Diff T1-T2 / Diff T2-T3  0.000  0.000  0.026  0.002

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Appendix 5 – Thematic Map of Qualitative Data from Paper 2

Thematic map from MeeMo teacher interviews and child participant focus groups

Design of MeeMo
- Children able to run programme independently in short space of time
- Elements that help children to learn & engage

MeeMo’s Impact on Children
- Children enjoying MeeMo
- Children achieving success with MeeMo
- Positive personal outcomes for children
- Positive social outcomes for children

Implementation
- Few issues with implementation of MeeMo
- Elements that allow for easy implementation of the programme
- Best practice in using MeeMo

Perceived Value of MeeMo
- Is MeeMo a valuable use of staff & students time
- MeeMo’s positive impact upon children
- Need for larger evidence base for efficacy of MeeMo
- Children developing memory strategies using MeeMo
Appendix 6 – Superordinate Themes and Supporting Quotes from Paper 2 Qualitative Data

Design of MeeMo

“What’s also great is that I could have the whole of my class doing MeeMo whilst I work with a small group on another task because the system is so well implemented and embedded that they know what the expectations are and could just get on with it basically unsupervised while I concentrate on working on something else.”

“I like that MeeMo is quite visual and pictorial rather than loads of words. We have some EAL children in class who struggle with language but once they have learned the words for the objects in MeeMo it is something they can access on a level playing field with peers which was a real positive.”

“The children pretty much ran the intervention after a couple of weeks which was great to see.”

“The children get instant praise from their partner and get the satisfaction from knowing that they can accomplish what the rest of the children can.”

MeeMo’s Impact on Children

“The children became quite competitive at times but in a very friendly way... you would hear them talking about MeeMo and sharing the strategies they were using.”

“What I will say is that if our kids didn’t find MeeMo interesting, they wouldn’t do it.”

“I would like, hear what was being said and then make up a kind of story in my head, that’s about, y’know, like the objects or whatever. Then they would be dead easy to rearrange in my head.”

“MeeMo became a highlight of the day for the kids and there were never really any (behavioural) issues during the intervention.”

“That ability to do MeeMo with peripheral noise, that’s really training that focus and that ability to filter out background information.”

“Socially I think it’s been good for the kids, they’ve been working with peers who they maybe don’t always get to work with and I think the intervention has help to foster a more supportive atmosphere in the class.”

“I thought it would be really hard at first but then you get used to it and realise that you can actually do it quite well.”

“It was really great to see children who are usually underperforming or struggling doing quite well and surprising both me and their peers and achieving success for themselves”
“I’ve definitely seen some improved confidence in some of the children. There are some who’ve done much better on MeeMo than their classmates and even themselves might have thought so that seems to have given them a little boost in terms of their confidence and standing in the class; it’s been nice to see”.

Implementation

“After a couple of days I felt like I’d got to grips with MeeMo; it’s pretty straightforward really once you’ve given it a go.”

“Once you’ve got the children in to the system and they know how it works, they’ll get it right every time and they’ll pull the teacher up when there’s something not quite right.”

“What I was really impressed with is how well the children do it and organise themselves after the first week of going through the routines with them.”

Perceived Value of MeeMo

“It’s incredibly difficult to say whether MeeMo is having a direct impact because alongside MeeMo kids are also getting all the other input, great teaching and interventions and it’s hard to say what’s contributing and what’s not.”

“The main thing for me is the confidence in some of the children when they’re doing it; these aren’t children I’m used to seeing confident in the classroom and it’s a real wake up call for me to see what these children can do when they’re confident.”

“I’d need to see some evidence of MeeMo having an impact on English and Maths because we just haven’t had the time to see whether that’s happened yet and to be fair, if MeeMo’s not going to help the children improve academically then it’s kind of like... hard to justify doing it.”
Appendix 7 – Semi Structured Interview Schedule and Focus Group Prompts used in Paper 2

Qualitative Data Gathering

Interview Schedule

1. What has the impact of MeeMo been

Main Question – In the course of the time you and your class spent using MeeMo what impact (if any) has MeeMo had on the children you work with?

(Bring interviewee’s attention to any sub areas they may have missed, see below).

Sub Questions:

• Academic Progress (e.g. literacy and numeracy)
• Attention and concentration
• Memory
• Other cognitive skills such as problem solving or comprehension
• Behaviour
• Social skills
• Self confidence
• Any other areas

2. Is MeeMo a valuable investment in time?

Main Question – From your experience working with the programme, do you feel MeeMo is a good investment in terms of the time spent on it in the school week?

Sub Questions:

• Is MeeMo a valuable use of staff time?
• Is MeeMo a valuable time investment for the children who use it?
• What factors make it valuable or not valuable?

3. Practical issues around implementation of MeeMo in a classroom setting

Main Question – During your time working with MeeMo in the classroom, what have been the practical issues you have encountered concerning its delivery?

Sub Questions:

• How difficult/straightforward do you find delivering the MeeMo programme?
• What elements of the programme make its delivery difficult/straightforward?
Focus Group Prompts

1. What did you think of MeeMo? / Think of some words to describe it.
2. Was there anything you really liked about MeeMo? / Favourite thing about MeeMo?
3. Was there anything you really didn’t like about MeeMo?
4. Through the course of playing MeeMo did you get better, worse or stay same at it?
5. Did you use any tricks or strategies when you played MeeMo?
6. Did you learn anything playing MeeMo that you could use in other lessons?
7. Would you play MeeMo again in school?
Appendix 8 – Guidelines for Authors in Educational and Child Psychology

Information for contributors

Educational & Child Psychology is published four times a year. Each part of the publication consists of papers devoted to a theme of relevance for educational psychologists. The themes are announced in advance – generally as a ‘Call for papers’ issued in The Psychologist with a nominated member of the Editorial Board as a point of contact for that issue.

These guidelines are provided to assist Authors, Referees and Editors. Compliance in all respects is appreciated. Manuscripts are accepted for consideration on the understanding that they consist of the authors’ original unpublished work that is not being submitted for consideration elsewhere.

The Abstract

All papers should include an Abstract (of not more than 250 words) and up to five ‘keywords’. The Abstract must be structured and presented under subheadings that indicate: The Aim(s); Method/Rationale; Findings; Limitations; Conclusions.

Length

The main body of text in papers should usually be 3500–5000 words in length although papers outside this range may be considered at the Editor’s discretion. Authors must indicate the wordlength of papers with and without the reference section, excluding any tables or figures. Any one issue of the publication will usually consist of a maximum of eight papers. Referees’ comments and Editors’ judgement of the balance and salience of papers will determine which papers are finally selected for publication.

Style

Overall, the presentation of papers should conform to the British Psychological Society’s Style Guide. Non-discriminatory language should be used throughout. Spelling should be anglicised when appropriate. Text should be concise and written for an international readership of applied psychologists. Abbreviations, acronyms and unfamiliar specialist terms should be explained in the text at least once. Referencing should follow the current Society formats.

For example:


C.M.Evertson & C.S.Weinstein (Eds.), *Handbook of classroom management* (pp.181–219) London: LEA.


The Editorial Board reserve the right to amend text to achieve conformity with Educational & Child Psychology’s aims and style.

**Manuscripts**

An electronic copy should be sent to the Editor for a specific issue, by emailed attachment (in MS Word or rich text format). We are unable to consider papers that are not submitted for a specific issue. Graphs, pictures or diagrams, etc., must be submitted in a format suitable for printing in black-and-white. The cover page must provide the full title of the paper, all authorial details and address (postal and email). The body of the paper, starting on page 2, should include the title and abstract, but omit any detail by which the author(s) may be identified. Text should be in at least 12 point Times New Roman and double-spaced. The submission must confirm that all authors approve the submission and that the paper is their original work and not under consideration elsewhere. Manuscripts that do not conform to these requirements will be returned to the author(s).

**Refereeing**

All papers are usually read by two referees in addition to the Editor. The refereeing process is anonymous. It is important, therefore, that all submissions conform to the above guidelines. The referees’ comments will, at the Editor’s discretion, be passed to the authors.

The Editorial Board is always pleased to consider suggestions for themed editions. Anyone wishing to propose a theme and to assist as a ‘Guest Editor’ should contact the General Editor.

**Contact**

Dr Simon Gibbs, at the School of Education, Communication and Language Sciences, Newcastle University, Newcastle-upon-Tyne NE1 7RU, or by email to s.j.gibbs@ncl.ac.uk
Appendix 9 – Guidelines for Authors in Child Neuropsychology

Aims and Scope: The purposes of Child Neuropsychology are to (a) publish research on the neuropsychological effects of disorders which effect brain functioning in children and adolescents, (b) publish research on the neuropsychological dimension of development in childhood and adolescence and (c) promote the integration of theory, method and research findings in child/developmental neuropsychology.

The primary emphasis of Child Neuropsychology is to publish original empirical research. Theoretical and methodological papers and theoretically relevant case studies are welcome. Critical reviews of topics pertinent to child/developmental neuropsychology are encouraged. Special topics are also encouraged, including book and test reviews and reviews of relevant professional issues in Child Neuropsychology.

Manuscripts must be submitted through the journal’s Scholar One website, http://neuropsychology.manuscriptcentral.com. Questions for the editor may be addressed to either Westerm@msn.com or JDonders@mfbrc.com. Book reviews can also be submitted to the editor at either address mentioned.

For authors without internet access who wish to submit to Child Neuropsychology, a copy on disk prepared in MS Word or WordPerfect is required. The disk must be clearly labeled with the authors’ names, file name, and software program. A hardcopy printout that exactly matches the disk must be supplied. Each manuscript must be accompanied by a statement that it has not been published elsewhere and that it has not been submitted simultaneously for publication elsewhere. Authors are responsible for obtaining permission to reproduce copyrighted material from other sources and are required to sign an agreement for the transfer of copyright to the publisher. All accepted manuscripts, artwork, and photographs become the property of the publisher. All parts of the manuscript should be typewritten, double-spaced, with margins of at least one inch on all sides. Manuscript pages must be numbered consecutively throughout the paper. The text should be divided into the following sections: Introduction, Methods, Results, Discussion, Acknowledgements and References. The manuscript must be in accordance with the APA Publication Manual, 4th ed.

Authors should also supply a shortened version of the title suitable for the running head, not exceeding 50 character spaces. Each article should be summarized in an abstract of not more than 100 words. Avoid abbreviations, diagrams, and reference to the text in the abstract.

