

**THE EFFECTS OF USING VIDEO SELF-MODELLING AND AN IPAD
APPLICATION ON SELF-EFFICACY AND ACQUISITION OF BASIC
MATH SKILLS IN YEAR 5 STUDENTS**

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Table of Contents

Abbreviations	i
Acknowledgements	ii
Abstract.....	iii
Chapter 1: Introduction and Literature Review.....	1
1.1 Dewey's learning theory	3
1.2 Learning mathematics	4
1.3 Mathematics needs fluency	5
1.4 Fluency contributes several advantages to the learner.....	6
1.5 Mastery of Mathematical operations	7
1.6 The relationship between academic achievement and self-efficacy	8
1.7 The effectiveness of feedback on students' mathematical performance and self-efficacy	11
1.8 Psychometric instrumental: Pattern of Adaptive Learning Scales (PALS).....	12
1.9 Computer-assisted educational software.....	14
1.10 Learning through an iPad (a new tool for teaching in a school setting)	18
1.11 The accessibility of technology and its relationship to learning performance	19
1.12 Video self-modelling (VSM)	22
Chapter 2: Methods	27
2.1 Experimental design.....	27
2.2 Participants.....	27
2.2.1 Recruitment of participants	28
2.3 Ethics Approval	28
2.4 Setting	29
2.5 Dependent variable	29
2.6 Assessment.....	30
2.7 Apparatus	32
2.8 Procedures.....	32
2.9 Data Analysis	37
Chapter 3: Results.....	37
3.1 Mean correct responses on The Test.....	38
3.2 Intervention groups' data	39
3.2.1 The Test	39
3.2.2 Specific level test	41
3.2.3 Number of possible interventions	41

3.2.4	Intervention phases (VSM and the iPad app)	42
3.2.5	The iPad app (FFM) progress report.....	45
3.2.6	Time spent on the intervention phases (VSM and iPad app) not accounting for missed sessions.	46
3.2.7	Session probes.....	46
3.2.8	Self-efficacy test (PALS).....	48
Chapter 4: Discussion		49
4.1	A comparison between the intervention groups (Group A and B) and the whole class: basic number fact performance levels.....	49
4.2	The effectiveness of the intervention phases (VSM and the iPad app)	51
4.3	Self-efficacy test (PALS)	53
4.4	Unexpected Findings	54
4.5	Limitations	55
4.6	Practical Implications.....	56
4.7	Future Study.....	57
4.8	Conclusions.....	58
References.....		60
APPENDIX A:.....		69
APPENDIX B:		70
APPENDIX C:.....		82
APPENDIX D: The Test.....		89
APPENDIX E: Specific level test.....		95
APPENDIX F: Self-efficacy test (PALS)		101

List of Figures

Figure 1: <i>A student holding a flash card in a VSM intervention session</i>	33
Figure 2: <i>An example of basic fact problems on the Fast Facts Math iPad app</i>	34
Figure 3: <i>An example of the feedback given by the Fast Facts Math iPad app</i>	35
Figure 4: <i>Mean performance scores of the whole class and the intervention group</i>	38
Figure 5: <i>Group A's performance scores on session probes (filtered to show only multiplication questions) across the VSM and the iPad app</i>	42
Figure 6: <i>Group B's performance scores on session probes (filtered to show only multiplication questions) across the iPad app and VSM</i>	43
Figure 7: <i>Jason and Timo's performance scores on session probes (filtered to show only addition questions) across the two intervention phases</i>	44

List of Tables

Table 1 <i>Top 3 factors encouraging teachers to use computer as a cooperative teaching tool in the classroom</i>	20
Table 2 <i>Top 3 factors discouraging teachers to use computer as a cooperative teaching tool in the classroom</i>	21
Table 3 <i>A Timeline of this study</i>	37
Table 4 <i>Intervention groups' number of correct responses on The Test (accuracy over five minutes)</i>	39
Table 5 <i>Intervention groups' number of correct responses on The Test (fluency on addition and on multiplication over 1 minute)</i>	40
Table 6 <i>Intervention groups' rate of correct responses on specific level test</i>	41
Table 7 <i>Intervention groups' number of possible intervention sessions attended</i>	41
Table 8 <i>The intervention groups' best performance scores in percentage and time taken (seconds) on FFM for multiplication and division</i>	45
Table 9 <i>The intervention groups' best performance scores in percentage and time taken (seconds) on FFM for addition and subtraction</i>	46
Table 10 <i>Contrast of average time spent (seconds) on VSM viewing and iPad app engaging</i>	46
Table 11 <i>The intervention groups' performance scores on session probes per intervention session</i>	47
Table 12 <i>Mean score per subscale on self-efficacy test (PALS)</i>	48

Abbreviations

VSM: Video self-modelling

iPad: An Apple iPad 2 with an iOS6 operating system

app: iPad application (software)

FFM: Fast Fact Math app

PALS: Patterns of Adaptive Learning Scales

This was used to measure the Intervention group's self-efficacy levels

The Test:

The Test was given to all participants; it was used to measure students' knowledge of basic number facts. This test evaluated accuracy and fluency in addition and multiplication. The Test was also used in the mid- and post-test phases.

Specific level test:

The specific level test contained questions that evaluate basic number facts on addition, subtraction, multiplication and division, and it was given to the intervention group before the interventions. The purpose of the specific test was to help the researcher determine which of the students' basic maths skills needed improvement before the intervention session began.

Session probes:

The intervention group was asked to complete the session probes at the end of each intervention session. The session probes allowed the researcher to investigate performance changes during the intervention sessions.

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Abstract

This study aimed to examine the effectiveness of video self-modelling (VSM) and the iPad application (Fast Fact Math, FFM) interventions on a group of Year 5 students to increase their knowledge of basic number facts. This study also aimed to measure the intervention group's self-efficacy levels (Patterns of Adaptive Learning Scales, PALS) before and following the interventions. Participants were drawn from a decile 9 primary school in a suburban area (teaches Year 1 to Year 6). The Test (pre-, mid-, and post-test phases) were administered by a class teacher to all Year 5 students. Following consultation with the teacher, eight students whose scores fell below the 25th percentile were invited to participate in the study. The intervention group took a specific level test to ascertain their basic number facts performance on all four operations (addition, subtraction, multiplication, and division). The videos and the FFM app were personalised to each intervention group's members in an effort to elicit from the errors that they made on specific level test. At the completion of each intervention sessions, session probes were conducted. Meanwhile, the researcher gave a self-efficacy test (PALS) to the participants before and following intervention phases. Results showed that, although more than half of the intervention group increased their basic number fact performance level following the interventions, their overall self-efficacy rating on PALS did not change. Results also showed that VSM is a time-efficient and rapid learning method to use with the intervention group as opposed to the iPad app, which took two times longer to complete a session. Further areas of study are suggested.

Chapter 1: Introduction and Literature Review

Mathematics is an essential skill that helps build a student's ability to think critically, logically, strategically, and creatively (Education Counts, 2012). Furthermore, mathematics concepts are not easy to comprehend and master on the first try; it takes time, practice, pre-requisite skill, and understanding to gain mastery. Previous studies suggested that mathematical ability is associated with the labour market particularly concerning income, a higher employment rate and higher income level (Haeck, Lefebvre, & Merrigan, 2011; Hitchcock, Prater, & Dowrick, 2004). For this reason, it is important for students to understand basic number facts and numeracy skills in order to have lasting positive outcomes (Le Grice, Mabin, & Graham, 1999). Students' perceptions are also essential for improving their mathematical performance. Bandura (1993) defined "self-efficacy" as one's belief in one's own ability to successfully achieve a goal or desirable outcome. Belief in one's efficacy can affect all academic achievements, including mathematics (Metallidou & Vlachou, 2007).

The New Zealand Curriculum, the Mathematics Standards, and the Number Framework place the expectation that, by the end of three years of schooling, students should "know and be able to do" the three operational domains (New Zealand Maths, 2014, para.2). The domains are addition and subtraction; multiplication and division; and proportions and ratios (New Zealand Maths, 2014). Any students who are labelled "below" or "well below" (similar to the terms "cause for concern" and "at risk") would fail to meet the mathematical standard for that year. Therefore, additional study support and teaching are required for these students in order to support and maintain their learning development and positive attitude toward mathematics (New Zealand Maths, 2014).

Mathematics curriculum should be based on the learner's interests and involve the learner in an active learning experience, according to Dewey's education-based experience theory (1938). This was also argued by the Lewinian Model of Action Research and Laboratory Training, and Piaget's Model of Learning and Cognitive Development, as they explained that the learning process can be developed from a learner's experience while interacting with an event or the environment. Kolb (1984) termed this the "learning experience". In this manner learners, can acquire skills more

quickly and be able to adapt them for use in future situations (Carr, 2012). According to Dewey's theory (as cited in Carr, 2012) a student's mathematical performance could be influenced through practice with an iPad. Using an iPad could be a new superior teaching tool to help failing maths students with their learning development and attitude. There is a growing body of research based on the positive relationship between learners' mathematical performance and computer-assisted educational games (Fisch, Lesh, Motoki, Crespo, & Melfi, 2011; Sarama & Clements, 2009; Schoppek & Tulis, 2010). In addition, interventions such as video self-modelling and computer-assisted educational software have been found to increase students' academic performance (Habgood & Ainsworth, 2011; Hitchcock, Prater, & Dowrick, 2004). Video self-modelling has been found to be an intervention that can help increase students' self-efficacy, which can lead to better performance (Dowrick, 1999; Dowrick, 2012; Hitchcock, Dowrick, & Prater, 2003). Computer-assisted educational software provides immediate feedback and is adjustable according to the task level, which helps students engage with the task and increase their performance (Hattie & Timperley, 2007; Sedig, 2008; Wang, Kinzie, Pan, & McGuire, 2010). An extensive search of the literature did not reveal studies comparing the effectiveness of video self-modelling to computer software, even though these interventions on their own have been shown to be accessible, rapid and effective (Sedig, 2008).

The purpose of this study within a school setting was to explore strategies by using software (termed an application or app) on an iPad and video self-modelling (VSM), which is easily implemented in a classroom, to enable students to increase their knowledge of basic number facts as observed by their increasing scores that reflect accuracy and fluency in addition and multiplication. Beyond the students' basic maths scores, a further aim was to investigate any change in Year 5 students' self-efficacy levels before and following the interventions.

1.1 Dewey's learning theory

American philosopher John Dewey saw strengths and weaknesses in traditional and progressive education systems. He described progressive education as the opposite of traditional education and viewed traditional education as a dictated system (focussed on studying facts, ideas, curriculum and rules; with the learner being under the direction of the educator), and progressive education as a system of freedom (focussed on the learner's interests free from constraint by the educator). Dewey (1938) pointed out that traditional education does not yield a connection to individual experience and learning, and it gives little help for learners to grow in the future.

Dewey (1938) suggested that experience and education are sometimes not equivalent to each another; some experiences are educationally worthwhile and some are not. An educative experience encourages students to continue to learn in the future and promotes the learning performance and attitude of the learners. His view was that the educators needed to select this kind of experience to promote individual learning.

Dewey urged that progressive education would be more effective if combined with the philosophy of experience based on the two key principles of continuity and interaction (International Centre for Educator's Learning Styles [ICELS], 2013; Neil, 2005). Continuity is the evolution of one's experiences, which are acquired from past encounters, and it also influences one's future experiences. A person's attitude could be influenced by the continuity of experience, whether desirable or undesirable (Dewey, 1938). The concept of interaction explains how an individual's present encounters are created and formed by past experiences as well as how they interact with various situations. Both continuity and interaction are inseparable; they work with each other. They both give the value of an experience, which provides the measure of effective education (Dewey, 1938; Neil 2005). If someone can adequately acquire knowledge from past experiences (continuity) and can aptly use knowledge from the present situation (interaction), this means he or she will have gained an educative experience. Therefore, the education system will be more effective if it can relate to a person's development of growth experiences (ICELS, 2013).

Learners need an active experience in the education system to influence their future learning. Dewey's theory suggested that learners' favourable experiences would help foster their learning in the future. Dewey (1938) argued that a

combination of feedback, as well as enjoyment of the experience, can positively affect a learner's attitude to continuing learning and also assist learners to stay focussed and engaged in tasks (Carr, 2012; ICELS, 2013). Furthermore, enjoyment of the experience also increases the automaticity of a learner's skill for further experiences (Dewey, 1938).

1.2 Learning mathematics

A 1999 New Zealand study by Le Grice, Mabin, and Graham found that it was important for students to understand basic numeracy facts and numeracy skills in order to maintain positive learning outcomes for their future. It was necessary for students to understand how to operate the four basic mathematical operations (i.e. addition, subtraction, multiplication, and division) at an acceptable level of automaticity or fluency. Individuals who achieved at an acceptable level of fluency in the basic facts could benefit from these skills for successful independent living; for example, using the skills that involved money, time, and problem solving (Coddington, Burns, & Lukito, 2011).

Performing these operations automatically plays a significant role in students' development of their later mathematical literacy (Baroody, Bajwa, & Eiland, 2009; Carr, 2012; Kroesbergen & Van Luit, 2003; Stein, Silbert, & Carnine, 1997). Basic number facts are essential for students to succeed in mathematics. According to Le Grice et al. (1999) students who can develop their mathematics performance at the fluency level would benefit by applying the skill to other areas of development (e.g. language, oral reading, or text comprehension skills). As, fluency is an underlying basis, which builds upon the student's knowledge and understanding of conceptual, for example, strategic reasoning and problem solving (National Council of Teachers of Mathematics [NCTM], 2014). Therefore, failure to obtain the basic number facts in the mid-primary years can create problematic behaviours and increase the likelihood of students dropping out of school, resulting in fewer possibilities for employment (Hitchcock et al., 2004).

Le Grice et al. (1999) suggested that five instruction-related factors affect a student's performance in mathematics. The first factor is the identification of prior knowledge. The student should be able to perform the task at a fluent level in order to concentrate and be able to learn a new task, which was also explained by Cognitive

Load Theory (which will be elaborated upon in this chapter). Fluency at a basic level of maths will help students transfer the skills to a more advanced level or task. The second element is explicitness of instruction, via a clear expressed or demonstrated model is a factor for improving a variety of students' mathematics skills; the third, the selection of mathematical examples. The examples should be appropriate and at a suitable level for use with individual students, which in turn will help each student apply the skills to the appropriate situation. Forth, the teacher must provide opportunities for students to achieve a fluent level with their new mathematics skills. For example, teachers can improve a student's learning by setting a daily goal for him or her to achieve. Once the student achieves the goal the teacher add more goals until the student's performance reaches automaticity. Lastly, the structure and language use in the exercises should have good oral reading and structure, which help motivate the learners to engage in the exercises. In addition to an effective mathematical practice to develop the students' fluency level, "practice should be brief, engaging, purposeful, and distributed" (NCTM, 2014, para.3).