Special topics are also encouraged, including book and test reviews and reviews of relevant professional issues in Child Neuropsychology.

References: Cite in the text by author and date (Smith, 1983). Prepare reference list in accordance with the APA Publication Manual, 4th ed. Only references published in generally available journals or books will be accepted.

Examples:

Archives of Sexual Behaviour, 7(6), 417-427.


Illustrations: Illustrations submitted (line drawings, halftones, photos, photomicrographs, etc.) should be clean originals or digital files. Digital files are recommended for highest quality reproduction and should follow these guidelines:
- 300 dpi or higher
- Sized to fit on journal page
- EPS, TIFF, or PSD format only
- Submitted as separate files, not embedded in text files
Color illustrations will be considered for publication; however, the author will be required to bear the full cost involved in their printing and publication. The charge for the first page with color is $900.00. The next three pages with color are $450.00 each. A custom quote will be provided for color art totaling more than 4 journal pages. Good-quality color prints should be provided in their final size. The publisher has the right to refuse publication of color prints deemed unacceptable.

Tables and Figures: Tables and figures (illustrations) should not be embedded in the text, but should be included as separate sheets or files. A short descriptive title should appear above each table with a clear legend and any footnotes suitably identified below. All units must be included. Figures should be completely labeled, taking into account necessary size reduction. Captions should be typed, double-spaced, on a separate sheet. All original figures should be clearly marked in pencil on the reverse side with the number, author’s name, and top edge indicated.

Proofs: Page proofs are sent to the designated author using Taylor & Francis’ EProof system. They must be carefully checked and returned within 48 hours of receipt. Offprints or copies of the journal may be ordered at this stage through the publisher.

Offprints/Reprints: The corresponding author of each article will receive one complete copy of the issue in which the article appears. Offprints of an individual article may be ordered from Taylor & Francis. Use the offprint order form included with page proofs. Up to 10 additional issue copies may also be ordered. If offprints are not ordered by the required date, reprint pricing goes into effect, and issue copies may not be ordered.
Appendix 10 – Ethical Approval Application

RESEARCH RISK AND ETHICS ASSESSMENT

Manchester Institute of Education, University of Manchester

The Manchester Institute of Education is committed to developing and supporting the highest standards of research in education and its associated fields. The Research Risk and Ethics Assessment (RREA) resource has been created in order to maintain these high academic standards and associated codes of good research practice. The research portfolio within the Manchester Institute of Education (MIE) covers a wide range of fields and perspectives. Research within each of these areas places responsibilities of a differing nature on supervisors and students subject to course, level, focus and participants. The aim of the Research Risk and Ethics Assessment is to assist supervisors and students in assessing these factors.

The Manchester Institute of Education has determined three levels of Research Risk each of which has a number of associated criteria and have implications for the degree of ethical review required. In general, the research risk level is considered to be:

- **High** IF the research focuses on groups within society in need of special support, or where it may be non-standard, or if there is a possibility the research may be contentious in one or more ways.
- **Medium** IF the research follows standard procedures and established research methodologies and is considered non-contentious.
- **Low** IF the research is of a routine nature and is considered non-contentious.

Agreement to proceed with research at each of these levels is provided by an appropriate University Research Ethics Committee, a MIE Research Integrity Committee member, or by the supervisor/tutor respectively.

How to complete the Research Risk and Ethics Assessment (RREA) form.

This form should be completed, in consultation with the MIE Ethical Practice Policy Guidelines, by Manchester Institute of Education students and their supervisors in all cases, except where a pre-approved assignment template currently exists. A separate Fieldwork Risk Assessment form must be completed as indicated in this RREA, in order to plan how safety issues will be responded to during fieldwork visits. The Fieldwork Risk Assessment form is available on the MIE ethics intranet. For all projects where this does not apply, a LOW Risk Fieldwork Declaration (Section D) must be completed. Instructions on this and subsequent stages of the RREA process are provided at the end of each following sections.

---

6 A reasonable person would agree that the study includes no issues of public or private objection, or of a sensitive nature.
7 [http://www.education.manchester.ac.uk/intranet/ethics/](http://www.education.manchester.ac.uk/intranet/ethics/)
8 For courses with approved templates see: [http://www.education.manchester.ac.uk/intranet/ethics](http://www.education.manchester.ac.uk/intranet/ethics)
There are six main sections to this document, with three additional sections for UG/PGT research, PGR Pilots or Prof Doc Research Papers seeking ethical approval for LOW risk studies from a supervisor/tutor:

ANY student

- Section A – Summary of Research Proposal (page 1)
- Section B – Description of Research (page 2)
- Sections C.0-C.1 – Criteria for HIGH risk research (page 4)
- Section C.2 – Criteria for MEDIUM risk research (page 6)
- Section C.3 – Criteria for LOW risk research (page 8)

Where indicated

- Section D – LOW risk Fieldwork Declaration (page 9)

LOW Risk UG/PGT/PGR Pilot/Prof Doc Research Papers only

- Section E.1 – Criteria for LOW risk ethical approval (page 11)

Supervisors and tutor approvals of LOW risk student research

- Section E.2 – Supervisor confirmation that research matches LOW risk criteria (page 12)
- Section E.3 – Minor Amendments to LOW risk study and supervisor approval (page 13)

It may be appropriate for supervisors and students to review and discuss responses to these questions together.
To be completed by AEF administrator

<table>
<thead>
<tr>
<th>RIA reference</th>
<th>Date received</th>
<th>Date approved</th>
</tr>
</thead>
</table>

SECTION A - SUMMARY OF RESEARCH PROPOSAL
This section should be completed by the person undertaking the research.

<table>
<thead>
<tr>
<th>A1. Name of Person/Student:</th>
<th>Lee Randall</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2. Student ID (quoted on library/swipe card):</td>
<td>9266776</td>
</tr>
<tr>
<td>A3. Email Address:</td>
<td><a href="mailto:leerayrandall@hotmail.co.uk">leerayrandall@hotmail.co.uk</a></td>
</tr>
<tr>
<td>A4. Name of Supervisor:</td>
<td>Dr Kathleen Tyldesley</td>
</tr>
<tr>
<td>A5. Supervisor email address &amp; contact phone no.:</td>
<td><a href="mailto:Kathleen.Tyldesley@manchester.ac.uk">Kathleen.Tyldesley@manchester.ac.uk</a> / 07875 219 562</td>
</tr>
<tr>
<td>A6. Programme (PhD, ProfDoc, MEd, PGCE, MSc, BA etc):</td>
<td>Profdoc</td>
</tr>
</tbody>
</table>
A7. Year of Study | 2 | A8. Full/Part-time | Full
A9. Course Code | EDUC D.Ed.Ch.Psychol
A10. Title of Project: Evaluating the Impact of the MeeMo Working Memory Training Programme on the Academic Performance of Typically Developing 8-9 Year Old Children
A11. Participant Recruitment Start Date: On confirmation of ethical approval | A12. Project Submission Date: 01/06/2016
A13. Proposed Fieldwork Start Date: 01/12/2014
A14. Location(s) where the project will be carried out: Primary School Premises
A15. Student Signature:

The following section to be completed by the SUPERVISOR

A15. Assessed Risk Level

<table>
<thead>
<tr>
<th>Low</th>
<th>x</th>
<th>Medium</th>
<th>High</th>
<th>NRES reqd.</th>
</tr>
</thead>
</table>
A16. Supervisor Signature

A17. Date 12/09/2014

SECTION B – DESCRIPTION OF RESEARCH

This section should be completed by the person undertaking the research.

B1. Provide an outline description of the planned research (250 words max).
Principle Research Question(s):

RQ1: Does MeeMo improve the working memory and academic performance of typically developing 8-9 year old children?

RQ2: What effect (if any) does the explicit teaching of Working Memory strategies within the MeeMo programme have on the working memory and academic performance of typically developing 8-9 year old children?

Academic justification:

The researcher has identified a specific but significant knowledge gap in the literature in that research examining the human mediated working memory training programme MeeMo, has yet to identify whether it makes a significant positive contribution to children’s learning in terms of academic outcomes. This is made all the more pertinent in that research on this matter regarding computer based working memory training programmes has proved inconclusive at best. If the researcher were to find evidence that MeeMo was making a positive contribution to children’s learning, it could have significant implications in terms of how we approach the design of working memory training programmes and for the legitimacy of working memory training programmes as an educational tool.

Project Design:

The researcher intends to use a parallel quasi-experimental waiting list cross over design to measure the impact of MeeMo on participants WM ability and Academic performance in four groups of children across two primary schools.

Data Collection Methods: I would seek to use some standardised tests of working memory, literacy and numeracy to collect my data.

Sampling: I will use a purposive sampling to select suitable primary schools from within the local authority in which I am placed.

Method(s) of Analysis: I would seek to use descriptive statistics and inferential statistics (if appropriate) to analyse my data.

NB: If your research methods include collection of image or video data, you must complete the VASTRE document (regardless of research risk).
**B3.** Please indicate which of the following groups are expected to participate in this research:

- Children under 16, other than those in school, youth club, or other accredited organisations.
- Adults with learning difficulties, other than those in familiar, supportive environments.
- Adults who are unable to self-consent
- Adults with mental illness/terminal illness/dementia/residential care home
- Adults or children in emergency situations
- Those who could be considered to have a particularly dependent relationship with the researcher
- Prisoners
- Young Offenders
- Other vulnerable groups (please detail)

**OR**

- None of the above groups are involved in this study

**B4.** Number of expected research participants. 50-60

**B5.** Will you conduct fieldwork visits?

Yes

Complete either the Declaration in Section D1 or the Fieldwork Risk Assessment (FRA) form if indicated in your RREA by criteria marked by an X

No

Complete the Declaration in Section D2

---

9 The person with learning difficulties has appropriate support within the setting from accredited support workers or family members.
B6. The research will take place (tick all that apply):

- [X] within the UK
- [ ] within the researcher’s home\(^{10}\) country if outside the UK
- [ ] wholly or partly outside the UK and not in the home country of the researcher*

* You must complete a separate Fieldwork Risk Assessment form

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\(^{10}\) The researcher’s ‘home country’ is defined as one in which (1) the researcher holds a current passport through birthright or foreign birth registration, (2) a country where the researcher has resident status, or (3) where the researcher holds a permit or visa to work, has a contract of employment, and is not a UK tax-payer.
SECTION C – RESEARCH RISK ASSESSMENT

The following sections should be completed by the person undertaking the research in discussion with their supervisor/tutor.