1.3 Mathematics needs fluency

There is no worldwide agreement on a mathematical performance standard; nevertheless fluency should be used to help differentiate students' achievement levels (Binder, Haughton, & Bateman, 2002; Kubina & Morrison, 2000). Many educational settings measure students' performance by the percentage of correct answers (accuracy), where the best percentage score for anyone is 100% (Binder et al., 2002). Thus, if two students received the same score on a test, it would be almost impossible to separate them. However, a different picture would emerge if one of the students took 15 minutes to complete the test, while the other took 30 minutes to achieve the same score. The time taken to complete a test provides further information about a student's performance level in term of fluency.

Fluency is the combination of accuracy and speed that is demonstrated by the performer. "Called by many names, overlearning, automaticity, and fluency all appear germane to one another and may even refer to the same set of behavioral events (Dougherty & Johnston, 1996). Many words such as 'smooth' (Schreiber, 1991), 'rhythmically' (Harris, 1970), 'effortless' (Zutell & Rasinski, 1991), 'automatic'

(LaBerge & Samuels, 1974), and ‘second nature’ (Lindsley, 1996) have described fluent performance” (Kubina & Morrison, 2000, p. 89).

A study by Binder (2003) discovered that accuracy alone cannot distinguish between the skill levels of people; for example, between adults, mainstream students, and students with severe developmental disabilities. Hence, fluency facilitates the quantitative accuracy by a standard unit, and this helps teachers distinguish between acquisition and mastery performances of students. Without fluency to detect the learners’ skill level and support in the academic classroom, learners often accomplish little or no improvement beyond a certain point (Binder, 2003).

1.4 Fluency contributes several advantages to the learner

According to Cognitive Load Theory, the term ‘schema acquisition’ is directly related to the learner’s performance level and refers to the learner’s ability to organise and manipulate information in a meaningful fashion (Sweller, 1994). Learners organise the information in a meaningful way by associating new knowledge with pre-existing material, which significantly strengthens their future understanding. Sweller (1994) suggested that learners who can manage to interconnect both previous and new information together are most likely to become versed in automaticity. Binder (as cited in Dougherty & Johnson, 1996) defined that both fluency and automaticity shared the same definitions and yielded the same benefits to the learner. Fluency facilitates retention, endurance, and application, which are the key performance indicators of automaticity or fluency (Binder et al., 2002; Church, 2014; Dougherty & Johnston, 1996; Kubina & Morrison, 2000). In an educational context, retention refers to how well the students retain skills after a long period of time. If the students cannot recall their skills or learning, difficulties will occur for both teachers and students. As an example, teachers will have to re-teach and students will have to re-learn and refresh the skills that were previously taught in the class, which is not time efficient.

The second aspect of fluency is endurance. Endurance can be described as how well a student can focus his or her attention on the same tasks over extended periods of time (Binder et al., 2002). Binder, Haughton, and Eyk (as cited in Kubina & Morrison 2000) found that endurance deficits cause students to decrease their level of performance or even stop focussing on the task over prolonged amounts of time. Students who cannot stay focussed on the targeted task may make more errors and

may increase their negative emotional behaviours (Kubina & Morrison, 2000). It is necessary to provide enough practice on a target skill for the students until they can perform it with a certain degree of fluency. Once the student can perform the skill quickly and accurately enough, then the fluency skill tends to act as a reinforcer for the student. In other words, students will continue to perform the target skill at a fluent level over time because the target skill has become their reinforcer (Church, 2014).

The final component is application or generalisation. Application refers to the students' ability to combine the learnt skills and use together in a new situation (Binder et al., 2002; Church, 2014; Dougherty & Johnston, 1996; Kubina & Morrison, 2000). Students who successfully acquire skills at a fluent level tend to have an advantage on learning new tasks, as well as tasks that involve more advanced skills, than students who are not. For example, a student may score 90% of the total marks during the daily maths practice; but during the timed test or exam, the same student does not reach a score of 90%, because solving maths during a timed test requires two fluency skills from a student; calculation, and to writing digits very quickly and accurately on paper. For the application to occur, compounding the two skills is necessary; if one of the required skill did not reach automaticity (for example, the student writes slowly), then student is unable to perform a timed test at a fluent level.

1.5 Mastery of Mathematical operations

The level of automaticity or fluency for mathematical operations is relevant for students who need to memorise basic number combinations. These include single-digit addition items (a basic combination; e.g. $9 + 3 = 12$) and related subtraction items (a family of related combinations; e.g. $12 - 9 = 3$). "Automaticity is the basis for the development of children's thinking from one Piagetian stage to the next through the freeing up of working memory for more complex tasks as schemes are automatised" (Engelmann & Carnine, 1991, p. 98). This automaticity or fluency is important for students in order to achieve more complex academic tasks.

According to Baroody et al. (2009) children memorise basic number facts combinations in progression. In Phase 1 (the counting strategies phase), students determine the answer by using objects or verbal counting. In Phase 2 (the reasoning strategies phase), students determine the answer to an unfamiliar combination by

deducing the relationship of familiar known facts. Lastly, in Phase 3 (the mastery phase), students produce an automatic or an unconscious answer from their memory network (Baroody et al., 2009).

How a student progresses to Phase 3 (the mastery phase) can be described from two perspectives. Firstly, the Passive Storage View (mastery with limited fluency) is described as routine expertise, where students master the basic number combinations by rote learning (knowledge retrieval from stored memory and somewhat limited usage). The knowledge is not adaptive or flexible to new tasks but can be applied effectively and aptly to recognisable tasks. With the Passive Storage View, the automatic fact retrieval part of the brain operates separately from the conceptual and procedural knowledge part. Therefore, automaticity of basic number combinations can be accomplished with extensive practice (e.g. a verbal statement, such as “five plus three is eight”, or flash card drills). While Phases 1 and 2 are not crucial for students to achieve the mastery phase (Phase 3), they could be used as opportunities to understand the meaning of basic number facts before mastery (Baroody et al., 2009).

Another perspective is the Active Constructive View (mastery with fluency). This is often called the Number Sense View (Baroody et al., 2009). It is described as adaptive expertise, where in students master basic combinations by understanding the knowledge via rehearsing, organising and elaborating their knowledge or facts into the memory network rather than memorising individual facts by rote. The knowledge can extend to both recognisable tasks, and unfamiliar or unpractised combinations. Phases 1 and 2 are essential for this view to enrich the knowledge in a meaningful way that strengthens the associations between the knowledge and the memory network. The practice of such reasoning and counting strategies will develop into automaticity (Phase 3). For example, if $2 + 2 = 4$ and 3 is 1 more than 2, then the sum of $2 + 3$ must be one more than 4 (Baroody et al., 2009).

1.6 The relationship between academic achievement and self-efficacy

Mathematical learning has been described as a constructivist process through which students develop their cognitive skills by relating the previously acquired knowledge to new learning. Through this learning, students can also develop other skills, such as social interaction and affective development (Montague, 1998).

Students' perceptions are essential to improving their mathematical performance (Bryant & Rivera, 1998; Pantziara & Philippou, 2007). The way students see or view themselves is called "self-efficacy". Self-efficacy is defined as one's belief in one's own ability to successfully achieve a goal or desirable outcome (Bandura, 1993). The belief in one's efficacy can affect all academic achievement, especially mathematics (Metallidou & Vlachou, 2007). Bryant and Rivera (1998) suggested students will make a commitment towards learning when they have confidence and a positive perception of their learning ability. Therefore, a student survey about oneself and learning is one of the most effective mathematics assessment strategies. This can provide valuable insight into students' motivation and confidence levels during their learning (Bryant & Rivera, 1998).

Four factors can affect an individual's level of self-efficacy. The first factor is enactive performance accomplishments; that is, how a person performs on a test. The second factor is vicarious experiences, which refers to how a person observes others and compares their ability to his or her own. As an example, a student sees her classmate succeeding in mathematics; and, as a result, feels that she can succeed, too. Thirdly, verbal persuasion, such as feedback or approval from others, impacts a person's self-efficacy. The final factor is emotional and/or physical arousal, such as a person's reaction to an unfamiliar situation. For example, a person may display physical symptoms, such as feeling nervous during an examination, which could lead to low marks and resulting low levels of self-efficacy (Kitching, Cassidy, Eachus, & Hogg, 2011; Phan, 2012).

Several studies (e.g. Chen, 2003; Friedel, Cortina, Midgley, & Turner, 2010; Kitching et al., 2011; Metallidou & Vlachou, 2007; Norwich, 1987; Pantziara & Philippou, 2007; Ramdass & Zimmerman, 2008; Throndsen, 2011) suggest that students' self-efficacy appears to be an important component in academic learning and development. This research suggests that students with high levels of self-efficacy perform better in comparison to students with low levels of self-efficacy.

Another longitudinal study by Caprara, Vecchione, Alessandri, Gerbino, and Barbaranelli (2011) suggests that academic self-efficacy at a young age could impact on academic achievement at an older age. The 412 in Caprara et al.'s study were aged between 13 and 19 years old. The results show that academic self-efficacy at the age of 16 was affected by an earlier academic self-efficacy at the age of 13. A correlation coefficient suggests a weak positive relationship between self-efficacy and academic

achievement based on participants' junior high school and high school self-efficacy scores. The findings from this study suggest that academic self-efficacy influence students' academic achievement between the age of 13 and 19.

Metallidou and Vlachou (2007) found self-efficacy to be a significant predictive factor for two key curricula; those were mathematical and language performance. Their participants consisted of 263 Greek students between 11 and 12 years of age. The results showed a weak correlation between self-efficacy and language performance. Likewise, self-efficacy also showed a moderate positive correlation with mathematics performance. This study indicated that self-efficacy influences students' academic performance, particularly more in mathematics performance than in language performance.

A longitudinal study by Phan (2012) suggests that some factors can affect an individual's level of mathematical self-efficacy. The study participants were 252 Australian students, equivalent to New Zealand year 7 and 8, over a one-year period. A correlation coefficient was computed to assess the relationship between students' mathematical self-efficacy and the four factors of self-efficacy (including enactive performance accomplishment, vicarious experience, verbal persuasion, and emotional/or physical arousal). The results suggest that, at the beginning of the year, students' mathematical self-efficacy was strongly positive with emotional/or physical arousal and a weak positive relationship with enactive performance accomplishment. By the end of the year, students' mathematical self-efficacy indicated a weak positive relationship with verbal persuasion and a moderately negative relationship with emotional/or physical arousal. This finding suggests that the three self-efficacy factors do affect a person's self-efficacy in mathematics, but verbal persuasion did not make any difference.

However, self-efficacy does not always play a predictive role when it comes to cultural differences. According to a cross-cultural study by Lee (2009) an investigations of students in 41 countries found that maths self-efficacy is different in Western European and Asian students. Findings from Korea, Japan, and Thailand found students to have low maths self-efficacy in spite of their high levels of maths performance. In contrast, in Western European countries, such as Finland, the Netherlands, Austria, Germany, Liechtenstein, Sweden, and Switzerland, a positive correlation between maths self-efficacy and mathematics performance was shown.

In an era of new technologies, there are many new teaching strategies that help to develop students' learning in mathematics, such as video self-modelling via iPads, other type of iPad software, and/or computer assisted games. Handheld technologies have become more popular in educational settings as teachers have been using iPods and iPads to increase students' attention and learning (Carr, 2012). These computer-based technologies have also been found to improve students' self-efficacy and learning (Habgood & Ainsworth, 2011; Sedig, 2008).

1.7 The effectiveness of feedback on students' mathematical performance and self-efficacy

Feedback provides information and direction to learners, assisting them to improve their performance (Hattie, 1999). Winne and Butler (as cited in Hattie & Timperley, 2007) noted that information from feedback had a positive outcome on learners' performance, which allows them to gain more understanding about knowledge and/or build upon learned skills. Hattie and Timperley (2007) suggested that feedback can reinforce learners' engagement in tasks and learning. They suggest the most effective form of feedback can be found in video, audio, or computer-assisted instruction, and/or related to goals (for example, video self-modelling and iPad app). These forms of feedback are reinforcers that will affect the level of students' performance and attitude. Agents such as teachers, parents, learners' experiences, and educational software can provide feedback on an individual's performance. This feedback should be meaningful, clear, detailed, and provide a logical connection with the learners' previous knowledge in order to improve their performance and increase their self-efficacy (Hattie, 1999; Hattie & Timperley, 2007). Learners' commitment to completing a task can be influenced by other factors, such as their role models or intrinsic motivation. Earley and Kanfer (as cited in Hattie & Timperley, 2007) defined video modelling as an effective intervention to improve the learners' performance. The study also suggested that students who observed a video recording of high-performing students completing a task had a higher commitment (endurance) level than those who observed low-performing students completing a task (Hattie & Timperley, 2007). Some reviews suggested that video self-modelling could increase levels of performance and self-efficacy (Dowrick, 1999;

Dowrick; 2012; Elain, Utah, Kehle, Jensen, & Beck, 1992; Hitchcock, et al., 2003; Kehle, Bray, Margiano, Theodore, & Zhou, 2002).

According to Hattie and Timperley (2007) there are four levels of feedback: feedback about the task (whether the work is correct or incorrect), feedback about the processing of the task (giving advice about how to process or complete the task/work), feedback about self-regulation (promoting confidence to engage in the task in the future, thereby influencing the learner's self-efficacy); and, lastly, feedback about the self as a person (direct feedback to the learner, such as, "well done!").

Software that gives immediate and direct feedback to learners would allow them to attain automaticity or fluency levels faster. However, immediate and direct feedback can be most effective when the task is easy, such as basic number facts. According to Hattie and Timperley (2007) whether the feedback is effective or not also relies on the learner's endurance and retention in learning and responding to the feedback.

1.8 Psychometric instrumental: Pattern of Adaptive Learning Scales (PALS)

A number of studies have utilised psychometric instruments to measure whether self-efficacy plays a significant role in mathematics achievement (Bong; 2008, Friedel Cortina, Midgley, & Turner ; 2010; Usher & Pajares; 2008). Bandura (2006) suggests that scales should include (1) content validity (the items should accurately reproduce the concept), (2) face validity (measure what they propose to measure), (3) reliability (are effective and reliable), (4) discriminate and predictive validity (can predict future performance in certain participants), and (5) construct validation (both the nominee items and concepts are valid and measure what needs to be measured).

An example of a well-documented rating scale is the Pattern of Adaptive Learning Scales (PALS): a psychometric instrument to measure self-efficacy and learning in mathematics. PALS was developed in the early 1990s by a group of researchers and was based on goal orientation theory, to examine the relationship between the learning environment and students' motivation and behaviour (Midgley et al., 2000). In 1997, the researcher team improved some scales and labelled them "Revised", as they believes the revised scales are more suitable for the PALS concept.

M. Middleton stated that PALS has been available for more than twenty years free of charge to all researchers (personal communication, September 9, 2014).