C.0 – Criteria for research classified as HIGH RISK – National Research Evaluation Service

- The study involves primary research with adults who are unable to self consent
- The study involves primary research with NHS patients
- The study involves primary research with prisoners/young offenders

Students - If any of these options apply, you should complete an NRES application. See your supervisor for further guidance.

Supervisors – Forward this RREA form to ethics.education@manchester.ac.uk when you are satisfied that the project requires approval through the Integrated Research Application Service (IRAS).

C.1 – Criteria for research classified as HIGH RISK (tick any that apply)

I/we confirm that this research:

- involves vulnerable or potentially vulnerable individuals or groups as indicated in B3
- addresses themes or issues in respect of participant’s personal experience which may be of a sensitive nature (i.e. the research has the potential to create a degree of discomfort or anxiety amongst one or more participants)
- cannot be completed without data collection or associated activities which place the researcher and/or participants at personal risk*
- requires participant informed consent and/or withdrawal procedures which are not consistent with accepted practice
- addresses an area where access to personal records (e.g. medical), in collaboration with an authorised person, is not possible
- involves primary data collection on an area of public or social objection (e.g. terrorism, paedophilia)
- makes use of video or other images captured by the researcher, and/or research study participants, where the researcher cannot guarantee controlled access to authorised viewing.
- will involve direct contact with participants in countries on the Foreign and Commonwealth Office warning list11 *
- involves face to face contact with research participants outside normal working hours12 that may be seen as unsocial or inconvenient*

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will take place wholly or partly without training or qualified supervision*

requires appropriate vaccinations which are unavailable*

will take place in locations where first aid and/or other medical support or facilities are not available within 30 minutes*

may involve the researcher operating machinery, electrical equipment, or workplace vehicles, or handling or working with animals at the research location(s), for which they are not qualified, and where a qualified operative or handler is not available to act as supervisor.*

* IF YOU HAVE TICKED these HIGH risk criteria you must also complete a separate Fieldwork Risk Assessment form

IF YOU HAVE ONLY TICKED HIGH risk criteria NOT marked (*) you MUST complete the LOW Risk Fieldwork Declaration on page 9 of this form

A. PGR research / PGR Pilots

If ONE OR MORE of the HIGH risk criteria have been selected ethical approval must be sought from a UREC committee. The person undertaking the research should

B. PGT/UG research not reviewing/evaluating professional roles or practice

If ONE OR MORE of the HIGH risk criteria have been selected ethical approval must be sought from a UREC committee. The supervisor and person

C. PGT or UG research reviewing / evaluating professional roles or practice,

If ONE OR MORE of the HIGH risk criteria have been selected ethical approval must be sought from the Manchester Institute of Education (MIE) Research Integrity Committee.

For example, in the UK, normal working hours are between 8am-6pm, Mon-Fri inclusive.
NB: ‘Supporting documents’ include recruitment adverts/emails, draft questionnaires / interview topic guides, information sheets and consent forms.

**The documents listed above should be submitted to:**

A. Mrs. Debbie Kubiena, Room B3.10 along with your PhD Research Plan for consideration at the PhD/Prof Doctorate Review Panel.

B. The Administrator for Ethics and Fieldwork (AEF) via Ethics.Education@manchester.ac.uk by your supervisor. In doing so, supervisors confirm that they have agreed the assessed risk level and that the documents are complete and correct. The AEF will arrange authorisation for your documents to be submitted to UREC.

C. The Administrator for Ethics and Fieldwork (AEF) via Ethics.Education@manchester.ac.uk by your supervisor. In doing so, supervisors confirm that they have agreed the assessed risk level and that the documents are complete and correct. The AEF will forward your completed documents to a member of the MIE RIC committee for approval.

*If no HIGH risk items are ticked supervisors and students should continue to section C.2 on the next page*
C.2 – Criteria for research classified as MEDIUM RISK (tick any that apply)

I/we confirm that this research:

- is primary research involving children or other vulnerable groups which involves direct contact with participants¹³.

- study is on a subject that a reasonable person would agree addresses issues of legitimate interest, where there is a possibility that the topic may result in distress or upset in rare instances.

- is primary research which involves substantial direct contact¹⁴ with adults in non-professional roles*

- is primary research which focuses on data collection from professionals responding to questions outside of their professional concerns.

- is primary research involving data collection from participants outside of the EU or the researcher’s home country via direct telephone, video, or other linked communications.

- is practice review/evaluation involving topics of a sensitive nature which are not personal to the participants.

- involves visits to site(s) where a specific risk to participants and/or the researcher has been identified, and the researcher may not be closely supervised throughout*.

- requires specific training and this is scheduled to be completed before fieldwork starts, or, training will not be undertaken but the research will be closely supervised by an academic advisor with appropriate qualifications and skills.

- requires vaccinations which have been received, or are scheduled to be received in a timely fashion*.

- requires face to face contact with research participants partly outside normal working hours¹⁵ that may be seen as inconvenient*.

- takes place in, or involves transport to and from, locations where the researcher’s lack of familiarity may put them at personal risk*.

- may require the operation of machinery, electrical equipment, or workplace vehicles, or handling or working with animals at the research location(s), for which they are not qualified, but such operation or handling will be undertaken under close supervision from a qualified operative or handler*.

---

¹³ This does not include research in locations where children are present if they are not the focus of the research.

¹⁴ For example in focus group or one to one interview in private locations, and not ‘market research’ which is characterised by brief interaction with randomly selected individuals in public locations.

¹⁵ In the UK normal working hours are between 8am-6pm, Mon-Fri inclusive.
* IF YOU HAVE TICKED these MEDIUM risk criteria you must also complete a separate Fieldwork Risk Assessment form.

IF YOU HAVE ONLY TICKED MEDIUM risk criteria NOT marked (*) you MUST also complete the LOW Fieldwork Risk Declaration on page 9 of this form.
If ONE OR MORE of the **MEDIUM risk** criteria have been selected, ethical approval must be sought from the Manchester Institute of Education (MIE) Research Integrity Committee (RIC) and so you should complete the MIE Ethical Approval Application form (available on the Manchester Institute of Education Ethics Intranet).

The supervisor and student should agree this RREA assessment and submit:

- Completed RREA form
- Completed Manchester Institute of Education Ethical Approval Application form
- Completed Fieldwork Risk Assessment form where indicated
- Supporting documents.

**NB:** ‘Supporting documents’ include recruitment adverts/emails, draft questionnaires / interview topic guides, information sheets and consent forms.

**Document should be submitted for review as indicated below:**

**A. PGR Thesis** - Mrs. Debbie Kubiena, Room B3.10 along with your PhD Research Plan for consideration at the PhD/Prof Doctorate Review Panel.

**B. All other cases** - to the Administrator for Ethics and Fieldwork (AEF) via Ethics.Education@manchester.ac.uk by your supervisor. In doing so, supervisors confirm that they have agreed the assessed risk level and that the documents are complete and correct. The AEF will forward your completed documents to a member of the MIE RIC committee for approval.

*If none of the HIGH or MEDIUM risk criteria have been ticked, supervisors and students should continue to section C3 on the next page.*

---

16 This document and guidance for completion can downloaded from [http://www.education.manchester.ac.uk/intranet/ethics](http://www.education.manchester.ac.uk/intranet/ethics)
C3 – Criteria for research classified as LOW RISK

C 3.1 NO human participants

I/we confirm that this research (tick as appropriate):

☐ is not of high nor medium risk to the researcher, in accordance with the criteria provided in sections C.1 and C.2 respectively.

☐ is Secondary research (i.e. it will use material that has already been published or is in the public domain).

☐ is Secondary data analysis (i.e. it will involve data from an established data archive)

If you have ticked one of the options in C3.1 above, and C3.2 does not apply, you should now complete section C3.3

C 3.2 Human participants

I/we confirm that this research (tick as appropriate):

☒ is not of high nor medium risk to the researcher, or participants, in accordance with the criteria provided in sections C.0, C.1, and C.2 respectively.

☒ A reasonable person would agree that the study addresses issues of legitimate interest without being in any way likely to inflame opinion or cause distress

☒ is Practice review (i.e. the research involves data collection from participants on issues relating to the researcher’s professional role, in a setting where the researcher is employed or on a professional placement)

☒ is Practice evaluation (i.e. the research involves data collection on a student’s professional role, in a setting where the researcher is employed or on a professional placement. The data collected will be used for comparison against national or other targets or standards).

☐ is Primary research on professional practice with participants in professional roles conducted in their work setting.

☐ is Market research (i.e. the research may involve data collection from the general public approached or observed in public locations for the purposes of market investigation).

☐ is Primary research using a questionnaire completed and returned by participants with no direct contact with the researcher.

☐ is part of a research methods course and participant groups are limited to peers, colleagues, family members and friends.

☐ is a Pilot Study

C 3.3 Research context

17 A reasonable person would agree that the study includes no issues of public or private objection, or of a sensitive nature.
I/we confirm (tick as appropriate):

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td><strong>the location(s) of the research are not listed on the Foreign and Commonwealth Office warning lists</strong> 18</td>
</tr>
<tr>
<td>X</td>
<td><strong>the researcher is not in a position to coerce potential participants/secondary data owners</strong></td>
</tr>
<tr>
<td>X</td>
<td>Primary or practice research involves <strong>no</strong> vulnerable group (as indicated in question B3).</td>
</tr>
<tr>
<td>X</td>
<td>Primary or practice research will be conducted in a public space or building (e.g. the high street, the University campus, a school building, etc)</td>
</tr>
</tbody>
</table>

**D. LOW Risk Fieldwork Declaration**

Students **not** directed to complete the separate Fieldwork Risk Assessment in Section C should tick the items in D.1 or D.2 to confirm the LOW risk nature of their fieldwork visits. Then sign the Declaration in D.3

**D.1 Fieldwork visits** *(If you will **not** make any fieldwork visits, tick the alternative items in D.2 below.)*

I/we confirm:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>the researcher will not travel outside the UK or their home nation.</td>
</tr>
<tr>
<td>X</td>
<td>the fieldwork does not require overnight stays in hotels or other types of public temporary accommodation.</td>
</tr>
<tr>
<td>X</td>
<td>public and private travel to and from the research location(s) are familiar to the researcher and offer no discernable risk.</td>
</tr>
<tr>
<td>X</td>
<td>the researcher will not travel through, or work in research locations which may have unlit areas, derelict areas, cliffs, or local endemic diseases</td>
</tr>
<tr>
<td>X</td>
<td>the researcher will carry only necessary personal items when travelling to, and within, research locations.</td>
</tr>
<tr>
<td>X</td>
<td>no specific vaccinations are required to undertake this research</td>
</tr>
<tr>
<td>X</td>
<td>first aid provision and a trained first aider are available where appropriate</td>
</tr>
<tr>
<td>X</td>
<td>the researcher will only operate machinery, electrical equipment, or workplace vehicles, or handle or work with animals at the research location(s) if they are qualified to do so</td>
</tr>
<tr>
<td>X</td>
<td>the fieldwork will be carried out within normal working hours 19 at a time convenient to participants.</td>
</tr>
<tr>
<td>X</td>
<td>the researcher will not give out personal telephone information to participants, or owners of secondary data resources, in relation to the research project</td>
</tr>
<tr>
<td>X</td>
<td>the researcher is fully aware of and sensitive to cultural and religious practices of participant groups,</td>
</tr>
</tbody>
</table>

---


19 For example, in the UK normal working hours are between 8am and 6pm Mon-Fri inclusive.
If you are unable to tick all items above, you must complete a separate Fieldwork Risk Assessment form.