PALS has been refined and improved throughout the past decade. To test its validity, it was used in a longitudinal study that followed students from grades five to nine (Year 6 to Year 10 in New Zealand equivalents) to investigate the values of validity and reliability of PALS (Anderman, Urdan, & Roeser, 2003). The statistical evidence of Cronbach's alpha was used to provide a measure of PALS' internal consistency under the three subcategories (task goal orientation, performance approach-goal orientation and performance-avoid goal orientation) and the analysis showed that PALS has a strong internal consistency, indicating that the instrument is a reliable psychometric test (Anderman et al., 2003; Pantziara & Philippou, 2007).

Ross, Shannon, Salisbury-Glennon, and Guarino (2002) demonstrated that PALS is an appropriate instrument for measuring learning progress in young students from Year 4 (New Zealand's Equivalent) through intermediate school and university. PALS results (under the subcategories of task goal orientation, performance-approach goal orientation and performance-avoid goal orientation) demonstrate a strong reliability and a strong validity (Anderman et al., 2003; Pantziara & Philippou, 2007; Ross et al., 2002).

The revised PALS revised scale was used in studies to measure the relationship between a student's self-efficacy and mathematics (Bong, 2008; Friedel et al., 2010). Bong (2008) used PALS to measure the relationship of 753 Korean high school students' mathematical performance using the "revised personal achievement goal orientation" subscales from PALS (mastery goal, performance-approach goal and performance-avoid goal items). The "zero-order correlation coefficients" among the observed variables indicated that academic self-efficacy (six items from the self-efficacy subscale of the Motivated Strategies for Learning Questionnaire) positively correlated to PALS items: mastery goal, performance-approach goal, and performance-avoid goal items (Bong, 2008). The study suggested the strong reliability of the PALS "revised personal achievement goal orientations" subscale.

PALS was also used in a study by Friedel et al. (2010) to validate the reliability for "academic efficacy", "mastery goal orientation", and "performance-approach goal orientation" subscales. The Cronbach's alpha was assessed with the "academic self-efficacy", "mastery goal orientation", and "performance approach

goal” subscales. The results indicate that PALS under these three subscales is reliable to use as a psychometric test.

In summary, self-efficacy, according to social cognitive theorists has been shown to have an effect on students’ learning performance. The PALS instrument measures the level of self-efficacy and appears suitable for all age groups.

1.9 Computer-assisted educational software

In an era of computer-based technologies, touch-screen apps are now ubiquitous in educational settings; for example an Apple’s iPad technology (iPad2). Dewey (1938)’s education-based experience theory suggested that fluency of learner skills can be promoted by immediate feedback and enjoyment of experiences. Computer-assisted educational software instruction appears to provide intrinsically motivating conditions, which encourage students to perform tasks when they receive no apparent reward except the completion of the activity itself (Habgood & Ainsworth, 2011). For example, the motivation features in many type of computer-assisted educational software (e.g. animation, and figures), which in turn produce positive attitudes in learners and improve their learning (Leh & Jitendra, 2012). Computer educational software has been shown to be an innovative tool for self-study as it appears to be an enjoyable and motivational way of learning with parents and teachers able to observe students’ learning progress. For example, computer software may display learning progress via a graph or table immediately after students have completed a task. Furthermore, computer educational software is adaptive to each individual’s level and rate of performance; it provides instant and continuous feedback during the activities (Mevarech & Rich, 1985; Wang et al., 2010).

According to Wang et al. (2010) computer educational software is adjustable to all learning styles and, as a result, the use of computer software can lead to higher test scores, particularly in mathematics, and help students become more familiar with computer interactions (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991; Wang et al., 2010). Alternatively, the combining of computer-assisted educational software with physically manipulative material (physical objects that students can grasp with their hands) would allow students to obtain a greater complexity skill and rational thinking than students who only use physically manipulative material (Fisch et al., 2011; Sarama & Clements, 2009). Because

educational software provides both knowledge and concreteness (sense of touch) to learners, this could facilitate their performance.

A Canadian study by Sedig (2008) suggests that lower mathematics performance is caused by one of the four factors that affect self-efficacy, termed enactive performance accomplishment. Sedig (2008) introduced computer software called Super Tangrams (ST) as an enjoyable and motivating tool to 59 Grade 6 students (Year 7 in New Zealand) who were learning geometry. Participants were assigned into three groups. The first group was comprised of 29 students who received assistance while the software was running. The second group (n=15) did not receive assistance while the software was running. The third group (n=15) did not receive assistance and had no music or sound effects playing while ST was running. The pre and post-test results indicated that ST increased student learning as the performance of the three groups increased significantly from pre-test to post-test. The mean percentages of the test scores increased from 21.8 to 75.6 (G1), 25 to 76.1 (G2), and 37.1 to 74.9 (G3). All groups were asked to rate whether ST motivate them to continue working on the exercise, with five being the highest degree of motivation. The mean motivation indices were 4.6 (G1), 4.3 (G2) and 4.2 (G3). This study suggests that computer-assisted educational software combined with music and assistance from adults would motivate and improve students' learning. In this between-groups design study, the participants worked in pairs and shared one computer (2:1). The results could have been different if the participants were working with the software on their own.

Schoppek and Tulis (2010) suggested that immediate feedback from computer software has more potential to promote students' learning of mathematics skills in comparison with regular classroom instruction. The mathematics computer software Merlin's Math Mill (MMM) provides students with feedback as they use the application. A study was conducted in Germany in which MMM was introduced to 36 third grade students (New Zealand's equivalent of Year 4) who volunteered to participate in the study. The computer software group did not attend a regular mathematics class and the results were compared to 58 grade three students who received no intervention and attended a regular mathematics class.

Schoppek and Tulis' results showed that the computer software group increased their maths performance, with the mean percentage from a pre-test level of 55.4% moving to 65.1% (post-test). Schoppek and Tulis (2010) found that MMM

gives immediate feedback to students, which can enhance the learning performance of young students more than a regular classroom can because teachers cannot give immediate feedback to all student answers in every instance. However, two months after the post-test, the control group had improved their performance with the mean percentage moving from 49.2% post-test to 53.1%, whereas the computer software group dropped from 65.1% post-test to 58.8%. This could be a result of using MMM as a complete replacement for regular classroom instruction.

Habgood and Ainsworth (2011) suggested that educational software could provide intrinsic motivation (providing both enjoyment and feedback); which in turn would facilitate learners' mathematical performance. They used Zombie Division software to determine whether the application could improve students' mathematics performance and motivation. The participants in this study were 58 English students aged 7 to 8 years who were randomly assigned to one of three groups: intrinsic software version (via in-game action), extrinsic software version (end-of-level quiz), and a control group. An ANOVA was run to find out the main effect and interaction between the three groups. The results suggested that all three groups showed an improvement in the post-test; but 16 days afterwards (delayed test); only the intrinsic software group had improved on their performance. Also, the extrinsic group and control group made no further improvement. The post-hoc analysis was assessed to explore the differences between the three groups. The results suggested that the intrinsic software version group scored significantly higher than the other groups. The result from an ANOVA analysis also suggested that the control group took a longer time to answer each question than the intrinsic and extrinsic software groups. However, students who took a longer time to answer questions were more accurate than the faster students. This study suggested that students who practised mathematics with the Zombie Division software were found to improve their skills more than the control group based on results from timed computer-based multiple choice questions. As for the study, they used computer-based tests in order to run the multiple-choice test with four options in each problem for all participants. Assuming that the study uses a pen and paper test, it may reduce the chance of students randomly selecting the correct answer.

Leh and Jitendra (2012) suggested that agents, such as teacher or computer-assisted educational games are both comparable in terms of providing students with instruction and feedback, as well as increasing the level of students' performance in

mathematics and maintaining positive attitudes. The participants in this study comprised 25 third-grade students (Year 4 in New Zealand) from the United States, who scored at or below 50th percentile on the Total Mathematics of the Stanford-10 Achievement Test-Tenth Edition . The participants were randomly assigned into either computer-mediated instruction (CMI, n=13) or teacher-mediated instruction (TMI, n=12) group. Both groups held the same characteristics of intervention conditions (instructional elements), with an exception of one element (personalisation of word problems). For the CMI group, —software called Go Solve Word Problems was programmed to customise word problems to motivate student learning. Furthermore, this study also assessed students' attitudes and teachers' perceptions toward to effectiveness of CMI and TMI. Using ANCOVA, the results suggested that both ICM and TMI showed a non-significant difference on students' performance level, both on the post-test and 4-weeks after the post-test, as well as on students' attitudes. This indicates that the students' performance and attitude from both groups (ICM and TMI) made no further improvement after the intervention. It is worth noting that although, both CMI and TMI were comparable, the teachers preferred to apply TMI as their teaching strategy primarily for two reasons; they were not confident with their skills in using CMI, and CMI is not intuitive; therefore it consumes excessive time and resources to use as a teaching tool. In addition, the two primary reasons that discouraged the teachers from using computer-mediated instruction were also confirmed by an earlier study Forgasz (2006) which will be discussed in a later section (The accessibility of technology and its relationship to learning performance). This study suggested that computer or teacher agents (CMI or TMI, respectively) were equally effective on students' performance and were both feasible to apply in schools. However, the risk of transferring instruction from TMI to CMI was inconsistent, as the researchers reduced TMI curriculum from 21 to 15 sessions and the study couldn't guarantee that teachers can be consistent while instructing the students.

1.10 Learning through an iPad (a new tool for teaching in a school setting)

Today, handheld technologies are more ubiquitous in Western society, and they can be applied in the classroom. These technologies, including mobile phones, iPods, and iPads, provide new opportunities to give students a tactile experience. Most students have become familiar with these technologies in recent years, therefore, these handheld devices could be viewed as new learning tools in school settings. “With interactive ways to learn numbers, master multiplication, solve algebraic equations, conquer statistics and more, these apps for all ages make maths more engaging, interactive and fun” (Apple in Education, 2013, para. 2).

Carr (2012) and Wang et al. (2010) have noted the positive relationship between these tools and students’ learning and mathematical achievements. The iPad offers multiple sensory feedbacks, such as auditory, visual and tactile. In addition, iPads have become more popular in schools, particularly for mathematics because they are easy to use and adaptive to all types of users. They are lightweight and could be used as a substitute for heavy textbooks. Furthermore, iPads are Internet accessible, which allows students to use Web-based searching and educational game-based applications (Carr, 2012). An individual learning style via an iPad app has been found to improve students’ mathematical performance in comparison to students who use only textbooks (Carr, 2012). Perhaps the value lies in its ability to provide immediate feedback.

The iPad is adjustable to different teaching tools, such as video self-modelling or using an application to improve a student’s mathematical performance and attitude. New technologies not only motivate students’ enjoyment level, but also improve their performance skills (Wang et al., 2010).

A recent study by Carr (2012) suggested that iPad use as a 1:1 practice for mathematics was not significantly different in comparison with students who did not practise with iPads. The study participants were 104 American fifth grade students (Year 6 in New Zealand) and two teachers. The students were randomly assigned into either the iPad group or control group. The results suggested that there was not enough evidence to assume differences between the control and the iPad group, as the mean percentage difference between the two groups was 0.07%. The lack of

significant findings from this study could be explained by some variances during the implementation of the study: the duration of the study was less than one academic term (32 days), and the students from the experimental group did not always use the iPad during mathematics lessons and they were not able to take the iPad with them outside math class.

1.11 The accessibility of technology and its relationship to learning performance

The use of and access to technology at home can influence a student's academic achievement. The availability of a computer is also associated with increased maths performance in young students for both English language learner students (ELL) and native English speakers (Espinosa, Laffey, Whittaker, & Sheng, 2006).

A longitudinal study by Kim and Chang (2010) suggested that the mathematics performance of ELL and native English speakers was different due to students' use of and access to computers. Their study used a US nationwide longitudinal dataset, the Early Childhood Longitudinal Survey Kindergarten Cohort (ECLS-K) from kindergarten through to fifth grade (Year 1 through Year 6 in New Zealand). A total of 1,277 schools participated in the data collection. The data was taken from four cohort groups during spring intake; namely: kindergarten (1998), first grade (1999), third grade (2001), and fifth grade (2003). Their study adopted two-level longitudinal hierarchical linear modelling (HLM) in order to analyse the longitudinal effects of the three computer variables on the mathematic achievement at each cohort groups. Their longitudinal (HLM) analysis suggested that the frequency of use of a home computer had a positive and significant impact on improving mathematical performance for English native speakers but not for ELLs. Computer use for various purposes (for example, using Microsoft Word and Excel) had a positive and significant impact on improving mathematical performance for English native speakers and ELLs. However, the ELL group improved their mathematics performance when mathematics software was used at school, whereas English native speakers decreased their performance over time (Kim & Change, 2010). The study suggests that native English speakers could benefit from home computer access and

computer use for various purposes to improve their mathematical performance. Computer use for mathematics at school was found to increase the mathematic achievement more for the ELL group than for the native English group, which in turn could help reduce the gap in maths achievement between them. The results from this study were based on a dataset from ECLS-K and the researchers adopted a two-level longitudinal hierarchical linear model to predict the longitudinal outcome of the dataset. This study provided a statistical analysis as a possibility prediction; the results would be different if the actual data were collected.

Forgasz (2006) suggested the factors that encouraged and discouraged the use of computers as a cooperative learning tool in the classroom. In a study conducted in 2001 and again in 2003, the participants consisted of 96 mathematics secondary school teachers (grades 7 to 10, equivalent to Year 9 to 12 in New Zealand) who taught across three different schools in Victoria, Australia. In 2001 and 2003, the top three factors ranked from among 15 response categories that encouraged and discouraged the teachers to use computers as a teaching tool and are showed in Table 1 and Table 2 respectively.

Table 1
Top 3 factors encouraging teachers to use computer as a cooperative teaching tool in the classroom

Factors	2001		2003	
	Rank	Percentage	Rank	Percentage
Software: quality, variety, motivation, fun, relevance	1	41%	3	29%
Availability of computers and/or computer laboratories	2	37%	2	40%
Teachers' confidence, skills, experience, enjoyment	3	24%	1	37%

Table 2
Top 3 factors discouraging teachers to use computer as a cooperative teaching tool in the classroom

Factors	2001		2003	
	Rank	Percentage	Rank	Percentage
Access to computers and/or computer laboratories	1	60%	1	67%
Need professional development and time for professional development	2	31%	2	22%
Technical problems, lack of technical support, old equipment	2	31%		
Time: students to cover syllabus, acquire basic skills, set up computers; teachers to prepare lessons			2	22%

Table 1 showed the top three factors that encouraged teachers to use computers as a teaching tool. Out of 15 encouraging factors, teachers rated the availability of a computer factor as the second most important issue that encouraged them to use computers as teaching tools in 2001 and again in 2003.

Meanwhile, Table 2 disclosed the top three factors that discouraged teachers from using computers as a teaching tool. Out of the 11 discouraging factors, the access to computers and/or computer laboratories was ranked as number one in both 2001 and 2003. This study highlights that the access to computers was the only factor which both encouraged and discouraged teachers from using computers as a teaching tool. This could be explained by the survey questionnaire that was developed and used in Forgasz (2006)'s study. Another explanation could be the unstable number of teachers participating in the survey questionnaire, entitled "You, Your Students, Mathematics and Computers", which was administered in both 2001 and 2003; of the teachers who took the survey in 2001, 21 teachers failed to retake the encouraging survey questionnaire, and 33 teachers did not retake discouraging survey questionnaire in 2003.