D.2 No Fieldwork visits

1 I/we confirm:

☐ this research does not involve fieldwork visits of any kind

☐ the researcher will not give out personal telephone information to participants, or owners of secondary data resources, in relation to the research project

D.3 Researcher Declaration:

By signing this completed document, I declare that the information in it is accurate to the best of my knowledge and that I will complete any actions that I have indicated I will complete.

Signature: ___________________________ Date: 27/06/2014

Name (in capitals): LEE RANDALL Student ID: 9266776
PGR Panel Students ONLY

If ONE OR MORE of the **LOW risk** criteria above have been selected, ethical approval must be sought from the Manchester Institute of Education Research Integrity Committee. The supervisor and student should agree this research risk assessment and submit:

- Completed RREA form
- Completed the Manchester Institute of Education Ethical Approval Application form\(^{20}\).
- Completed Fieldwork Risk Assessment form where indicated
- Supporting documents

**NB:** ‘Supporting documents’ include recruitment adverts/emails, draft questionnaires / interview topic guides, information sheets and consent forms.

Documents should be submitted to:

Mrs. Debbie Kubiena, Room B3.10 along with your PhD Research Plan for consideration at the PhD/Prof Doctorate Review Panel.

⇒ *UG, PGT, PGR Pilot studies, PROF DOC Research Papers involving ONLY LOW RISK CRITERIA*

⇒ *Go to Section E.1 page 11*

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\(^{20}\) This document and guidance for completion can downloaded from [http://www.education.manchester.ac.uk/intranet/ethics](http://www.education.manchester.ac.uk/intranet/ethics)
SECTION E  UG/PGT/PGR Pilot/PROF DOC Papers

Ethical Approval Application for LOW risk research

Section E.1 to be completed by students.  Section E.2 to be completed by supervisors/tutors

E. 1 Research ethics criteria

Tick as appropriate and/or indicate NA against items in bold where they do not apply to this research.

I/we confirm:

Codes of Practice

- I/we have read and understood the Manchester Institute of Education Ethical Practice and Policy Guidelines
- the researcher will abide by the Manchester Institute of Education’s Ethical Protocol detailed therein
- the researcher is aware of and will abide by any organisation’s codes of conduct relevant to this research

Researcher skills/checks

- all necessary training procedures for this research have been completed
- all appropriate permissions have been obtained to use any database or resource to be analysed in Secondary research
- all relevant enhanced DBS or other checks have been completed
- I will inform the AEF if my DBS (or related) status changes
- written permission to be on the site to conduct primary research has been received

Rights of participants

- participant information sheets (PIS), consent forms, questionnaires, and all other documentation relevant to this research have been discussed with supervisor/tutor named in A.5
- PIS and consent forms have been confirmed by the supervisor named in A.5, as covering required headings illustrated in the MIE Participant Information and consent templates, AND as accessible to proposed participant groups.
- the researcher understands the Data Protection Act and the University Data Protection Policy and all data will be handled confidentially and securely, including storage on encrypted devices.

Research Integrity
X no data will be collected before approval of the study by the supervisor/tutor

X the student researcher will immediately report any issues arising during the course of the study that conflict with the Manchester Institute of Education protocol, to the supervisor who has signed the ethics approval and suspend data collection pending advice from that supervisor/tutor

X the researcher will report any proposed deviation from the research specification outlined in this assessment to the supervisor/tutor to update the current assessment or clarify any need for further approvals BEFORE such changes are made

1

2 Research output

X the only publication/output from this research will be the assignment or dissertation unless consent has been obtained from participants for further dissemination

3

4
E.2 Supervisor confirmation that research matches LOW risk criteria above.

When satisfied that the assessment is correct, supervisors should complete this section.

For ‘low risk’ research approval relevant items in bold must be ticked or marked as NA if not applicable to this research and one or more of the specific research criteria as appropriate.

The supervisor confirms:

- The submission has been discussed and agreed with the person(s) undertaking the research.
- The student has had appropriate training and has the skills to undertake this study, or has qualified supervision in place.
- The research activities outlined in the proposal involve no substantive risks to the student researcher or potential participants.

AND one or more of the following as appropriate:

- Primary or Practice research will not address issues of public or social objection or of a sensitive nature.
- Information giving and consent taking processes follow Manchester Institute of Education guidance.
- Where fieldwork visits do not correspond to all items in the LOW Risk Fieldwork Declaration, a separate Fieldwork Risk Assessment form has been completed and approved.
- Secondary research assignment/project has appropriate resource or database access permissions.
- They will act as custodian for data used for any study that results in a publication (Masters dissertation or otherwise) and will arrange for archiving of data within the Manchester Institute for a minimum period of 5 years.

I confirm that the proposed research matches low risk criteria and that the documents supplied are complete and correct. I submit the items below in support of this Low Risk Ethical Approval:

<table>
<thead>
<tr>
<th>Submitted</th>
<th>NA</th>
<th>Document</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NA</td>
<td>Completed RREA form</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>Completed Fieldwork Risk Assessment form where indicated</td>
</tr>
</tbody>
</table>
Student research **proposal, or equivalent**, on which the assessment is based

<table>
<thead>
<tr>
<th>Supporting documents including:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft questionnaire/interview topic guide/other data collection tool</td>
</tr>
<tr>
<td>Recruitment email/advertisement</td>
</tr>
<tr>
<td>Information sheet for each participant group</td>
</tr>
<tr>
<td>Consent form (or alternative) for each participant group</td>
</tr>
</tbody>
</table>

Documents should be submitted electronically for archiving and audit purposes, to the Administrator for Ethics and Fieldwork (AEF) via Ethics.Education@manchester.ac.uk by the supervisor. The AEF can only provide formal confirmation of ethical approval via email to both student and supervisor when a complete set of documents are supplied. Copies of all documents should be retained by the supervisor.

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21 For audit purposes, a person unfamiliar with the research outlined in Section B must be able to ascertain the full details of the student project from this RREA form and/or supporting documents appended.
This ethical approval application form has been revised to incorporate changes made to the new University Research Ethics Committee (UREC) Form. It has been designed to incorporate prompts for information needed to ascertain whether the proposed research matches MIE’s research template pre-approved by UREC and to facilitate completion of the form to a standard that will allow speedier review, and approvals, by RIC members. Please follow all directions contained in this document.

SECTION 1: Student Details /Identification of the person responsible for the research

<table>
<thead>
<tr>
<th>Name of Student:</th>
<th>Lee Randall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student ID (quoted on library/ swipe card):</td>
<td>9266776</td>
</tr>
<tr>
<td>Email Address:</td>
<td><a href="mailto:leerayrandall@hotmail.co.uk">leerayrandall@hotmail.co.uk</a></td>
</tr>
<tr>
<td>Name of Supervisor:</td>
<td>Dr Kathleen Tyldesley</td>
</tr>
<tr>
<td>Supervisor email:</td>
<td><a href="mailto:Kathleen.Tyldesley@manchester.ac.uk">Kathleen.Tyldesley@manchester.ac.uk</a></td>
</tr>
<tr>
<td>Programme (PhD, Prof Doc, MEd, PGCE, MSc, BA etc):</td>
<td>Prof Doc</td>
</tr>
<tr>
<td>Year of Study</td>
<td>2</td>
</tr>
<tr>
<td>---------------</td>
<td>---</td>
</tr>
<tr>
<td>Full/Part-time</td>
<td>Full</td>
</tr>
<tr>
<td>Title of Research Project:</td>
<td>Evaluating the Impact of the <em>MeeMo Working Memory Training Programme</em> on the Academic Performance of Typically Developing 8-9 Year Old Children</td>
</tr>
</tbody>
</table>
| Recruitment and Data Collection | Start Date: *On receipt of confirmation of ethical approval*  
End Date: *July 2015* |
| Location(s) where the project will be carried out: | Primary School premises |
| Student Signature: | |
| Supervisor Signature:**  
*Date:* | 12/09/2014 |

** Supervisor signature confirms that the student has the relevant experience, knowledge and skills to carry out the study in an appropriate manner
SECTION 2: PROJECT DETAILS

(Please write your answers in the boxes provided. Boxes will expand to fit answers as necessary)

1. Aims and Objectives of the Project

1.1 Research Question

State the principal research question(s).

RQ1: Does MeeMo improve the working memory and academic performance of typically developing 8-9 year old children?

RQ2: What effect (if any) does the explicit teaching of Working Memory strategies within the MeeMo programme have on the working memory and academic performance of typically developing 8-9 year old children?

1.2. Academic justification

Briefly describe the academic justification for the research. (Why is it an area of importance/ has any similar research been done?)

The researcher has identified a specific but significant knowledge gap in the literature in that research examining the human mediated working memory training programme MeeMo, has yet to identify whether it makes a significant positive contribution to children’s learning in terms of academic outcomes. This is made all the more pertinent in that research on this matter regarding computer based working memory training programmes has proved inconclusive at best. If the researcher were to find evidence that MeeMo was making a positive contribution to children’s learning, it could have significant implications in terms of how we approach the design of working memory training programmes and for the legitimacy of working memory training programmes as an educational tool.

2. Methodology

2.1 Project Design:
2.2 Data Collection Methods:

Describe the research procedures/activities as they affect the study participant and any other parties involved.

Which of the following will your research involve and what will you be asking your participants to do.