The technology has changed over the years, but the lack of access to computers still limits some schools from using this technology (Forgasz, 2006). Kim and Chang (2010) pointed out that the accessibility of computers and technology alone could not positively improve a learner's mathematical performance. The use of or access to a computer should be guided or supervised by an adult in order to gain a positive learning outcome for students. iPad software on the one hand can provide

immediate feedback that can improve students' learning performance and; on the other hand it can be easily supervised by teachers or adults who can give students instructions.

1.12 Video self-modelling (VSM)

Dewey (1938) states that an educational system is more effective if the education relates to the person's development and experience, which then would lead to growth of the learner. The use of video self-modelling (VSM) as a teaching tool could be beneficial for students who want to improve their basic mathematical skills. Video self-modelling refers to behavioural change that can be derived from observing oneself on a video that portrays only desired targeted behaviours (Dowrick, 1999). Some studies have found that observing one's own image can increase self-efficacy (Dowrick, 1999; Dowrick, 2012; Hitchcock et al., 2003; Kehle et al., 2002; Schunk & Hanson, 1989). Video self-modelling provides a clear picture of the best performance practices to use and it also acts as a powerful and culturally adaptive model. It can be used with participants from any background. Furthermore, because the students are watching themselves demonstrating the tasks, they are more likely to concentrate and pay attention to the task, thus modelling it themselves (Hitchcock et al., 2004).

There are two forms of video self-modelling: positive self-review and feed forward (Dowrick, 1999; Dowrick, 2012). Positive self-review refers to the reconstruction of a desired performance in order to strengthen the viewers' performance by selecting the best performance from the viewers' past behaviour or response. For example, an athlete's best running time is 10 seconds per 100 metres, but her average running time per 100 metres is 15 seconds. Self-review can help improve her performance when she reviews the video in which she did her best (Dowrick, 1999; Dowrick, 2012). Feedforward generally involves some video editing in order to show the viewer an appropriate performance if the target behaviours or skills were not accomplished in the past or were not yet acquired. It constructs unachieved performances from the past and shows the viewer how they can perform the task in the future. The VSM is like "the Lego of learning" because VSM is bringing the pieces of the previous behaviours together to create the future learning event (P. W. Dowrick, personal communication, September 3, 2014). The feedforward form of video self-modelling is the most common, and is used in

education and therapy, especially for children with disabilities (Dowrick, 1999; Dowrick, 2012; Hitchcock et al., 2003; Hitchcock et al., 2004; Hitchcock, Prater, Carter, & Dowrick, 2012; Elaine et al., 2002).

Video self-modelling has been shown to be an effective and rapid intervention in many ways by addressing language acquisition, academic learning, behaviour disorders and learning disabilities (Hitchcock et al., 2003; Hitchcock et al., 2012). VSM is mostly effective with students who have typically experienced problems or doubt their ability to perform a task because VSM helps build students' self-efficacy and motivation (Schunck & Hanson 1989).

A single-subject changing conditions (A-B-BC) study designed by Blood and Johnson (2011) found that video self-monitoring via iPod touch immediately decreased the disruptive behaviour of a Russian 10-year-old student in a Grade 5 classroom (Year 6 in New Zealand). The conditions included baseline (A), video modelling (B), and video modelling plus self-monitoring (C). The results indicated that the student's mean percentage of engagement in disruptive behaviour was 40% during baseline, 11% with video self-modelling, and 0% with video self-modelling and self-monitoring (Blood & Johnson, 2011). This study showed that the video self-modelling strategy can be successfully used with an iPod. However, the study was a single case design with only one participant, so it cannot be generalised to the classroom.

Schunck and Hanson (1989) conducted an experiment to investigate the effectiveness of video self-modelling on learning maths fractions and participants self-efficacy. A self-efficacy test was used to determine how students perceive their ability to solve mathematics problems correctly. Responses ranged from 10 (not sure) to 100 (really sure). The participants comprised 48 primary school students in California aged between 9 and 12 years, who were split into groups of 12 in either: a peer-modelling group (observing peers perform task on video), a self-modelling group (observing oneself performing the task on video), a peer and self-modelling group, and a control group.

During the study, the groups were tested twice (pre and post-test) on fraction skills. The results suggest that the peer-modelling groups' mean self-efficacy on a 1 to 100 rating scale increased from 52 to 85.2; the self-modelling group rose from 52.2 to 87.7; the peer and self-modelling group increased from 46.8 to 86.2; and the control group grew slightly from 51.2 to 66.7. The mean performance was significantly

improved for the experimental groups (the peer-modelling group increased by 8.7, the self-modelling group by 9.5, the peer and self-modelling group by 9.4). The control group's mean performance increased slightly by 3.7. The results from a correlation analysis suggested that the experimental groups showed significantly higher outcomes on both performance and self-efficacy compared with the control group. The finding from this study was promising, but the study was conducted more than two decades ago and a correlation analysis table was not included. Developing some newer methodologies based from this study and applying it to present populations would help strengthen this research.

A recent study by Burton, Anderson, Prater, and Dyches (2013) found that video self-modelling using an iPad is capable of teaching new mathematical skills to adolescents with autism and intellectual disabilities. The experimental design was a multiple-baseline study across four participants whose ages ranged from 13 to 15 years and a fading procedure (by decreasing the number of video viewings when attending each session) was also introduced to all participants. There were six phases each of which reduced the number of video models provided to the students. The students' baseline scores ranged from 0 to 30% on the skills assessment, and three weeks after the intervention, the average score of all four participants was nearly 70% on the test. Video self-modelling intervention showed a promising result, as it improved the maths skills of adolescents with autism and intellectual disability. However, the effectiveness of this intervention could have been influenced by the researcher because the researcher was also the teacher.

Video self-modelling, and computer software or iPad apps appear to increase the level of mathematical skills by giving students increased motivation to learn, thereby improving their levels of self-efficacy (Habgood & Ainsworth, 2011; Hitchcock et al., 2003; Hitchcock et al., 2004; Kehel et al., 2002; Mevarech & Rich, 1985; Sedig, 2008; Wang et al., 2010).

Mathematical ability is associated with critical logical, strategic and creative thought, and as a result it is important for students to understand its concepts in order to maintain lasting positive outcomes. Mastery with a level of fluency in mathematics is not easy—it requires students' understanding of concepts and the ability to perform at an acceptable level. Mastery of mathematics with a level of fluency will benefit the students' later mathematical skills. (Baroody et al., 2009; Carr, 2012; Dougherty &

Johnston, 1996; Kroesbergen & Van Luit, 2003; Kubina & Morrison, 2000; Stein et al., 1997).

New Zealand Mathematics (2014) proposed in the Number Framework curriculum that by the end of their first three years of school, students should “know and be able to do” the three operational domains (addition and subtraction, multiplication and division, and proportion and ratios). It is also compulsory to support and maintain students’ learning development and positive attitude toward mathematics, especially for students who fail to meet the mathematical standard. According to Dewey’s theory, which applies experience and education (1938), curriculum is effective when it is based on the students’ interests and involves them in an active learning environment. As a result, active interaction from students would improve their learning, performance and attitude.

The connection between levels of self-efficacy and mathematics has become an interesting area for education and psychological studies. The interventions, which adapt to the needs of students in learning environments, such as video self-modelling and computer/iPad apps, appear to promote rapid and effective learning for students with mathematics difficulties (Habgood & Ainsworth, 2011; Hitchcock et al., 2003; Hitchcock et al., 2004; Kehle et al., 2002; Mevarech & Rich, 2001; Sedig, 2008; Wang et al., 2010). Perhaps these interventions provide an effective form of feedback that could be found in the form of video, audio, or computer-assisted instruction (Hattie & Timperley, 2007). In order to measure the relationship between a student’s self-efficacy and mathematics skills, the Pattern of Adaptive Learning Scales (PALS) was used in the studies to test the values of validity and reliability (Anderman et al., 2003; Bong, 2008; Friedel et al., 2010). It appears that PALS is an appropriate instrument to measure the relationship between self-efficacy and mathematics skills in different age groups.

Based on previously discussed research, computer-assisted educational software and video self-modelling have been found to be effective at fostering mathematics development. Both of these strategies have one common advantage: they can be used with participants from any background (adjustable to an individual’s level of learning and rate of performance, and can be used via handheld technologies). VSM is adequate for anyone with any cultural background (Schunck & Hanson, 1989; Hitchcock et al., 2003).

On one hand, computer-assisted educational software can provide immediate feedback and intrinsic motivation, which can increase the performance of students and their self-efficacy (Mevarech & Rich, 1985; Schoppek & Tulis, 2010; Sedig, 2008; Wang et al., 2010). On the other hand, video self-modelling portrays only the desired targeted performances of the student, which increase the student's level of self-efficacy and performance. In studies students paid more attention when they viewed themselves performing a task successfully. By observing their own image, the students' level of self-efficacy and performance increased (Dowrick, 1999; Dowrick, 2012; Hitchcock et al., 2003; Kehle et al., 2002; Schuck & Hanson, 1989).

Carr (2012) suggested that iPad apps are adjustable to all types of users (same as video self-modelling and computer-assisted educational software), and also offer multiple sensory feedback (such as, audio, video and tactile). Dewey's theory (as cited in Carr, 2012) and suggested that there could be a positive learning relationship between iPad apps and students' mathematical achievement. However, his study did not support his expectations.

A review of the literature (using PsycINFO between October 19, 2013 and July 14, 2014) did not reveal studies that compared the effectiveness of teaching tools between video self-modelling and iPad apps, yet they both shared similar characteristics (adjustable for all individuals' level of learning and rate of performance, and able to use via handheld technologies).

The purpose of this study is to ascertain whether an iPad app or VSM is a more effective teaching tool in which to teach Year 5 students as observed by their basic maths facts test scores in accuracy, and fluency both in addition and multiplication. Furthermore, to investigate the relationship between the intervention group's basic maths facts test scored throughout the 6-week study and their levels of self-efficacy (PALS) test, the key questions asked were:

- a) Will the intervention groups (both Group A and Group B) show more improvement of their basic number facts knowledge than the whole class?
- b) Is VSM or the iPad app a more effective teaching tool to increase the basic number facts skills for the intervention group?
- c) Will the levels of self-efficacy from the intervention group changes after the VSM and the iPad app have been introduced?

Chapter 2: Methods

This chapter describes the selection of participants, ethical considerations and the procedures used to gather the results.

2.1 Experimental design

Single case research designs, which use small groups of subjects or single subjects in fields such as education, psychology, and clinical psychology, have had a long history of effective use (Horner, Swaminathan, Sugai, & Smolkowski, 2012; Nock, Michel, & Photos, 2007). The characteristics of single case research designs mostly involve the study of an individual subject (a person, small group, or study of a single unit), with an optional use of a control group (Smith, 2012; Nock et al., 2007).

This study used a single case research A-B-A-C-A design in which A was the baseline (and mid- and post-test) conducted with all of the participants in the study (n= 29), and B and C were interventions with the intervention group. The A-B-A-C-A is a repeated assessment method and it attempts to minimise the interaction from one intervention to another to strengthen the validity of the interventions (Nock et al., 2007; Riley-Tillman & Burns, 2009). This allowed the researcher to observe whether changes in the participants' performance were due to the direct interventions or attribute to the participants themselves. In other words, a single subject research design could demonstrate a clear and causal relationship between an intervention and its individual subjects (Riley-Tillman & Burns, 2009).

2.2 Participants

Seven primary schools in Christchurch were selected on the basis of having at least one class from which possible participants could be drawn. Each school was initially approached through email and asked to respond if it was interested in participating in the research. One school (decile rate nine) invited the researcher to elaborate on the project and agreed to participate; permissions were gained from the school's Board of Trustees, the principal, the teacher, the students and their parents or guardians to be involved in the study. According to Education Review Office (2012) the decile rate is a system for school funding, that is distributed by The Ministry of Education. Schools with a low decile rate will receive more funding than higher decile rate schools.

2.2.1 Recruitment of participants

Selection of students. The school principal selected the Year 5 class that would participate and its teacher agreed to be involved in the study. The Test was administered to all of the students in the class with the teacher's assistance. The Test included of 303 basic number facts, covering examples of addition, subtraction, multiplication and division. It consisted of a five-minute test consisting of addition, subtraction, multiplication and division; a one-minute test of addition, and a one-minute test of multiplication. The eight students who scored the lowest marks were asked to participate in the project after consultation with the teacher.

Whole class. A Year 5 class consisting of 29 students (20 males and 9 females) participated in this study. After consultation with the teacher, eight students whose scores fell below the 25th percentile in the pre-test phase were asked to participate in the intervention group. Five students were excluded from the study because they were absent for one or more of the tests. Additionally, one student did not provide the parental permission form to participate in the study as was also excluded.

Intervention group. The eight selected participants were randomly assigned into two groups (A and B). Group A and B each included three males and one female. Group A's first intervention phase was VSM, followed by the iPad app, whereas Group B began their first intervention phase with the iPad app then VSM was their second intervention phase. The participants completed session probes at the end of each session. Seven of the participants were 10 year olds and one student was 9 years old. Only two of the students attended all 12 sessions. The other students were absent for one or two sessions due to a clash of school activities or being absent from school.

2.3 Ethics Approval

The Educational Human Ethics Committee at the University of Canterbury authorised the ethical release form, information sheet and informed consent permission for the research project (Appendix A). An information sheet was given to all classroom participants and their parents to inform them of the study, its aim and what was expected of them as participants. Informed consent was sought from the students, their parents or caregivers, the school principal, the teacher, and the Board

of Trustees before the study began. A copy of the information sheet and informed consent form can be found in Appendix B. After the consultation with the teacher, an additional information sheet and informed consent form permission for the eight selected students were given to the students and their parents or caregivers (Appendix C) before the intervention sessions began.

2.4 Setting

During the pre-, mid-, and post-tests, the whole class took The Test in their classroom. The teacher was the administrator for both the pre- and post-tests. The mid-test was administered by a relief teacher.

The intervention group was withdrawn from the main classroom during the first period of the school day. These students participated in twelve of 10-minute intervention sessions. Seven sessions were conducted in the library (where another class was working), two sessions were in a meeting room and three sessions were in the music room. The choice of room was dependent on what was available on the days the sessions took place. The researcher controlled the number of the opportunities students had to view or interact with the iPad during the VSM and the iPad app interventions, as all the iPads in this study were taken from the students at the end of every session and were returned at the next session. During the study, the intervention group received the initial feedback on their basic math facts performance, which was initiated from the FFM when the students worked with the iPad app. In addition all participants in the study received feedback on pre-, mid- and post-tests at the end of the study.