2.2.1. Interviews

Yes ☐  No ☐

If Yes, describe how these are to be conducted (Append your interview guide):

Semi-structured interviews conducted after quantitative data collection with teaching staff involved in the research, in their place of work at a time of their convenience.

2.2.2. Questionnaires

Yes ☐  No ☐

If Yes, how will these be delivered to and collected from participants? (Append your draft questionnaire(s)):

These will be delivered at the end of the qualitative data gathering and will be given to the participating children by their teacher during the normal school day for them to fill out there and then. They will then be collected in by the researcher as soon as is convenient for the school.

2.2.3. Observations

Yes ☐  No ☐

2.2.4. Diary

If Yes, describe the context for use of the diary and what participants will be asked to do. (Append copy of the Diary instructions and format):

2.2.5. Intervention

If Yes, describe the intervention and what participants will be asked to do. (Append a detailed description and any images necessary to support the description):

The intervention will be a 6 week working memory training programme called MeeMo delivered to two whole primary school classes by their respective teachers. The programme uses 5 different memory games designed to help students improve different facets of their working memories. A teacher guide to MeeMo is appended for further details.

2.2.6. Assessments

If Yes, describe the context for the observation and what participants will be engaged in. (Append copy of any observation framework or other data collection guide to be used):
If Yes, give full details of the assessment(s) and what participants will be asked to do. (Append a copy of the assessment schedules to be used):

In order to assess the participants working memory the Automated Working Memory Assessment Battery will be used and will involve each individual pupil undertaking an approximately half hour test assessing various aspects of working memory on a computer. To assess the participants literacy the Test of Silent Contextual Reading will be used as a whole class assessment of approximately 15 minutes. To assess the participants numeracy the Access Mathematics Test will be used as a whole class assessment of approximately 45 minutes. A table the schedules of the assessments throughout the project has been appended.

2.2.7. Other

Yes ☐ No ☒

If Yes, give full details and what participants will be asked to do. (Append supporting documentation as appropriate):

2.2.8. Does data collection use video or still image?  Yes ☐ No ☒

If Yes, complete the VASTRE documentation - Available from:
http://www.seed.manchester.ac.uk/studentintranet/miestudenthome/integrityethics/stillimageresearch/

2.2.9 Research Experience
Please state your experience in conducting these research interventions or assessments (where applicable) and methodologies outlined above - provide supporting evidence (e.g. course unit code).

I conducted my Assignment 1 project on MeeMo, interviewing primary school staff who delivered the programme regarding the implementation of the programme in their schools and their views on its efficacy. I saw the programme delivered numerous times during the course of this research in schools where it has been used effectively (in the view of the staff using it) for over a year. As such I have a good understanding of how the programme should be implemented by primary school staff. Though I have not used the assessments I plan to use in this research before, I have in the first year of my doctorate undertaken the Test User: Educational, Ability and Attainment (CCET) qualification in psychological testing and have used numerous educational assessments during my work with children. As such I feel confident of being able to use and deliver the assessments needed for this research competently.

2.3 Sampling

What type of sampling method do you propose to use?

2.3.1. Statistical

Yes [ ] No [X]

If Yes, describe the type, your justification for taking this approach and proposed sample size:

2.3.2. Other

Yes [X] No [ ]
If Yes, describe the type, your justification for taking this approach and proposed sample size:

I am using a purposive sampling technique because research indicates that the MeeMo programme is most effective for children between the ages of 7-10. As such I am purposively selecting two classes of mixed ability Year 4 children from a good or outstanding primary school in which I work on placement. This will allow me to strike a balance between garnering a representative sample of 8-9 year old children and working in a way that will cause the minimum amount of disruption to the participants. The proposed sample size will be between 50 & 60 children.

2.4 Analysis method

What type of analyses do you propose to use to explore this data?

2.4.1. Quantitative analyses

If Yes, please give details:

I will use descriptive statistics to analyse the quantitative data gained from the questionnaires. To analyse the data from the assessments the researcher will firstly undertake a power analysis to see if inferential statistics can be used and if so, the researcher will use Spearman’s Rho to determine the distribution of the data. Effect sizes will be calculated and descriptive statistical analysis such as histograms, box-plots and stem-leaf diagrams will also be used to analyse and visually represent the data, regardless of whether inferential statistics can be used or not.

2.4.2. Qualitative analyses

If Yes, please give details:

Pupil comments from the questionnaire will be used to provide insight into the quantitative data. The interviews will be analysed using Braun & Clarke's, (2006) six phase model of thematic analysis.

2.5 Ethical Issues
Briefly state the main ethical issues raised by the methodology outlined above.

As the children will be getting assessed the researcher needs to be aware of the negative psychological effects that can occur during assessments as it is the researchers ethical duty to protect children from harm (British Psychological Society, 2002). As such the researcher will stop any assessment of a child if at any point the child becomes distressed.

As there is an intervention being put in place during the children’s learning time, there is also the issue of efficacy, namely: will the intervention be worth the time spent on it by children and staff? The research conducted by the researcher suggests that the MeeMo programme will help the children to improve their working memories as well as contributing to development of social skills and self-efficacy; as such the researcher feels using the intervention in this study is justifiable.

3. Participant Details

3.1 Characteristics of participants

Please specify the characteristics of the participants you wish to recruit.

<table>
<thead>
<tr>
<th>number</th>
<th>50-60</th>
</tr>
</thead>
<tbody>
<tr>
<td>sex</td>
<td>Male &amp; Female</td>
</tr>
<tr>
<td>age group(s)</td>
<td>8-9 years old</td>
</tr>
<tr>
<td>Location(s)</td>
<td>1 Primary school in Liverpool</td>
</tr>
</tbody>
</table>

3.2 Vulnerable groups

3.2.1. Will your project include participants from either of the following groups?

(Tick as appropriate)
Children under 16 in school, youth club or other accredited organisation. □
Adults with learning difficulties in familiar, supportive environments □
NONE OF THE ABOVE (go to item 4.) □

3.2.2. Inclusion of vulnerable groups

Please describe measures you will undertake to avoid coercion during the recruitment stage.

All children will be given the chance to opt out of partaking in the research. Not only will parental consent be sought but pupil assent will also be sought (see appendix 5 for the pupil assent form). Parents, teaching staff and children will all be fully informed of how the research will work, what it will involve, why they are doing it and how their data will be used before they are asked to give consent/assent.

3.2.3. Research in UK with vulnerable groups

Please confirm you have relevant clearance for working with vulnerable groups from DBS and/or other relevant sources.

DBS* Yes □ No □ NA □
Other Yes □ No □ NA □

If Other, please describe

*NB: You will need a DBS application through the University. Any work related DBS clearance is not valid for your University research.

3.2.4. Please confirm that you will notify the Administrator for Ethics and Fieldwork (AEF) immediately if your DBS status changes.

I will immediately notify the AEF if my DBS status changes □
NA □
4. Recruitment

4.1 Permissions

Do you have permission to collect data from an organisational fieldwork site from...

4.1.1. The organisation where the research will take place

(e.g. School head etc)?

Yes [ ]

NA [x]

4.1.2. Sub-settings within the organisation (e.g. class teacher etc)?

Yes [ ]

NA [ ]

If Yes, append letter/email confirming access to this application

If NA, please explain why permission is not applicable.

I do not yet have permission as I only began working in my primary schools 3 days ago and have not yet had the opportunity to approach the schools. I will get permission as soon as I am able to and have appended the letter and permission sheet I intend to send to head-teachers in appendices 6 & 7 respectively.

4.2.1. How will your pool of potential participants be identified? (tick all that apply)

- [ ] Letters/emails and follow up phone calls to organisations
- [x] Posters/Advertisements
- [x] Website/Internet (including Facebook/other social media)
- [x] Known or named client groups (students, etc).
- [ ] Networks and recommendations
- [ ] Person in a position of authority in organisation
4.2 Participant recruitment

4.2.2. Who will the potential participants be?

- Persons unknown to the researcher
- Client groups (students, etc) within an organisation known by the researcher
- Persons accessed through networks and recommendations
- Persons nominated by a position of authority
- Other (describe here):

Indicate whether there is any existing relationship between yourself and the source/group of potential participants.

I am currently developing a professional relationship with the school staff within the potential participating schools. There is also the possibility of me working with pupil participants in a professional capacity as the schools designated educational psychologist.
4.2.3. How will you approach potential participants? (tick all that apply)

- Letter
- Email
- Website/internet (including Facebook/other social media site)
- Presentation at meeting or similar
- Other (describe here):

Indicate how information about your study will be delivered to potential participants and how they will (directly or indirectly) let you know they would like to take part in your research.

I will speak to school staff and pupils as well as delivering a presentation on the research to both using a sample of the MeeMo programme. I will also send letters to parents, pupils and staff involved in the research explaining the research and seeking their consent/assent.

4.2.4 How will you ensure those interested in the research are fully informed about the study and what will be expected of them if they take part?

Append text of letters / emails / posters / advertisements / presentation etc
Information giving will be undertaken through:

- Letter
- Email
- Website/internet (including Facebook/other social media site)
- Telephone
- Information sheet (covering headings in University template)
- Presentation at meeting or similar
- Other (describe here):

Append text of recruitment letters / emails / information sheet to this application

Information giving will be undertaken by:

- the researcher
someone in a position of authority

a neutral third party to known or named client groups

Other (describe here):

Provide details on how you will fully inform potential participants about your study:

Not only will I present details of how the research will progress, what will be required of participants and what will be done with their data (in both a presentation and on the consent and information forms), I will also demonstrate the use of MeeMo to them before I ask for their consent/assent.

4.2.5 Information accessibility

What arrangements have you made to ensure information is accessible to those unable to read standard English? (low literacy level, non-English speaker, persons with learning disabilities)

Once a school has been identified I will ask teaching staff to inform me of any possible accessibility issues for any of their pupils or their families. In these cases I will speak to the families personally, using local authority interpreter services if required. The pupil assent form is also designed to present the salient information regarding the research in an easy to understand way using basic English.

Please confirm:

- X* I have supplied information relevant to each participating group
- X* The information provided follows the guidance provided in the University of Manchester Participant Information Sheet Template

*I have not yet supplied the information for the reasons explained in section 4.1. However as you will see from the appendices the information I will provide to the identified participants follows the guidance provided in the UoM participant information sheet.

4.2.6 Decision period
### 4.2.7. Incentives

State any payment or any other incentive that is being made to any study participant. *Specify and state the level of payment to be made and/or the source of the funds/gift/free service to be used and the justification for it.*

None.