2.5 Dependent variable

The dependent variables for the whole class were the participants' scores on The Test, and their scores on addition and multiplication on fluency tests during the pre-, mid- and post-tests.

The dependent variables for the intervention groups (Group A and B) were their scores on The Test, and their scores on addition and multiplication on fluency tests during the pre-, mid- and post-tests, specific level test and session probes.

2.6 Assessment

The researcher used the Math resource Studio software version 5.0.12.12 by Schoolhouse Technologies to compile The Test, and used Probe Generator version 3.0 by Richard Smart to compile all the tests for the intervention group. All the tests used in this study were then printed out for use as a pen and paper test. The purpose of using pen and paper tests was to allow the students to generalise and apply their basic math facts skills during the study into the school setting. For example, they could use their skills during classroom activities, examinations, and tests, which are typically condition as written pen and paper tasks.

The Test. The Test administered to all students in the class ($n=23$) assessed their accuracy and fluency in basic number facts. The same test was used in the mid- and post-test phases. The Test measured students' knowledge of basic number facts, which included five minutes on 103 items made up of addition (32 items), subtraction (20 items), multiplication (36 items), and division (15 items), a minute on fluency in addition problems (100 items) and a minute on fluency in multiplication problems (100 items). A digital timer was used to time all the tests in this study. A copy of The Test can be found in Appendix D.

The specific level test. The intervention group took a specific level test to determine which basic maths items that the students was already component with and to find any errors that they were making. The specific level test assessed addition (20 items), subtraction (20 items), multiplication (40 items) and division (40 items). It had no timed limit, which allowed the researcher to observe the strategies the students employed to solve the problems. Six students were tested only on two operations—multiplication and division—because they were competent in addition and subtraction. The other two students were tested on all four operations, as they needed to improve in all four operations. A copy of specific test can be found in Appendix E.

Session probes. The researcher gave the session probes to all students from intervention group at the end of each session. These tests were individually created for each student, and the items were retrieved from the specific level test reflecting the errors that the students made. The session probes were a pencil and paper tests consisting of 20 basic fact problems with a one-minute time allowance. The session

probes helped the researcher investigate changes in performance during the intervention phases as the test consisted of the same basic fact problems delivered during the intervention sessions via VSM and iPad app. However, the items were presented differently, to prevent the students from memorising the order of the basic number facts equations.

Self-efficacy test for the intervention group. The self-efficacy scales for students, the Pattern of Adaptive Learning Scales (PALS), was developed in the early 1990s based on goal orientation theory and has been available for over twenty years (M. Middleton, personal communication, September 9, 2014). PALS measure the relationship between students' self-efficacy and mathematics performance (Bong, 2008; Friedel et al., 2010). PALS consisted of five student scales and three teacher scales and they have been tested with students and teachers ranging at elementary, intermediate, and high school levels (Midgley, et al. 2003). Previous studies suggest, PALS showed a strong internal consistency and concurrent validity of 0.74 to 0.89 (Anderman, et al., 2003; Pantziara & Philippou, 2007; Midgley, et al. 2003).

The present study, PALS's five subcategories were used to measure the levels of self-efficacy for each participant: "mastery goal orientation revised" (5 items), "performance-approach goal orientation revised" (5 items), "performance-avoid goal orientation revised" (4 items), "academic efficacy" (5 items), and "avoiding novelty" (5 items). These five subcategories reflected this research study's purpose; measuring students' levels of self-efficacy in mathematics. The mastery goal orientation and performance-approach goal orientation subscales assessed students' purposes or goals in an achievement setting to demonstrate their competence in maths skills. The performance-avoid goal orientation helped determine whether students would avoid demonstrating of their incompetence in class. The academic efficacy subscale helped determine students' perceptions towards their class work. Lastly, the avoiding novelty subscale assessed how students responded to unfamiliar or new work.

The present study, took 24 items from PALS. The participants responded all items using the five-point Likert-type scale in PALS (1=not at all, 3=somewhat true, 5=very true). The scale in PALS used an emoticon, which is shown in Appendix F. The researcher compiled all the tests for all participants in this study, including The Test, specific level test, the session probes, and self-efficacy test (PALS) and printed them all out for use as a pen and paper test.

Data verification

The researcher collected The Test from the participants at the end of each test. An undergraduate student marked 20% of the pre-, mid-, and post-tests. Both graders agreed 100% on the marking. The researcher alone marked the specific level test, session probes and self-efficacy tests for the intervention group.

2.7 Apparatus

Video self-modelling. A Flip Ultra camera made by Cisco was mounted on a tripod in order to capture the video and audio of each selected student. The students dictated their 20 targeted number fact sentences as the camera recorded. The video was edited on an Apple MacBook Pro using iMovie 08. The purpose of video editing was to show the viewer's best performance while performing the task (see the later section on how the VSM was compiled). The edited video was transferred back to the iPad through iTunes. The intervention group viewed their video self-modelling vignette twice in each session on the iPad in full screen landscape mode, and listened using earphones.

iPad2 and the iPad2 app. The study used iPad2 running iOS6. The iPad app used was Fast Facts Math (FFM) version 1.1 (StudySmart 2012) downloaded from iTunes. The researcher selected 20 basic number facts to present in the FFM programme. The lists of problems were individually created based on each student's specific level test results before the start of the intervention. The researcher chose three seconds as the time to answer each question.

2.8 Procedures

The Test (pre-test). The Test refers to the pre-test phase because it was introduced for the first time of the study. In the first week of the study, The Test was administered to all students to measure accuracy and fluency in basic facts of addition, subtraction, multiplication and division. The whole class was asked to complete as many basic number fact problems as they could in five minutes, and then completed a one-minute test of fluency in addition problems, and a one-minute test in multiplication problems using a pen and paper. The class teacher said, "Ready, Go!".

Pre-intervention and self-efficacy pre-test. During the second week, the intervention group was trained in using the iPad app and viewing their VSM. After they trained both intervention groups A and B took the PALS test to measure their self-efficacy levels. They took this test three times during the project; before initiated the intervention phases, at the mid-point, and at the end of the intervention phases. The researcher allowed the students to read and rate the PALS on their own and told them they could ask questions if they did not understand. PALS rating took approximately ten minutes.

The intervention group took the specific level test after they completed PALS. The intervention group was told to complete the questions that they knew and skip the ones that they did not. The testing took place in the library whilst a class of Year 1 students was present. The Year 1 students did not interrupt the test, but their voice were audible in the background.

The following day, the researcher individually video recorded Group A's members; as they individually dictated the 20 targeted basic facts for the VSM intervention session. The researcher issued the 20 basic number facts individually to each student. These basic facts consisted of their errors from their specific level test from the previous session.

Compilation of the VSM. The researcher compiled four sets of flash cards, individualised to each student in Group A. Each set of flash cards consisted of 20 basic fact problems with the same number of sentences printed on both sides of the card using Calibri font, and at a size of 92 points. (see Figure 1).

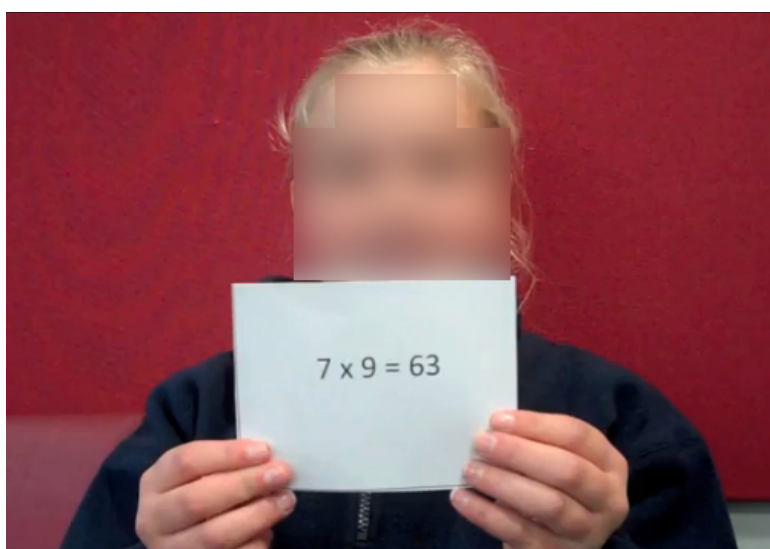


Figure 1: A student holding a flash card in a VSM intervention session.

The students were asked to hold their printed flash card up to the camera and read the problem and answer out loud as quickly as they could, while, the researcher used a Flip Ultra camera to record the students' videos. The researcher then edited the footage to produce a video of about one minute in length, for each student

Administering the iPad app (Fast Fact Math or FFM). Groub B received 20 basic fact problems individually issued based on incorrect answers from the specific level test. The 20 problems were entered into FFM for the students to answer (see Figure 2). The FFM was programmed created by StudySmart to provide feedback about whether the answer was correct or incorrect after of each question. The programme repeated the items until the respondent provided the correct answers (see Figure 3).

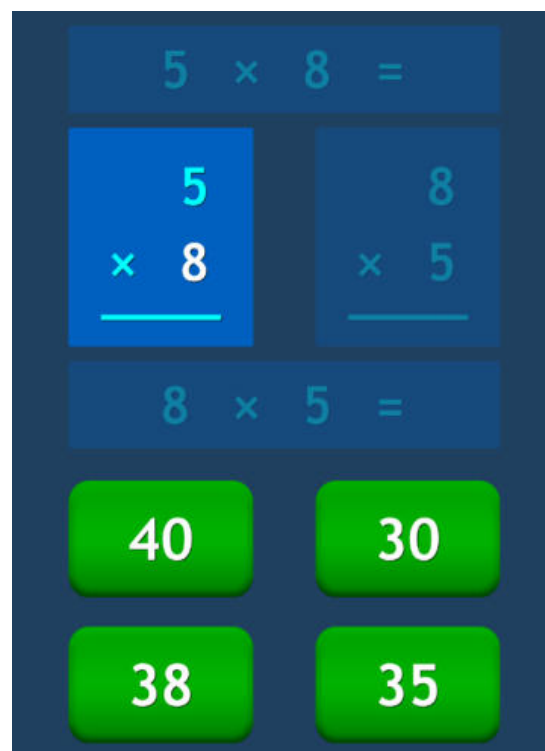


Figure 2: *An example of basic fact problems on the Fast Facts Math iPad app.*



Figure 3: An example of the feedback given by the Fast Facts Math iPad app.

Intervention Phase 1. After the researcher trained the intervention group, including viewing a VSM and using an iPad app, the six intervention sessions were scheduled during the second and the third week of the study. These six intervention sessions were held in the school's library whilst a class of Year 1 student was present because it was the only available room at that time. At the end of each intervention session, the intervention group took the session probes each of one minute duration.

Group A withdrew from the class to take their first VSM intervention session, and was to view the video twice per session. After Group A finished viewing the videos, they took session probes together. Group A then had unstructured time to use the iPads for five minutes, during which the students could download any free iPad app (for example, educational games or online games) before returning to their class. After the unstructured time to use with the iPads, Group A was asked to return to their class.

All members from Group B then came to participate the first iPad app intervention session, after Group A returned to the class. Group B practised basic number facts using FFM on iPads for ten minutes per intervention session, which had 20 questions to be solved in each session. The researcher took screenshots on the app to capture their progress reports at the end of every session. The students waited until

the others finished with the iPad app and then took session probes together. The students in Group B then had their five minutes of unstructured time with iPads before they returned to their class.

The Test (mid-test). On the Wednesday of the fourth week a relief teacher administered the mid-test to the whole class involve in the study. The mid-test contained the same questions as in the pre-test phase. The purpose of this phase was to see if there were any changes in the participants' basic number fact performance after two weeks.

Self-efficacy mid-test. At the end of the fourth week, the intervention group took the self-efficacy test (PALS) to rate their levels of self-efficacy. It took approximately ten minutes to administer the test, which took place in the music room. The intervention group was to return to their class after they completed this test.

Intervention Phase 2. At the beginning of the fifth week, Group A, which had started with VSM as the first intervention phase, switched to the iPad app for the subsequence intervention phase and vice versa for Group B. The researcher then trained the intervention group, on using the iPad app (Group A) and viewing VSM (Group B). The intervention group took session probes at the end of every session. Four sessions were held with the intervention group for four consecutive days (during the fifth week) and two sessions were held at the beginning of the sixth week. The intervention sessions were held in the meeting room (session 1 and 3), library (session 2), and music room (session 4 to session 6).

The Test (post-test). On the Thursday of the sixth week, all participants including the whole class and the intervention group took the post-test. The Test was exactly the same as the pre- and mid-tests.

Self-efficacy post-test. The following day after the post-test, the intervention group rated their levels of self-efficacy using PALS at the library, with no other class present on that day.

2.9 Data Analysis

All the data in this study was analysed using Microsoft Excel 2008 to generate the graphs and to associate data analysis such as, the effect size and average. The size of the effect can measure the differences between the variables; a large effect size indicates a tremendous improvement of the intervention group, in comparison to medium and small effect sizes (Mitchell, 2008). According to Cohen's d effect size, $d=0.2$ represents small effect, medium effect represents $d=0.5$ and $d=0.8$ represent a large effect size (Mitchell, 2008).

Chapter 3: Results

The following chapter reports the results of the intervention group's sessions and presents the average whole class data on The Test during pre-, mid-, and post-test phases. The researcher compared the average scores on The Test from the whole class with those from the intervention groups (Group A and B), including their effect sizes. The intervention groups A's and B's data reported includes The Test, specific level test, number of possible interventions, intervention phases (VSM and the iPad app), The iPad app (FFM) progress report, time spending on the intervention phases (VSM and iPad), session probes, and the self-efficacy test (PALS).

Pre-test	GA VSM	Mid-test	GA iPad	Post-test
	GB iPad		GB VSM	

Table 3 *A Timeline of this study.*

As shown in Table 3, the pre-, mid-, and post-tests were completed by all of the participants in the study. The interventions were carried out with the intervention groups, who were divided into either Group A or Group B and the duration of this study was six weeks.

3.1 Mean correct responses on The Test

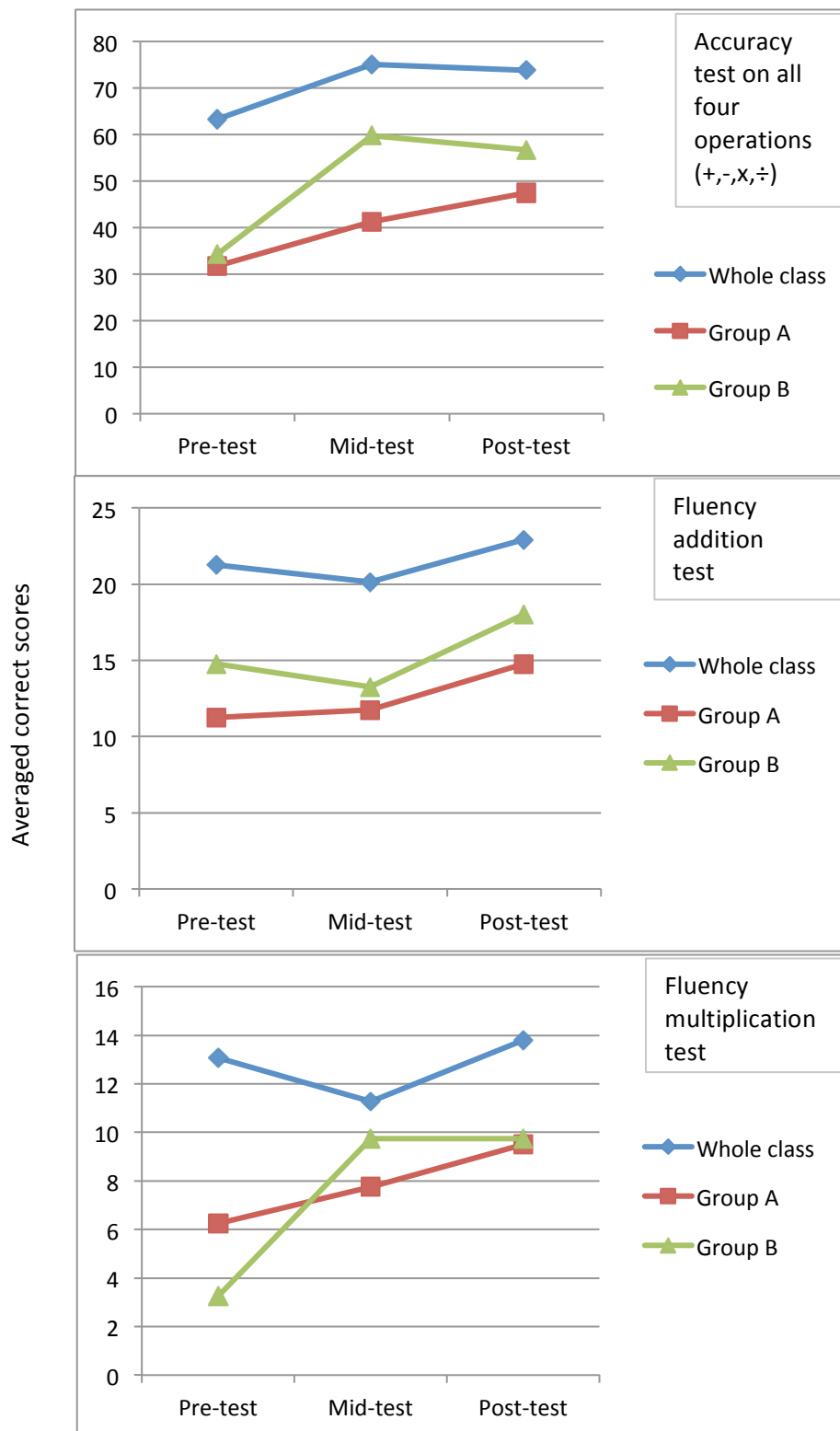


Figure 4: Mean performance scores of the whole class and the intervention group.

Figure 4 shows the whole class group scored higher on all tests than the intervention groups (Group A and B) throughout the study. The whole class improved

their level of fluency in both addition and multiplication on the post-test result. Group A gradually increased their test scores throughout the six-week study. Likewise, Group B mid-test scores on accuracy and multiplication fluency increased but the group made no further improvement on the post-test. The intervention groups' (Group A and B) scores on multiplication fluency were identical (see Figure 4).

No discernible pattern emerged between intervention groups (Group A and B) during the study. However, the intervention group made more progress than the whole class. The effect size of the intervention group was higher than the whole class, and was large for both accuracy and fluency in multiplication ($d= 1.049$ and $d = 1.178$, respectively), and moderate size for fluency on addition ($d=0.595$). By contrast, the whole class's effect size was lower on all tests ($d= 0.651$ on accuracy, $d = 0.294$ on addition fluency, and $d = 0.107$ on multiplication fluency). For explanation, see the Methods chapter.

3.2 Intervention groups' data

3.2.1 The Test

The students took The Test, which included accuracy and fluency in addition, and fluency in multiplication were introduced three times during the study (pre-, mid-, and post-test).

Table 4
*Intervention groups' number of correct responses on The Test
(accuracy over five minutes)*

Intervention group	No. responses		
	Pre-test	Mid-test	Post-test
A			
Jason	0	1	9
Robin	36	55	53
Linda	50	56	59
Brian	41	53	69
B			
Timo	19	53	35
Ray	39	64	63
Alan	43	66	68
Helen	36	56	61

Table 4 shows that more than half of the intervention group increased their scores on the accuracy test throughout the course of the study. The majority of Group A continued to increase their accuracy test scores from the mid-test to the post-test, but only half of Group B increased their accuracy test scores from the mid- to post-test phase. Timo's scores increased on his mid-test and decreased on his post-test (see Table 4).

Table 5
Intervention groups' number of correct responses on The Test (fluency on addition and on multiplication over 1 minute)

Intervention group		No. responses					
		Pre-test		Mid-test		Post-test	
		Addition	Multiplication	Addition	Multiplication	Addition	Multiplication
A	Jason	0	1	0	5	11	9
	Robin	14	7	13	5	15	5
	Linda	17	11	12	9	11	11
	Brian	14	6	23	12	22	13
B	Timo	10	2	8	4	13	4
	Ray	19	0	21	11	24	11
	Alan	13	6	17	18	22	18
	Helen	17	5	7	6	13	6

Table 5 shows that the majority of the intervention group increased their fluency test scores in both addition and multiplication (pre- and post-test). Half of Group A improved on their fluency tests scores throughout the study. Table 5 also shows that Group B's multiplication fluency on both the mid-test and post-test were identical. Additionally, Linda's (Group A) and Helen's (Group B) pre-test fluency scores in both addition and multiplication were higher than their mid- and post-test scores (see Table 5).

3.2.2 Specific level test

Table 6
Intervention groups' rate of correct responses on specific level test

Intervention group	No. responses				Rate per minute
	Addiiton	Subtraction	Multiplication	Division	The four operations
A					
Jason	7	16	21	0	0.863
Robin	20	20	26	14	2.424
Linda	20	20	34	1	2.206
Brian	19	19	34	28	1.961
B					
Timo	19	18	20	0	1.118
Ray	20	19	34	35	2.118
Alan	20	20	24	14	1.696
Helen	20	20	23	0	1.8

Table 6 shows that the intervention group achieved at least a rate of one correct response per minute. Seventy-five percent of Group A achieved a rate of two correct answers per minute on their specific level test. However, Jason had the lowest score and took the longest time among the group, at a rate of less than one correct response per minute (see Table 6). The average rate of correct responses per minute for Group B was one correct response per minute. Table 6 shows that Timo scored the lowest, and took the longest time among the group (at 51 minutes) to complete the specific level test.

3.2.3 Number of possible interventions

Table 7
Intervention groups' number of possible intervention sessions attended

Intervention group	No. sessions	
	VSM	iPad app
A		
Jason	5	6
Robin	6	5
Linda	5	6
Brian	6	5
B		
Timo	6	4
Ray	6	6
Alan	6	6
Helen	5	6

Table 7 shows more than half (75%) of the intervention group missed at least one session, but Timo from Group B missed two sessions. Only two students who attended all 12 intervention sessions during the six-week study (Ray and Alan from Group B) (see Table 7).

3.2.4 Intervention phases (VSM and the iPad app)

The number of correct responses on session probes across the two intervention phases (VSM and the iPad app) during the study.

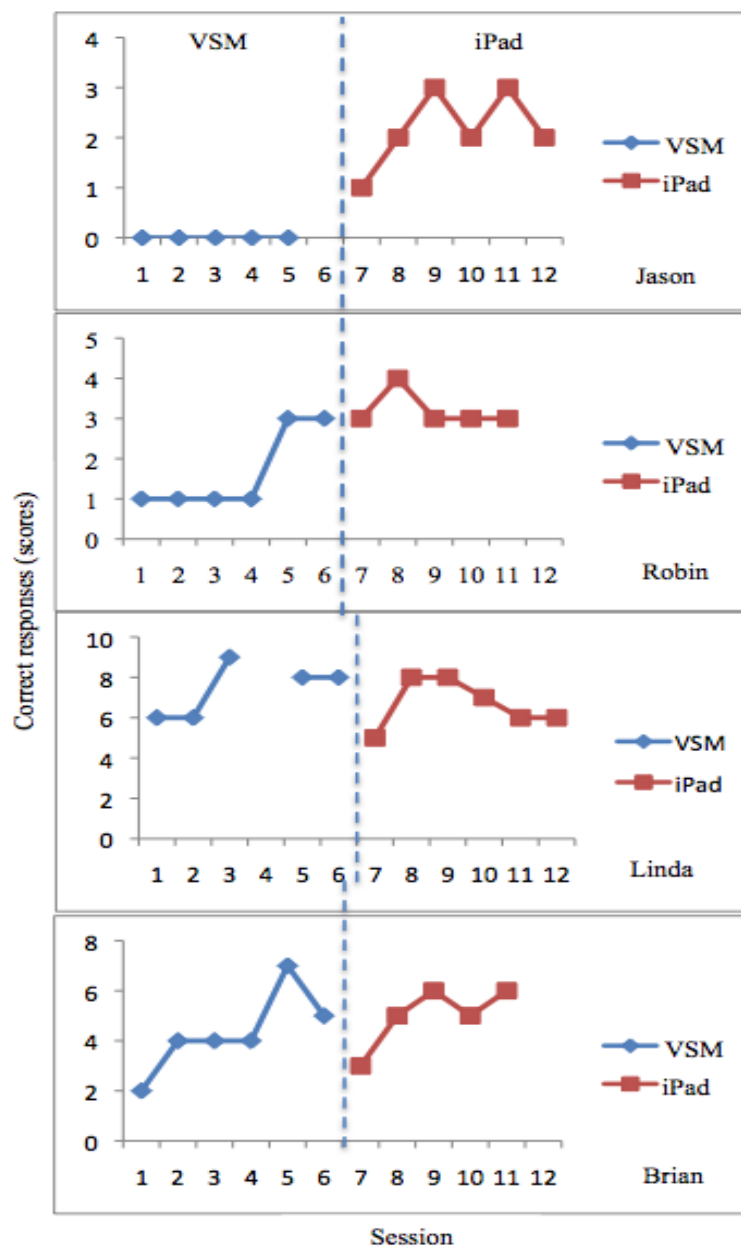


Figure 5: Group A's performance scores on session probes (filtered to show only multiplication questions) across the VSM and the iPad app.

As shown in Figure 5, half of Group A improved their test scores in multiplication fluency throughout the intervention phases. Figure 5 shows that Linda made no change in level of performance across the intervention phases. However, Jason showed an immediate change in level of performance on his session probes after the iPad intervention was delivered (see Figure 5).

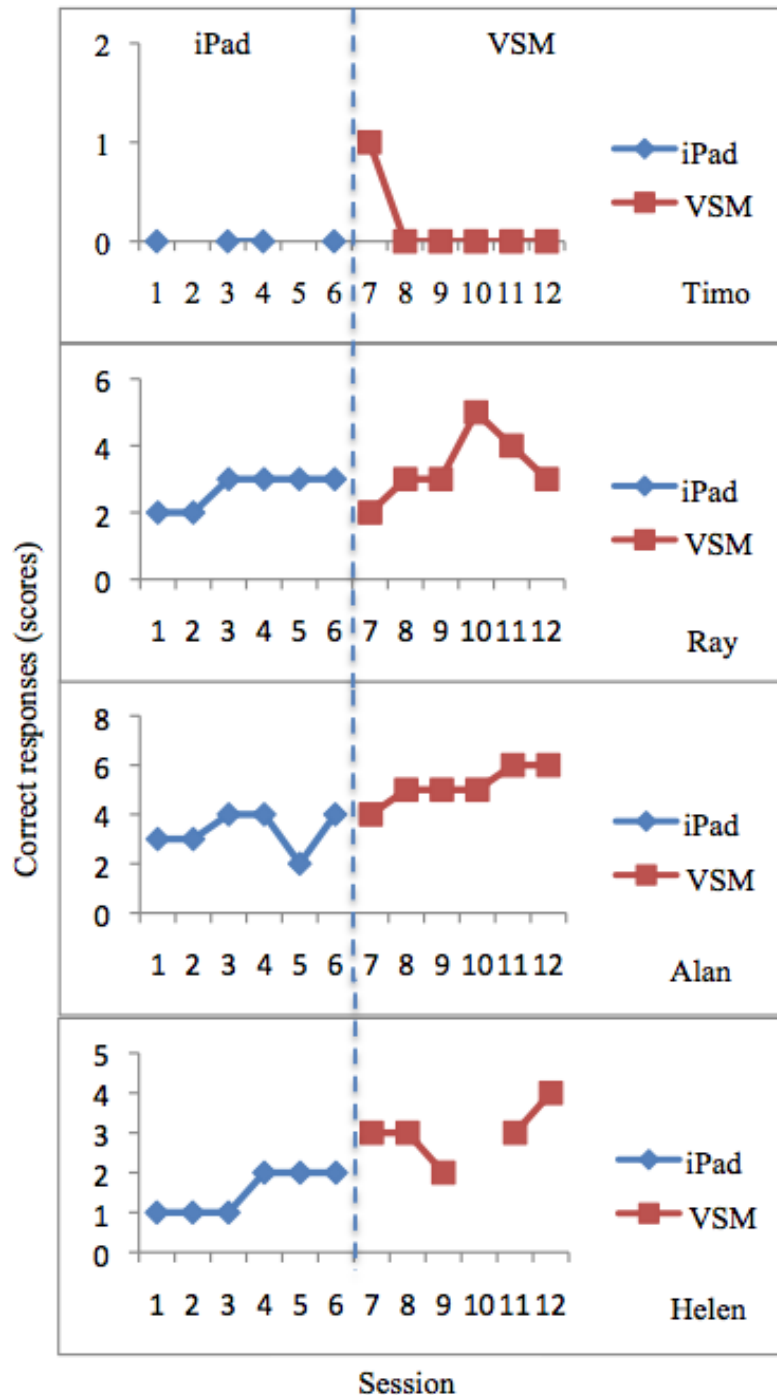


Figure 6: Group B's performance scores on session probes (filtered to show only multiplication questions) across the iPad app and VSM.

As, shown in Figure 6, the majority of Group B showed that there was no change in level of performance across the intervention phases. However, Helen changed in level of performance after the iPad app intervention was completed (see Figure 6).

Upon examining the results of the intervention phases as shown in Figures 5 and 6 demonstrates that, the majority of the students from intervention group increased the number of correct scores on the session probes during the six-week study. Figures 5 and 6 also showed that half of the intervention group changed in their level of performance on the session probes, after they completed their first interventions phase.