### 4.2.8. Avoiding coercion

How will your recruitment methods avoid putting any overt or covert pressure on vulnerable individuals to consent (children, junior colleagues, adults with learning disabilities)?

I will present the reasons for taking part in the research in an open and honest way. I will ensure that they are under no obligation to partake in the research if they do not want to. My pupil assent form in appendix 5 demonstrates how I am attempting to explain the research to children and give them a fully informed choice to make.

### 4.3. Consent

#### 4.3.1. How will participants’ consent to take part be recorded?

<table>
<thead>
<tr>
<th>Option</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implied consent - return/submission of completed questionnaire</td>
<td></td>
</tr>
<tr>
<td>Written consent form matching University template</td>
<td>x</td>
</tr>
<tr>
<td>Verbally (give details of how this will be recorded)</td>
<td></td>
</tr>
<tr>
<td>Other method (give details here):</td>
<td></td>
</tr>
</tbody>
</table>

*Append text of consent forms/consent taking procedure to this application.*

Please confirm:  

<table>
<thead>
<tr>
<th>Option</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>My consent taking procedures are relevant to each participating group</td>
<td>x</td>
</tr>
<tr>
<td>The consent taking procedures follow the guidance provided in the University of Manchester Consent Form Template</td>
<td>x</td>
</tr>
</tbody>
</table>
4.3.2 Special arrangements

Please outline any special consent taking arrangements relevant to your research study.

5. Participation in the research

5.1 Duration

How long will each participant be expected to take part in activities?

*Intervention will be no longer than 6 weeks. Assessment will happen on three separate occasions between January and July 2015*

5.2 Benefits to participation

Are there any benefits to participation for participants (beyond incentive noted above)?

*I believe that the research indicates MeeMo helps children between the ages of 7-10 to improve their working memory, social skills and self-efficacy. The research also indicates that children enjoy using MeeMo. The research is investigating whether MeeMo provides other academic benefits to children besides working memory improvement so there is also the possibility that partaking in the research could improve the children’s abilities in literacy and numeracy.*

5.3 Deficits to participation
Will any benefit or service otherwise received by participants be withheld (e.g. pupil misses lesson, or part thereof) as a consequence of taking part in this study?

Pupils will devote 30 minutes lesson time with the teacher each day for 6 weeks to MeeMo. However there are a number of primary schools using MeeMo in this way already voluntarily. Indeed these schools have paid a considerable sum of money for their own copies of MeeMo as they believe the daily 30 minutes for six weeks the children spend using the programme is more beneficial to their academic progress than using the time some other way. As such this possible deficit may in fact be more than made up for by the potential benefits of using the MeeMo programme.

6. Risks and Safeguards

Please outline any adverse effects or risks for participants in respect of the methods you have indicated in Section 2B [Interview; Questionnaire; Interventions; Assessments; Observation; Diary keeping; Other activity]

6.1 Physical risks

6.1.1 Potential

What is the potential for adverse effects of a physical nature; risks or hazards, pain, discomfort, distress, inconvenience, or change in lifestyle / normal routine for participants?

I think the potential for adverse effects of this research are small. Though MeeMo is a change in daily classroom routine it is only for a six week period and for a small amount of time each day. My A1 research indicated that teachers found the programme very easy to implement in their schools and I see no reason it should not be the case in this research. There is a small potential that a child may become distressed during assessment.

6.1.2 Safeguards
6.2 Psychological risks

6.2.1 Potential

Will any topics discussed (questionnaire, group discussion or individual interview) potentially be sensitive, embarrassing or upsetting, or is it possible that criminal or other disclosures requiring action could take place during the project?

No

6.2.2 Safeguards

What precautions or measures have been taken to minimise or mitigate the risks identified above?

NA

6.3 Risks for you as researcher

It is important that the potential for adverse effects, risks or hazards, pain, discomfort, distress, or inconvenience, of a physical or psychological nature to you as the researcher have been assessed. This is a requirement by law. Risks to you are identified as part of the RREA/FRA process. Ensure this assessment has been completed by either:

a. a completed and approved Fieldwork Risk Assessment (FRA), or
b. a signed Low Risk Fieldwork Declaration in Section D of RREA form.
Briefly state here the conclusions of your assessment and append a copy of your approved FRA form (if required), in addition to your RREA, to this application:

As I will be conducting the research in a school in which I will be working at the time, I see no greater risk being posed to myself during the course of the research than is posed during my everyday working life, which is minimal and worst. As such I can see very little personal risk in conducting this research.

6.4 Early termination of the research

6.4.1 Criteria

What are the criteria for electively stopping the research prematurely?

If the MeeMo programme is having a negative effect on the children’s learning or is unable to be implemented by school staff or if there is a significant drop-out from the research (over 60%).

6.4.2 Please confirm, by ticking here, that:

X any adverse event requiring radical change of method/design or abandonment will be reported in the first instance to your research supervisor and then to the MIE RIC Chair

7. Data Protection and confidentiality

7.1 Data activities and storage of personal data

Will the study use any of the following activities at any stage?
7.2 Confidentiality of personal data

What measures have been put in place to ensure confidentiality of personal data? Give details of whether any encryption or other anonymisation procedures have been used and at what stage?

All data will be stored on an encrypted data stick provided to me by the local authority for which I work. Though the data collected will temporarily be stored on home, work and university computers for the purpose of writing the thesis and analysing the data, these devices are password protected, as will the individual data files be. All data will be anonymised in that participants will be assigned designations (e.g., teacher 1 or pupil 4) as soon as they confirm their participation. All personal information contained within consent forms will be stored in a locked drawer at the Liverpool Educational Psychology Service for which only I have the key.

7.3 Research monitoring and auditing Please confirm:

The student researcher's supervisor(s) will monitor the research

If other arrangements apply please specify:
7.4 Data Protection

Please provide confirmation that you will employ measures that comply with the Data Protection Act and the University Data Protection Policy (UDPP)?

Data Protection Act: I confirm that all Data collected will be:

- [X] Fairly and lawfully processed
- [X] Processed for limited purposes as outlined in this application
- [X] Adequate for the purpose, relevant and not excessive
- [X] Accurate
- [X] Not kept longer than necessary
- [X] Processed in accordance with the participant’s rights
- [X] Secure – on an encrypted storage device
- [X] Only transferred to other settings with appropriate protection.

University Data Protection Policy (UDPP): I confirm

- [X] My data and its storage will comply with the UDPP
- [X] Paper copies of data and encrypted storage devices will be stored in a locked draw or cupboard

For UG research: On completion of my research, the data will be kept until the study has been completed and will then be shredded/destroyed

For PGT/PGR research: On completion of my research, the data will be passed to my supervisor for archiving at the University for a period of 5 years after which it will be shredded/destroyed

7.5 Privacy during data analysis Please confirm:

- [X] Analysis will be undertaken by the student researcher
- [X] Analysis will take place in a private study area
7.6 Custody and control of the data

Please confirm:

- The student researcher's supervisor will have **custody** of the data
- The student researcher will have **control** of the data

If other arrangements apply please describe:

---

7.7 Access to the data

- The student researcher will have access to the data
- The student's supervisor(s) will have access to anonymised data

If other/additional arrangements apply, please describe:

---

7.8 Use of data in future studies

Will the data be stored for use in future studies?  

- Yes [ ]  
- No [ ]

If Yes, confirm this is addressed in the information giving/consent taking process by ticking here. [ ]
8. Reporting Arrangements

8.1 Dissemination

How do you intend to report and disseminate the results of the study?

(Tick all that apply)

- Peer reviewed scientific journals
- Book / Chapter contribution
- Published review (ESRC, Cochrane)
- Internal report
- Conference presentation
- Thesis/dissertation
- Other e.g. Creative works (describe here):

8.2 Participant and community feedback

How will the results of research be made available to research participants and communities from which they are drawn? (Tick all that apply)

- Written feedback to research participants
- Presentation to participants or relevant community groups
- Other e.g. Video/Website (describe here):
9. Research Sponsorship

9.1 External funding

Are you in receipt of any external funding for your study? (tick one)

☐ External Funding  ✕ No external funding

If you have funding please provide details:

<table>
<thead>
<tr>
<th>Organisation</th>
<th>UK Contact</th>
<th>Amount</th>
<th>Duration</th>
</tr>
</thead>
</table>

9.2 Sponsoring organisation

Who will be responsible for governance and insuring the study? (tick one)

☒ The University of Manchester

☐ Other organisation

If not UoM, provide details of who will act as sponsor of the research and their insurance details
10. Conflict of Interest

Have any conflicts of interest been identified in relation to this project? (tick at least one option)

☐ Payment for doing this research?

If so, how much and on what basis?

☐ Direct personal involvement in the research of a spouse/funder?

If so, please provide details:

☐ Does your department/the University receive payment (apart from costs)?

If so, please provide details:

x NONE of the ABOVE APPLY

Thank you

This is the end of the form

Please use the checklist below to ensure that you append all necessary supporting documents

CHECKLIST
Please tick to indicate whether the document is APPENDED OR NOT APPLICABLE for this application.