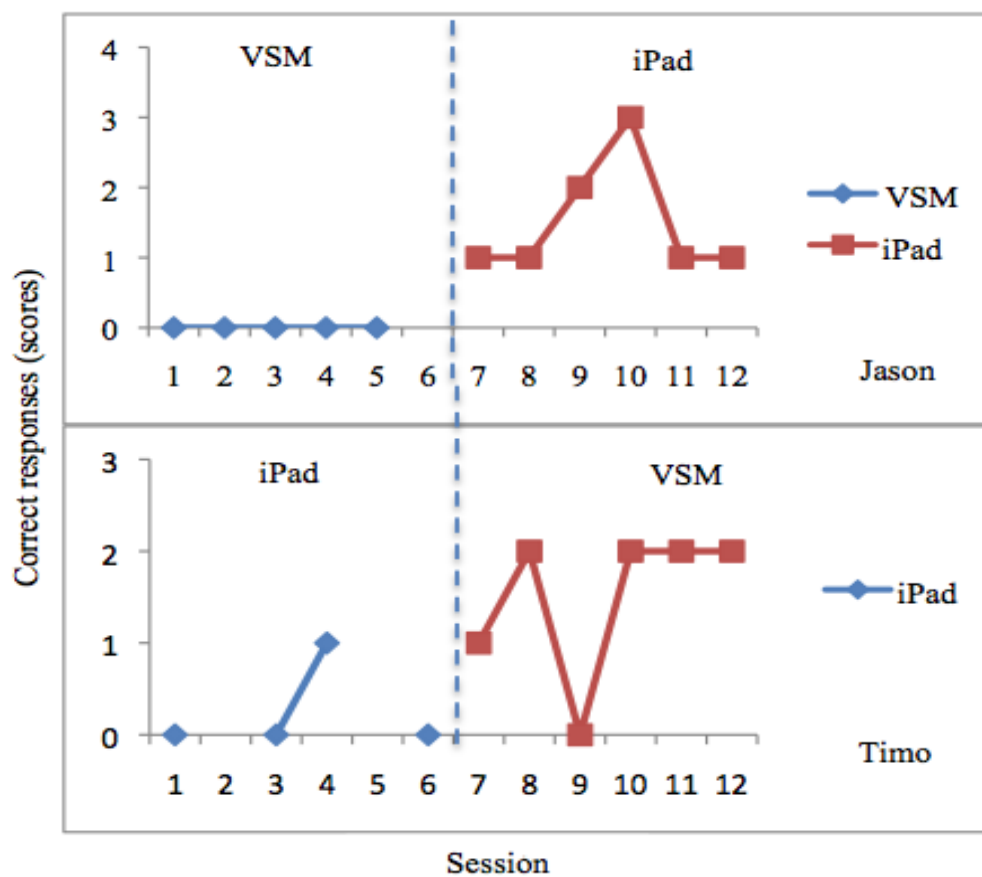


Figure 7: Jason and Timo's performance scores on session probes (filtered to show only addition questions) across the two intervention phases.

Figure 7 shows that Jason's (Group A) and Timo's (Group B) correct responses on session probes increased after the completion of the intervention phases. In addition, both Jason and Timo demonstrated an immediate change in level of performance after they completed the first intervention phase (see Figure 7).

3.2.5 The iPad app (FFM) progress report

The iPad app allowed the researcher to observe the individual data of the intervention group on total time taken (in seconds) to complete a task on the iPad app and the percentage of correct responses. The researcher took screenshots of the progress report for the students at the end of every session. One out of the eight students showed steady progress, whereas the majority of the intervention group was inconsistent in performance across the iPad intervention sessions.

Table 8
The intervention groups' best performance scores in percentage and time taken (seconds) on FFM for multiplication and division

Intervention group	Multiplication		Division	
	Percentage	Seconds	Percentage	Seconds
A				
Jason	59	34	53	34.7
Robin	56	50.9	32	79.7
Linda	71	63.2	51	94.5
Brian	93	66.7	90	67.5
B				
Timo	43	23.4	48	52.2
Ray	75	57.4	62	97.4
Alan	56	80.2	65	79.9
Helen	56	116.8	47	83.1

Table 8 shows that the majority of intervention group's best scores was higher than 50% on both multiplication and division. Specifically, Robin (Group A), Alan and Helen (Group B) obtained their best scores at 56% of correct responses on multiplication but they took different amounts of time to complete FFM. In addition, Group A on average achieved a higher percentage and faster response rate than Group B on both multiplication and division. Group A's mean best score in multiplication was 69.75% ($SD = 16.8$) in 53.7 seconds ($SD = 14.778$), and Group B's was 57.5% ($SD = 13.178$) in 69.45 seconds ($SD = 39.257$). The average best score in division for Group A was 56.6% ($SD = 24.2556$) in 69.1 seconds ($SD = 25.452$) and for Group B was 55.5% ($SD = 9.327$) in 78.15 seconds ($SD = 18.899$).

Table 9

The intervention groups' best performance scores in percentage and time taken (seconds) on FFM for addition and subtraction

Intervention group	Addition		Subtraction	
	Percentage	Seconds	Percentage	Seconds
A				
Jason	79	61.7	100	11.8
B				
Timo	64	44.7	80	46.6

Table 9 shows that both Jason (Group A) and Timo (Group B) scored higher than 60% in both addition and subtraction. Jason's correct percentage scores was relatively better than Timo's on both addition and subtraction (see Table 9).

3.2.6 Time spent on the intervention phases (VSM and iPad app) not accounting for missed sessions.

Table 10

Contrast of average time spent (seconds) on VSM viewing and iPad app engaging

Intervention group	VSM		iPad app	
	<i>M (min)</i>	<i>SD</i>	<i>M (min)</i>	<i>SD</i>
A	99.78 (1.68)	1.139	194.4 (3.24)	53.04
B	111.5 (1.86)	0.068	235.7 (3.94)	69.61

Table 10 shows that the average of time spent for Group A's VSM viewing and the iPad app engaging was faster than Group B. The average of time spent for Group A viewing on VSM was 1.68 minutes or 99.78 seconds ($SD = 1.139$), Group B was 1.86 minutes or 111.5 seconds ($SD = 0.068$). The average of time spent for Group A iPad app engaging was 3.24 minutes or 194.4 seconds ($SD = 53.04$), Group B's was 3.94 minutes or 235.7 seconds ($SD = 69.61$). Both Group A's and B's average of time spent on VSM viewing were faster than the iPad app engaging (see Table 10).

3.2.7 Session probes

The intervention group took session probes at the end of each intervention session, which contained 20 questions of basic number facts. Six out of the eight students received session probes, which covering multiplication and division.

However, two students' session probes covered addition, subtraction, multiplication and division.

Table 11
The intervention groups' performance scores on session probes per intervention session

Intervention session	1		2		3		4		5		6	
Intervention group	VSM	iPad	VSM	iPad	VSM	iPad	VSM	iPad	VSM	iPad	VSM	iPad
A												
Jason	1	4	3	4	2	10	4	9	4	9	-	8
Robin	1	3	1	4	1	5	1	7	3	6	4	-
Linda	6	5	7	8	9	10	-	7	9	9	8	7
Brian	3	6	10	10	10	10	8	9	11	11	12	-
B												
	iPad	VSM	iPad	VSM	iPad	VSM	iPad	VSM	iPad	VSM	iPad	VSM
Timo	4	4	-	6	3	1	4	6	-	6	3	6
Ray	3	4	4	9	8	7	12	10	11	10	9	8
Alan	5	7	3	8	6	7	9	8	5	9	8	10
Helen	1	5	1	5	1	5	3	-	3	6	3	6

Note: "-" indicates not present for the session.

Table 11 shows that the intervention group's number of correct scores on session probes was inconsistent across the intervention sessions. Seventy-five percent of the students from Group A obtained their highest scores on session probes after the iPad app intervention, though Brian reached his highest scores after the VSM intervention sessions. Furthermore, there was also 75% of students from Group B achieved their best scores after the VSM intervention sessions, but Ray achieved his best scores after the iPad app intervention session.

Overall, the intervention group generally improved after the intervention phases were introduced. The mean session probes score for Group A at the end of the first intervention phase was 5.364 ($SD = 3.866$) and increased to 7.318 ($SD = 3.085$) at the end of the second intervention phase. For Group B, the mean at the end of the first intervention phase was 4.955 ($SD = 3.362$) and increased by the end of the second intervention phase to 6.652 ($SD = 2.551$).

3.2.8 Self-efficacy test (PALS)

Table 12

Mean score per subscale on self-efficacy test (PALS)

PALS Subscales															
Intervention Test phase	1			2			3			4			5		
	<i>Mastery goal orientation</i>			<i>Performance- approach goal orientation</i>			<i>Performance-avoid goal orientation</i>			<i>Academic efficacy</i>			<i>Avoiding novelty</i>		
	VSM	iPad		VSM	iPad		VSM	iPad		VSM	iPad		VSM	iPad	
	Pre	Mid	Post	Pre	Mid	Post	Pre	Mid	Post	Pre	Mid	Post	Pre	Mid	Post
Intervention group A															
Jason	4.4	3.6	5.0	3.8	3.6	5.0	4.5	4.75	4.0	4.2	2.8	5.0	3.8	4.2	4.2
Robin	3.6	3.6	3.6	2.2	2.4	3.0	1.0	2.75	1.0	2.2	3.8	3.4	2.0	3.2	3.4
Linda	4.6	4.4	4.2	2.2	1.8	1.2	1.0	2.0	1.0	2.8	3.2	2.2	3.6	3.8	2.6
Brian	4.8	5.0	5.0	5.0	4.2	5.0	2.5	4.0	4.0	5.0	5.0	5.0	1.6	1.4	2.8
		iPad	VSM		iPad	VSM		iPad	VSM		iPad	VSM		iPad	VSM
B															
Timo	3.8	3.8	3.6	3.8	4.8	3.2	4.75	3.75	4.5	3.6	3.6	4.2	3.6	4.2	3.6
Ray	4.6	4.6	5.0	4.0	4.8	4.4	4.5	4.75	4.0	4.2	4.8	4.4	4.6	1.0	1.0
Alan	4.8	5.0	3.6	4.4	4.4	4.0	5.0	5.0	3.5	4.4	3.0	2.6	4.2	2.4	3.6
Helen	4.6	4.8	4.4	3.0	2.0	1.2	3.25	1.75	1.0	2.4	3.0	2.0	3.0	3.0	2.4

Note: Subscale 1: “Mastery goal orientation” (5items), Subscale 2: “Performance-approach goal orientation” (5items), Subscale 3: “Performance-avoid goal orientation” (4items), Subscale 4: “Academic efficacy” (5 items), Subscale 5: “Avoiding novelty” (5items).

Table 12 shows that the majority of the intervention group’s scores on PALS were inconsistent throughout the six-week study. Only three out of the eight students increased their self-efficacy scores on PALS during the pre-, mid- and post-tests (see Table 12). Three students from Group A increased their rating on PALS across the intervention phases. As seen on Table 12, Jason’s and Brian’s levels of self-efficacy consistently increased on most of the PALS subscales in their post-test. Robin had a slightly increased PALS rating four out of five PALS subscales during the mid- and post-tests, whilst Linda’s PALS rating was decreased over the six weeks of the study (see Table 12).

Group B’s PALS score were unstable throughout the study, as Ray’s rating (3 out of 5 subscales) on the mid-test increased and decreased on the post-test (see Table 12). Timo made a slightly changed of his rating on PALS; hence his PALS post-test score on subscales 3 and 4 were increased and decreased for subscale 5. Both Alan’s and Helen’s rating on PALS (a total of 4 subscales) decreased on the post-test (see Table 12).

Chapter 4: Discussion

The purpose of this study was to ascertain whether VSM or the iPad app was a more effective teaching tool. Another aim of the study was to investigate changes in the students' levels of self-efficacy as measured three times over six-weeks. The study used iPads to deliver the interventions (both VSM and the iPad app) to the students. The students had the opportunity to view their own VSMs 12 times (two views per session), and could use the iPad app six times during the study. In addition, the students took a PALS test three times throughout the course of the study to measure their self-efficacy levels. This chapter is a discussion of the results, addressing the intervention groups (Group A and B) and whole class: basic number fact performance levels, as well as the effectiveness of the intervention phases (VSM and the iPad app), and the self-efficacy test as reported using PALS, followed by the subsequent headings which include the unexpected findings, limitations, practical implications, suggestions for future study and conclusions drawn.

4.1 A comparison between the intervention groups (Group A and B) and the whole class: basic number fact performance levels.

The average scores of the participants in this study improved. The intervention group had a higher score increase in comparison to the whole class group. As, the intervention group had a larger effect size than the whole class on The Test during pre-, mid-, and post-test. This indicates the intervention phases (VSM and the iPad app) were effective in improving the intervention group's performance in basic maths facts.

Half of Group A showed a steady increase in scores on The Test throughout the study, while Group B's mid- and post-test scores on multiplication fluency stayed the same. This could be explained by Baroody et al.'s (2009) Active Constructive View (mastery with fluency). That is to say, half of Group A mastered the basic number facts by understanding the knowledge during interventions, and could apply the knowledge to perform the tasks with both new and recognisable tasks automatically. An explanation for Group B's identical scores on the mid- and post-test of fluency in multiplication tests could be a lack of basic application or generalisation, as Group B showed increased progress at the end of the first intervention phase (the

iPad app) because they were able to generalise the facts and information from the intervention sessions onto the pen and paper test. However, Group B could not apply the skills gained from the VSM to the fluency multiplication post-test phase.

Both of the intervention phases required endurance from the students. This affected the fluency level on their basic maths facts performance. According to Hitchcock et al. (2004) a learner's endurance can impact the effectiveness of the VSM intervention; without, endurance the learner is less likely to pay attention or concentrate on the VSM.

The iPad app (FFM) gave the students immediate feedback, that allowed them to acquire the information about their performance, and also helped them increase their performance levels. However, the power of feedback and its effectiveness relies on the learner's endurance and retention (Hattie & Timperley, 2007). Therefore, students' endurance and retention are keys to the success of the intervention phases. Automaticity facilitate retention, endurance and application which influence performers' learning outcomes (Binder et al., 2002; Dougherty & Johnston, 1996; Kubina & Morrison 2000).

After the intervention phases, the intervention group increased their accuracy scores on The Test; six students improved their fluency in addition and in multiplication scores on The Test. Although, the majority of students in the intervention group showed improvement in their performance levels in basic maths facts after the intervention, some students did not.

Linda's and Helen's scores were higher before they participated in the intervention phases. A possible explanation could be a lack of endurance during the intervention phases. After a few intervention sessions, Linda and Helen did not want to pay attention during the iPad app. The researcher noticed that during the intervention phases these two students were looking away from the iPad during the iPad app sessions, and chose answers on the iPad app without looking at the questions. A lack of endurance may cause the learners to increase their negative emotions or behaviours and to make more errors on a given task (Kubina & Morrison, 2000).

Another reason for Linda and Helens' lower scores after participation in the intervention phases could be the experimental room conditions, for example, some students may have been distracted from noise during eight of the twelve intervention sessions, which were held in the library while a Year 1 class was present.