<table>
<thead>
<tr>
<th>Documents</th>
<th>Appended</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data collection instruments</strong></td>
<td></td>
</tr>
<tr>
<td>Draft copy of each data collection instrument named in Q2.2</td>
<td>X</td>
</tr>
<tr>
<td>(Questionnaire, Interview guide, etc)</td>
<td></td>
</tr>
<tr>
<td>Video and Still Image Recording Declaration (VASTRE)</td>
<td>X</td>
</tr>
<tr>
<td><strong>Participant recruitment</strong></td>
<td></td>
</tr>
<tr>
<td>Letter(s) of permission to conduct research within each organisation</td>
<td>X</td>
</tr>
<tr>
<td>Recruitment advertisement(s) specified in Q4.2.1</td>
<td>X</td>
</tr>
<tr>
<td>(poster/email/letter/presentation)</td>
<td></td>
</tr>
<tr>
<td>Participant Information giving – one for each participant type specified in Q3.1</td>
<td>X</td>
</tr>
<tr>
<td>(Information sheet/letter/email/script)</td>
<td></td>
</tr>
<tr>
<td>Consent taking – one for each participant type specified in Q3.1</td>
<td>X</td>
</tr>
<tr>
<td>(Consent form or alternative procedure)</td>
<td></td>
</tr>
<tr>
<td><strong>Fieldwork risk assessment</strong></td>
<td></td>
</tr>
<tr>
<td>Fieldwork Risk Assessment Form (approved)</td>
<td>X</td>
</tr>
<tr>
<td>RREA form Low Risk Fieldwork Declaration (Section D) completed</td>
<td>X</td>
</tr>
</tbody>
</table>
Appendix 6 – Ethical Approval Form

Template Approval Summary  UG/ PGT/ Professional Doctorates (Research Papers)

### EAC Member Screening - Drew Whitworth

<table>
<thead>
<tr>
<th>1. Title of the Research</th>
<th>Evaluating the Impact of the <em>MeeMo Working Memory Training Programme</em> on the Academic Performance of Typically Developing 8-9 Year Old Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Name</td>
<td>Lee Randall</td>
</tr>
<tr>
<td>1.2 Programme</td>
<td>Professional doctorate</td>
</tr>
<tr>
<td>Yr of Study</td>
<td>2</td>
</tr>
<tr>
<td>Dissertation</td>
<td>Yes</td>
</tr>
<tr>
<td>Assignment/Research Paper</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Identification of the person responsible**

1.3. The project is to be conducted by a student within the School of Education

<table>
<thead>
<tr>
<th>1.4 Start does not pre date approval</th>
<th>√</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 Any UG, PGT, PGCE, Diplomas, Certificates in SoE</td>
<td>√</td>
</tr>
<tr>
<td>1.6 The supervisor has assessed and supports the study</td>
<td>√</td>
</tr>
</tbody>
</table>

**Section 2. Project Details**
1. Aims and Objectives of the Project and the main ethical issues which may arise

<table>
<thead>
<tr>
<th>1A</th>
<th>Principal research questions and objectives are clearly laid out.</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>1B</td>
<td>The reason for the research has been fully justified</td>
<td>✓</td>
</tr>
<tr>
<td>1C Adults able to Consent</td>
<td>The main ethical issues have been clearly identified. The ethical considerations/ issues reflect the amount of interpersonal contact the student will have with the participants. That is whether the contact is indirect or direct. For example a large quantitative survey which is completed anonymously so the participant cannot be identified, is not going to raise the same ethical considerations as a project which in the main will carry out in-depth interviews with participants.</td>
<td></td>
</tr>
<tr>
<td>1C Children/ Young Adults</td>
<td>The ethical considerations/ issues are around the fact that the study includes young adults/ children and therefore requires that the methodology is not only appropriate for children but that it fully takes consideration of the need to take extra care. The student needs to demonstrate that they are prepared to be adaptable and have thought through appropriate mechanisms to take account of participants becoming distressed or disturbed whilst participating in the research. The nature of the participant group pre-supposes that contact with the participants will be direct.</td>
<td>✓</td>
</tr>
</tbody>
</table>

2 Methodology
The proposed data collection and analysis methods are appropriate for the study.

### Indirect Contact with the Participants

<table>
<thead>
<tr>
<th>2B Procedures to be undertaken</th>
<th>Direct Contact with Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None other than those taught as part of the students’ professional training or forming part of existing professional role.</td>
</tr>
</tbody>
</table>

### Activities to be undertaken

<table>
<thead>
<tr>
<th>2B Procedures to be undertaken</th>
<th>2B Activities to be undertaken</th>
</tr>
</thead>
<tbody>
<tr>
<td>One or more postal questionnaires (or online equivalent) will be sent to potential participants, depending on whether the research is single or multi-staged. The questionnaires will take no longer than one hour to complete.</td>
<td>Questionnaire administered by the researcher – maximum 1 hour.</td>
</tr>
<tr>
<td>A copy of the questionnaire / or main topics and areas to be investigated is attached and has been confirmed by internal review as appropriate to the study.</td>
<td>Keeping a diary – maximum 10 minutes per day over 2 months.</td>
</tr>
<tr>
<td>Attending a focus group – maximum 2 hours</td>
<td>Attending an interview – maximum 2 hours</td>
</tr>
<tr>
<td>Participating in an activity that is observed by the researcher - maximum 4 hours</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>For adults with learning difficulties/ children/ young adults, activities are appropriate to the individual’s communication needs.</td>
<td></td>
</tr>
<tr>
<td>Questionnaire administered by the researcher – maximum 30 minutes.</td>
<td>√</td>
</tr>
<tr>
<td>Keeping a diary – maximum 10 minutes per day over 1 month.</td>
<td></td>
</tr>
<tr>
<td>Attending a focus group – maximum 30 minutes</td>
<td></td>
</tr>
<tr>
<td>Attending an interview – maximum 30 minutes</td>
<td></td>
</tr>
<tr>
<td>Participating in an activity that is observed by the researcher - maximum 4 hours</td>
<td>√</td>
</tr>
<tr>
<td>A copy of questionnaires and/or focus group/interview questions / or main topics and areas to be investigated is attached and has been confirmed by internal review as appropriate to the study.</td>
<td></td>
</tr>
</tbody>
</table>

<p>| 2C Experience in procedure/activity | Match | 2C Experience in procedure/activity | Match |</p>
<table>
<thead>
<tr>
<th>Training constitutes successful completion of an EDUC course unit</th>
<th>Professional role constitutes evidence of qualification and authorised current practice:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BSc Speech and Language Therapy and current membership of professional body.</td>
</tr>
<tr>
<td></td>
<td>First degree plus PGCE or BA Primary/Secondary Education, and current employment as a teacher.</td>
</tr>
<tr>
<td></td>
<td>Degree/Diploma in Nursing and current employment in relevant health setting.</td>
</tr>
<tr>
<td></td>
<td>Degree in Psychology/Counselling/ Educational Psychologist plus current membership of related professional body</td>
</tr>
</tbody>
</table>

3. Participants

<table>
<thead>
<tr>
<th>3A Number of participants appropriate for study</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>Sex and Age - Appropriate for study</td>
</tr>
<tr>
<td>✓</td>
<td>Type - Appropriate for study</td>
</tr>
<tr>
<td></td>
<td>The research participants are adults able to consent</td>
</tr>
<tr>
<td>The research participants are children/ young people</td>
<td>√</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>3B Participant group (s) adequately justified</td>
<td>√</td>
</tr>
<tr>
<td>The student has Criminal Record Bureau (CRB) disclosures where research involves adults with learning difficulties or children/young people</td>
<td>√</td>
</tr>
<tr>
<td>Permission for the study to take place has been gained from relevant authority/organisation management.</td>
<td>Not yet</td>
</tr>
<tr>
<td>Additional permissions have been gained from persons responsible for activities within sub-settings of organisations [for example College Principal and Course Director].</td>
<td>Not yet</td>
</tr>
</tbody>
</table>

### 4 Recruitment

<table>
<thead>
<tr>
<th>Indirect Contact with the Participants</th>
<th>Match</th>
<th>Direct Contact with Participants</th>
<th>Match</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4A.i Participants will be identified by the student researcher or person in authority.</td>
<td></td>
<td>4A.i Participants will be identified by the student researcher or person in authority</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recruitment is conducted by the student unless they are in a position of authority over potential participants. In this case recruitment activities are undertaken by a ‘facilitator’ who is a colleague/manager with whom the potential participants do not have a dependent relationship.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4A.ii The recruitment by student researchers will be via:</td>
<td>4A.ii The recruitment will be via:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directories/Databases in the public domain</td>
<td>Personal letters/emails/follow up phone calls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electoral Register</td>
<td>Posters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advertisements</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recruitment by a person in authority will be via:</th>
<th>Known or named client groups (students, etc). Not patients as this will require NRES approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisational records</td>
<td>Networks and recommendations</td>
</tr>
</tbody>
</table>

And/or

| Recruitment by a person in a position of authority via organisational records |

<table>
<thead>
<tr>
<th>4B An information sheet has been prepared which gives participants full details of the project. It will be made clear to participants in the covering letter that:</th>
<th>4B An information sheet has been prepared in a format that meets the individuals' communication needs, which gives participants full details of the project. It will be made clear to participants that:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A non-reply will not be pursued beyond a single reminder.</td>
<td>No one will be made to participate in the research study against their will, and no undue influence will be exerted in order to persuade the participant to take part in the research.</td>
</tr>
<tr>
<td>Anonymity and confidentiality will be maintained.</td>
<td>Participation is entirely voluntary and refusal will attract no sanction and no reason for non-participation is required.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Participation is entirely voluntary and refusal will attract no sanction and no reason for non-participation is required.</td>
<td>✓</td>
</tr>
<tr>
<td>Participants are informed that if they agree to participate in the study, they are free to leave the study at any time without being required to give reasons for leaving.</td>
<td>✓</td>
</tr>
<tr>
<td>Anonymity and confidentiality will be maintained as far as possible. <strong>Exceptions would be:</strong></td>
<td>✓</td>
</tr>
<tr>
<td>- if person revealed that they are being harmed in any way, then the researcher has a duty to report to an appropriate authority. This will be done with the person’s knowledge and it will be agreed with them whom to tell.</td>
<td></td>
</tr>
<tr>
<td>- if the participant states that they have, or intend to harm someone</td>
<td></td>
</tr>
</tbody>
</table>

4C The maximum decision time will be determined by the cut off date for return of questionnaires/completion of online questionnaires for the pilot study (no minimum decision time).  

4C A minimum period of two weeks is offered to the participant to decide whether to take part in the pilot study.  

4D Use of incentives – None  

4D Use of incentives – None  

Expenses or gift token not exceeding £20  

5 Risks and Safeguards  

5A What are the potential adverse effects, risks or hazards for research participants, including potential for pain, discomfort, distress, inconvenience or changes to lifestyle for pilot study participants? Physical Risks
<table>
<thead>
<tr>
<th>5B Will individual or group interviews/questionnaires discuss any topics or issues that might be sensitive, embarrassing or upsetting, or is it possible that criminal or other disclosures requiring action could take place during the study (e.g. during interviews/group discussions, or use of screening tests for drugs)? Psychological Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>No individual or group interviews/questionnaires will discuss topics or issues that would be considered by a reasonable person to be embarrassing or upsetting, nor likely to result in criminal or other disclosures requiring action (e.g. during interviews/group discussions). However, if the participant group includes young adults/children then it is recognised that topics or issues that the researcher considers to not be embarrassing or upsetting may cause discomfort for the participant.</td>
</tr>
<tr>
<td>No individual questionnaires will ask questions on any topics or issues that would be considered by a reasonable person to be sensitive, embarrassing, upsetting, or likely to reveal criminal or other disclosures requiring action.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5C What is the potential for adverse effects, risks or hazards, pain, discomfort, distress, or inconvenience to the researchers themselves? (If any)</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are no foreseeable potential adverse effects, risks or hazards, pain, discomfort, distress, or inconvenience to the researchers themselves.</td>
</tr>
<tr>
<td>There are no or minimal potential adverse effects, risks or hazards, pain, discomfort, distress, or inconvenience to the researchers themselves.</td>
</tr>
</tbody>
</table>
### 5D What precautions have been taken to minimise or mitigate the risks identified above?

<table>
<thead>
<tr>
<th>Indirect Contact with the Participants</th>
<th>Match</th>
<th>Direct Contact with the Participants</th>
<th>Match</th>
</tr>
</thead>
<tbody>
<tr>
<td>No foreseeable risks have been identified.</td>
<td></td>
<td>Marginal risks identified for participants.</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ If the activity is inconvenient then it will either be cancelled or rearranged for a time that is convenient for the participant. (Physical)</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ If participants work in the same organisation where the research is being carried out then due care will be taken to ensure that the research will not interrupt normal organisational procedures. (Physical)</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Where it is considered that there may be a <strong>marginal likelihood</strong> of a topic or issues being sensitive, difficulties are to be averted by a procedure of gaining ongoing consent. This will provide participants an opportunity to decline to answer particular questions or discuss particular topics. (Psychological)</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Risks to the Researcher</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ A risk assessment has been completed by the researcher’s supervisor and has identified only marginal risk levels. A copy of the assessment and recommended safeguards is attached.</td>
<td>✓</td>
</tr>
</tbody>
</table>

### 6A Informed Consent
<table>
<thead>
<tr>
<th>Information on the research has been provided in a suitable format for potential participants and includes the following details:</th>
<th>Informed consent and if appropriate assent will be obtained from all participants by the researcher. Information on the research has been provided in a suitable format for potential participants and includes the following details:</th>
</tr>
</thead>
<tbody>
<tr>
<td>the name of the researcher and contact details</td>
<td>the name of the researcher and contact details of the researcher or recruitment facilitator for any questions prior to deciding whether to take part.</td>
</tr>
<tr>
<td>an explanation that it is a student project and what the researcher is hoping to achieve in the research</td>
<td>an explanation that it is a student project and what the researcher is hoping to achieve in the research</td>
</tr>
<tr>
<td>what is going to be done by the researcher</td>
<td>what is going to be done by the researcher</td>
</tr>
<tr>
<td>how long it will take to complete the questionnaire</td>
<td>a clear explanation of what the participant is expected to do during the study</td>
</tr>
<tr>
<td>a clear explanation of what the participant is expected to do during the study</td>
<td>a statement that the participant is not obliged to take part, and may withdraw at any time</td>
</tr>
<tr>
<td>a statement that the participant is not obliged to take part</td>
<td>a clear statement of payment of any out-of-pocket expenses or gift voucher.</td>
</tr>
<tr>
<td>a clear statement on confidentiality and data security and usage in line with University policy.</td>
<td>a clear statement on confidentiality and data security and usage in line with University policy.</td>
</tr>
<tr>
<td>The consent of a parent <strong>only</strong> will be obtained where the child is too young to comprehend the issues involved or the nature of the research and it is part of routine practice e.g. joining a reading table.</td>
<td></td>
</tr>
</tbody>
</table>

**Other information that will be included as relevant:**

**Other information that will be included as relevant:**
<table>
<thead>
<tr>
<th>duration of the study</th>
<th>duration of the study</th>
<th>√</th>
</tr>
</thead>
<tbody>
<tr>
<td>location of the study</td>
<td>location of the study</td>
<td>√</td>
</tr>
</tbody>
</table>

Participants have the right to decline the use of data gathering devices such as tape recorders and video cameras, and use of direct quotations from transcripts in any published documents. Specific permission will be sought via the record of consent for the use of recording devices and quotations.

<table>
<thead>
<tr>
<th>anticipated outcomes in respect of revision of research methodology</th>
<th>anticipated outcomes in respect of revision of research methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where projects have multiple stages informed consent is to be obtained for each phase of the work.</td>
<td>Where projects have multiple stages informed consent is to be obtained for each phase of the work.</td>
</tr>
</tbody>
</table>

Training received in taking consent | Training received in taking consent | √ |

Consent from a legal representative. | Extra Measures taken appropriate |

**7. Data Protection and Confidentiality**
Will the research involve any of the following activities at any stage (including identification of potential research participants)? *(Tick as appropriate)*

<table>
<thead>
<tr>
<th>Indirect Contact with the Participants</th>
<th>Match</th>
<th>Direct Contact with the Participants</th>
<th>Match</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic transfer by magnetic or optical media, e-mail or computer networks</td>
<td></td>
<td>Electronic transfer by magnetic or optical media, e-mail or computer networks</td>
<td></td>
</tr>
<tr>
<td>Use of personal addresses, postcodes, faxes, e-mails or telephone numbers</td>
<td></td>
<td>Use of personal addresses, postcodes, faxes, e-mails or telephone numbers</td>
<td>✓</td>
</tr>
<tr>
<td>Publication of direct quotations from respondents</td>
<td></td>
<td>Publication of direct quotations from respondents</td>
<td>✓</td>
</tr>
<tr>
<td>Use of audio/visual recording devices</td>
<td></td>
<td>Use of audio/visual recording devices</td>
<td></td>
</tr>
</tbody>
</table>

**Storage of personal data on any of the following:**

| NHS computers                                                                                   |       | Home or other personal computers                                                                    | ✓     |
| Home or other personal computers                                                                |       | University computers                                                                                | ✓     |
| University computers                                                                            |       | Laptop computers                                                                                    | ✓     |

The researcher will abide by the provisions of the Data Protection Act and the University Data Protection Policy.

Data and results obtained from the research will only be used in the way(s) for which consent has been given.

7B Data will be:

| Fairly and lawfully processed                                                                  |       | Fairly and lawfully processed                                                                       | ✓     |
| Processed for limited purposes | Processed for limited purposes | ✓ |
| Adequate, relevant and not excessive | Adequate, relevant and not excessive | ✓ |
| Accurate | Accurate | ✓ |
| Not kept longer than necessary | Not kept longer than necessary | ✓ |
| Processed in accordance with the participant’s rights | Processed in accordance with the participant’s rights | ✓ |
| Secure | Secure | ✓ |
| Not transferred to settings without adequate protection. | Not transferred to settings without adequate protection. | ✓ |

**7C Anonymity**

Anonymity will be preserved by the removal of identifiers and the use of ID numbers or pseudonyms, breaking the link between data and identifiable individuals.

Anonymity will be preserved by the removal of identifiers and the use of ID numbers or pseudonyms, breaking the link between data and identifiable individuals.

Where such links need to be preserved in order to match data sets in a repeated measures design, coding frames including participant identities are to be kept securely in a locked draw (or other secure location, e.g. encrypted data stick) accessed only by the researcher and separate from the data base.

Where such links need to be preserved in order to match data sets in a repeated measures design, coding frames including participant identities are to be kept securely in a locked draw (or other secure location, e.g. encrypted data stick) accessed only by the researcher and separate from the data base.

**7D Where will the analysis of the data from the study take place and by whom will it be undertaken?**

The analysis is to take place in a **private** study area by the student researcher conducting the study.

The analysis is to take place in a **private** study area by the student researcher conducting the study.

**7E Who will have control of and act as the custodian for the data generated by the study?**
The student researcher will control and act as custodian for the data generated by the study.

7F Who will have access to the data generated by the study?

The student researcher will have access to the data generated by the study. In addition the supervisor of the student researcher may see the data, in order to guide the student in analysis of the data, but only when all links that could identify individual participants have been removed.

7G For how long will data from the study be stored?

The data will be stored in a locked drawer until the pilot has been completed and then it will be shredded.

8. Reporting Arrangements

8A Please confirm that any adverse event will be reported to the Committee

<table>
<thead>
<tr>
<th>Indirect Contact with the Participants</th>
<th>Direct Contact with the Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Match</td>
<td>Match</td>
</tr>
</tbody>
</table>
Any adverse event will be reported to the UREC committee.  

8B How is it intended the results of the study will be reported and disseminated?

<table>
<thead>
<tr>
<th>Peer reviewed scientific journals</th>
<th>Peer reviewed scientific journals</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference presentation</td>
<td>Conference presentation</td>
<td></td>
</tr>
<tr>
<td>Written feedback to research participants</td>
<td>Written feedback to research participants</td>
<td></td>
</tr>
<tr>
<td>Presentation to participants or relevant community groups</td>
<td>Presentation to participants or relevant community groups</td>
<td></td>
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</tbody>
</table>

8C How will the results of research be made available to research participants and communities from which they are drawn?

They will not be available where there is no direct contact with participants in the study. However in a multistage study, a short report for participants will be provided.  

A short report, in an appropriate format, will be sent to participants in the study detailing the main results of the study. No individual feedback to be given to participants as links between the data and individuals will have been broken.

8D What arrangements are in place for monitoring and auditing the conduct of the research?

The Supervisor will monitor the research  

8E What are the criteria for electively stopping the trial or other research prematurely?
<table>
<thead>
<tr>
<th>Any unforseen harm that cannot be resolved</th>
<th>√</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Has External Funding for the research been secured?</strong></td>
<td></td>
</tr>
<tr>
<td>No - This is a student project and does not have external funding, therefore the sponsor is the supervisor of the student.</td>
<td>√</td>
</tr>
</tbody>
</table>

**10 Conflict of Interest**

| No conflict of interest has been identified at the point of application. Should a conflict of interest become apparent as the pilot study progresses then UREC will be informed. | √ |
| That the researcher is head teacher of this school has been identified as a possible conflict of interest but I believe adequate safeguards are in place |

**Signed by Student and Supervisor**

| √ |

I confirm that the application named above matches the Ethical Approval Template approved by UREC meeting 11th December 2009.

**Ethical Advisory Committee Member**
<table>
<thead>
<tr>
<th>Name</th>
<th>Drew Whitworth</th>
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</thead>
<tbody>
<tr>
<td>Signed</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>8 Oct 2014</td>
</tr>
</tbody>
</table>

**Ethical Advisory Committee Administrator**

<table>
<thead>
<tr>
<th>Decision Recorded Date</th>
<th></th>
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</table>

<table>
<thead>
<tr>
<th>Student and Supervisor Notified Date</th>
<th></th>
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<th>Signed</th>
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