4.2 The effectiveness of the intervention phases (VSM and the iPad app)

Before the intervention phases began, the intervention group's average fluency level on basic maths facts (based on their specific level test) was two correct answers per minute. After the completion of the second intervention phase, the majority of the intervention group improved their scores on this test. Furthermore, the mean rate of correct responses on session probes for intervention groups A and B increased to five correct answers per minute after the first intervention phase and seven correct answers per minute at the end of the second intervention phase. This suggests that both of the intervention phases were effective in increasing students' accuracy and fluency levels in basic maths facts. This could be explained by Baroody et al. (2009) using his Passive Storage View; when students perform with automaticity on the basic number facts combination through repeated practice. The repetition of the same basic maths facts assessment, for example session probes may cause an extensive practice in students. The intervention group took the session probes at the end of each intervention session, so students were likely to memorise the items on this test. As a result from extensive practice and tests (e.g., viewing VSM, tasks during FFM, and session probes), therefore the intervention group was able to complete session probes more accurately and fluently.

The majority of the students in Groups A and B showed variable progress during the iPad app intervention phase, only Brian had consistently increased his performance throughout the five sessions. However, he did not attend his last session due to a conflicting school activity.

The progress report from FFM showed that both Jason's and Timo's best scores on addition and subtraction were at least 60% correct answers. Most of the students from the intervention group performed their best scores in both multiplication and division (50% correct answers). However, Robin's, Timo's and Helen's highest scores were below 50% in division.

For Robin and Timo a possible explanation could be the number of sessions attended during the iPad app intervention phase. Robin was absent for the sixth session, and Timo was absent for the second and fifth.

An explanation for Linda's and Helen's inconsistent progress could be technical problems with FFM. In the second and fourth session, Linda had to repeat the task twice because of an app error. Helen had to start over on the app due to

technical problems during sessions two, three, four and five; her data was also lost in session six. The application worked without a problem for the other students.

Results from the FFM progress report for the multiplication and division tests suggest that Group A's performance on FFM improved more than Group B's after the iPad app intervention. On average, Group A took less than a minute to complete the FFM session on multiplication and gained higher scores, whereas Group B took longer than one minute and had lower scores. Groups A and B took longer than one minute to complete the FFM session on division but Group A was more accurate and fluent than Group B.

Robin (Group A), Alan and Helen (Group B) had the highest scores on multiplication (56% correct); however, the length of time they took to complete the FFM was different. Robin took the shortest time to complete FFM, then Alan, followed by Helen. A reason for this could be the enjoyment Robin and Alan had while using the application. As suggested by Habgood and Ainsworth (2011) educational software provides both enjoyment and feedback to learners, which facilitates their performance. At the same time, Helen refused to engage with the application or chose answers without looking at the questions. A possible explanation for her lack of ability to stay focussed on the iPad app, could be that Helen's skill and knowledge of basic maths facts was not fluent and accurate enough to act as a reinforcer, to sustain her performance on a task over an extended period of time. According to Church (2014) a learner's fluency level generates the reinforcement to perform a certain task or activity.

The results of session probes filtered to show only multiplication questions across the six-week study suggest that more than half of the intervention group's members improved their performance levels. Throughout the second intervention phase, most of the students in the intervention group increased their correct responses on session probes and reached their highest scores, including Jason and Timo's session probes filtered to show only addition questions. The intervention group's scores on session probes was not reported to the students; therefore improved performance could only be explained by students' endurance, retention and application rather than the feedback. A learner's degree of fluency is facilitated by endurance, retention and application (Kubina & Morrison, 2000).

In summary, no discernible pattern that would determine whether VSM or the iPad app was a more effective teaching tool to increase the basic number fact

knowledge amongst the intervention group. Both intervention phases helped the majority of the students in the intervention group increase their fluency and performance level in basic number facts. Among the intervention group, some students' scores were decreased or did not improve; this could be explained by the number of sessions they attended and the setting conditions (distracted from noise when the sessions were held in the library). In the success or failure of this research study, it is important to note that learners' endurance, retention and application were the crucial behaviours that would impact on the effectiveness of the two interventions.

Although the study provides evidence that both VSM and the iPad app were effective, however the time it takes students to participate in these two teaching tools is different. The VSM offered a rapid and effective intervention with students spending on average less than two minutes per session on it. Group A on average spent 1.66 minutes per session, Group B spent 1.86 minutes per session. Whereas, an average time spent on an iPad app per session for Group A was 3.24 minutes and 3.93 minutes for Group B. VSM could be a fast and effective strategy, in which the learners' performance can change in almost an instant (Dowrick, 2012).

4.3 Self-efficacy test (PALS)

Studies have suggested that students' academic performance is associated with their self-efficacy levels (Chen, 2003; Midgley & Turner, 2010; Kitching et al., 2011; Melallidou & Vlachou, 2007; Norwich, 1987; Pantziara & Philippou, 2007; Ramdass & Zimmerman, 2008; Thorndsen, 2011). To improve students' mathematics performance, requires improvement in their fluency levels as well as their self-efficacy levels. Metallidou and Vlachou (2007) suggested that students' mathematics achievement associates with their levels of self-efficacy.

In this study, an improvement in the basic number facts performance and test scores by the majority of the intervention group did not lead to an increase in their self-efficacy levels. The majority of the intervention group had inconsistent scores on subscales of PALS over the course of the six-week study, whereas their basic maths facts test scores were increasing. A potential explanation could be the cultural bias of the PALS assessment. Psychometric test results may vary among people from different cultural backgrounds. The PALS has been adjusted to the norm of the population in the United States; from Grades five to nine (Year 6 to Year 10 in New Zealand equivalent). Other countries have gathered data using PALS but New

Zealand has not yet, this may led to the unstable self-efficacy rate reported by the students. According to Lee (2009) the cultural background of students can affect their mathematics performance and self-efficacy levels.

Another possible explanation for the intervention group's inconsistency scores on PALS could be the students' self-disclosure. For example some students may not choose to reveal their true thoughts or feeling to the researcher or to other students, because the researcher asked the intervention group to write their names on the PALS rating paper.

Another potential factor for the intervention group's unstable PALS scores could be the instructions given to the students. The researcher allowed the students to read and rate PALS on their own and to ask any questions relating to PALS. According to the PALS manual, the administrator should read all of the instructions and items to the students. Also, the researcher asked one student to complete the self-rating again, as he did not follow the instructions given by the researcher.

An interrogation of the PsycInfo electronic databases of publications between October 19, 2013 and July 12, 2014 yielded no published studies on using PALS in New Zealand; to measure the students' self-efficacy levels in relation to basic math facts test scores (pre-, mid-, and post-test phases) and the use of VSM and the iPad app.

4.4 Unexpected Findings

In previous studies, computer software offered immediate feedback and enjoyment to the students, which allowed them to engage on the tasks and therefore, improve their performance levels (Habgood & Ainsworth, 2011; Schoppek & Tulis, 2010; Timperley, 2007). Additionally, Leh and Jitendra (2012) suggested that computer software is comparable with teachers' instruction and feedback. In other words, the instruction and feedback from both computer software and teachers facilitated students' performance in mathematics.

The researcher assumed that the iPad app would be more effective as it shared a similarity with computer software through feedback, graphics and interactivity. Therefore the iPad app would be more effective in improving students' performance on basic number facts than VSM. This was not the case

The iPads are handheld devices, ubiquitous in schools and growing in prevalence as teaching tools in New Zealand schools. The researcher also assumed that the FFM had become a popular teaching tool as an interactive experience for students. More than half of the students in the intervention group had their own iTunes account to access apps on the iPad in the unstructured time. According to Dewey's active experience theory (1938) learners' favourable experience (active experience) influences their future learning. As, an example, students may have already been using or following the feedback from an iPad app as part of their daily activities or to enjoy learning either at home or at school before this research study took place. In other words, the students' enjoyment experience from the iPad app's feedback had become their active experience. Students' active experiences tend to assist their learning progress by positively encouraging them to engage on the target task or activity thereby increasing task endurance (Carr, 2012; ICELS, 2013).

However, this study suggests that VSM and the iPad app improved the intervention group's basic number facts performance. Using the iPad app was not more effective than VSM as the researcher had expected. Some students had negative attitudes about the iPad and did not want to engage with the app. These students were less motivated, and looked elsewhere while selecting answers on FFM. After a few sessions on the iPad app, some students paid less attention. A possible explanation for the students' lack of motivation could be their lack of success in the task.

4.5 Limitations

While the findings of this study showed signs the students in the intervention groups (Group A and B) improved their basic maths skills, the study had several limitations that must be noted. One limitation was students' technical problems with the iPad app. Linda and Helen experienced the (FFM) technical problem. Helen had the most difficulty, while she was practising on FFM. The app stopped working in four out of six sessions requiring her to restart FFM and her data was lost in the last session. The technical problem has caused Linda and Helens' to have negative feelings toward FFM and they did not want to engage in the task, this reflected in a lack of motivation. As a result, they were looking elsewhere and tapping the answers while FFM was running.

Other limiting factors were loss of opportunity to engage with the intervention. Only two students attended all 12 intervention sessions. In addition, a relief teacher administering the mid-test as a substitute for the class teacher may have had an unsettled effect on the students, as an evidence by a change in overall class behaviour. Unstable scores on PALS could relate to the instruction given by the researcher who told the students to read and rate the PALS by themselves. The final limited factor could have been the varying rooms used for intervention sessions (a library, music room, and a meeting room) may have impacted the results. Thus, further research needs to address these limitations.

4.6 Practical Implications

Two findings stand out as results of this study. First, it is possible to increase the students' performance levels on basic number facts by using iPads for delivering of a VSM and also an app. iPads offer touch interaction, and are lightweight and access the Internet. They can provide an interactive and fun experience, which holds the attention of students of all ages (Apple in Education, 2013; Carrs, 2012).

The VSM and the iPad app were effective in improving the basic number fact skills for a group of Year 5 students, perhaps this could be explained in terms of the influences of feedforward in case of VSM and immediate feedback from the iPad app. Feedforward from VSM allows viewers to see themselves as having the ability to perform tasks successfully that they have not yet achieved. According to Dowrick (2012) VSM has been described as an effective and rapid intervention technique. The iPad app (FFM) allows students to receive immediate feedback, which could have reinforced their performance levels and task engagement in building their endurance. According to Hattie and Timperley (2007) the most effective form of feedback comes from video, audio, as found in the computer software and these forms of feedback can act as a reinforcer to increase the students' engagement with the task. Therefore, give the opportunity to increase their self-efficacy levels.

Second, although both the VSM and the iPad interventions were effective in increasing the basic number facts skills in the intervention group, the participation time required for these interventions was different. On average, the iPad app intervention required students to engage for two times longer in each session (four minutes) than the VSM (two minutes). As a result of this longer engagement with the

iPad app, a few students became discouraged and less motivated to engage with it. These behaviours were not present in VSM because the intervention took less than two minutes a session, and the students paid more attention to viewing their own videos. VSM is an effective and time-efficient, and encourages the students to pay more attention as to view themselves performing the tasks (Dowrick, 2012; Hitchcock et al., 2004). The VSM in this study used the feedforward approach, which has been successful in education therapy to increase the learning performance both in behaviour and academic areas for students (Blood & Johnson, 2011; Burton et al., 2013).

4.7 Future Study

Previous studies had investigated the effectiveness of VSM and computer software, but had not yet compared VSM and the iPad app as teaching tools (Carr, 2012; Habgood & Ainsworth, 2011; Hitchcock et al., 2003,2004; Kehel et al., 2002; Mevarech & Rich, 1985; Sedig, 2008; Wang et al., 2010). The present study examines a new area—comparing the effectiveness of these two teaching tools in increasing students' math skills and to measure their levels of self-efficacy after the intervention phases.

There are some matters to consider before undertaking future study. One area is the variation during the implementation of the method; future studies should have a researcher to student ratio of 1:2. This way, the researchers could observe students' behaviour closely—for example, monitoring students' endurance levels during the interventions, to verify all of the students from intervention group views VSM twice per session, and assisting the students during the PALS rating.

The iPad app and all VSM videos were created, edited, and downloaded to the iPads by the researcher. A future researcher could try to administer a training session to other agents, such as teachers, parents, and students. In order to, edit the videos, and transfer the videos into an iPad by themselves. Agents who have confidence in technology and their ability to implement the interventions will have a higher chance in driving successful interventions (Blood & Johnson, 2011; Forgasz, 2006). Thus, future research should examine the experimental room feasibility and suitability for delivering these two interventions to the participants.

In addition, a future study could conduct a student survey on the accessibility of the technologies before the intervention begins. According to Kim and Chang (2010) students' mathematical performance rests on their access on computer and their purpose of using it. To discover whether the accessibility of technology and students' mathematics performance are associated a future study might include a brief survey of how often the students used iPads, if they have an iPad at home, are able to access one at school, and what the purposes for which they use them.

The decile rating for the participating school was nine. Future research could explore schools from various decile ratings, in order to investigate whether decile rating has an effect on the students' mathematical performance.

Finally, this study did not confirm whether the interventions were directly responsible for altering the intervention group's levels of self-efficacy. Therefore, further research is required to investigate which of these teaching tools (VSM or the iPad app) delivers more benefit to increase the intervention group's self-efficacy levels. Additionally, future research could extend the study by interviewing students' self-efficacy levels in regarding their attitudes towards mathematics skills.

4.8 Conclusions

This study showed that iPads are effective teaching tools for administering VSM and an iPad app to improve basic number facts knowledge in Year 5 students. The majority of the students in the intervention group improved their performance levels in basic number facts during the study. Although the two intervention phases were effective, the results, were inconclusive to discern the differences between the effectiveness of the VSM and the iPad app, and whether students' self-efficacy levels were influenced by the interventions. The limitations of this study should be addressed before implementing a replication.

This study underlined hope for new technology, using a handheld device (iPad) to deliver interventions (VSM and the iPad app), which improved the students' learning performance level. Overall, it is important to note that VSM (when compared with use of the iPad app) has greater potential as a form of targeted intervention, to improve the mathematical knowledge for a group of Year 5 students. Because VSM is so time efficient (less than two minutes per session), students pay much closer attention to viewing their own videos, as opposed to engaging with the ubiquitous

iPad app. Feedforward is an effective methods for rapid learning. As well as, being time-efficient, it has been proven as a successful intervention technique in building language, academic learning, and motor skills, along with creating the positive results for people with learning disabilities and behaviour disorders (Anderson et al., 2013; Blood & Johnson, 2011; Dowrick; 1999; Dowrick, 2012; Hitchcock et al., 2003; Hitchcock et al., 2012; Schunck & Hanson 1989).

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APPENDIX A:



HUMAN ETHICS COMMITTEE

Secretary, Lynda Griffioen
Email: human-ethics@canterbury.ac.nz

Ref: 2013/01/ERHEC

15 February 2013

Kanta Techaphulphol
College of Arts
UNIVERSITY OF CANTERBURY

Dear Kanta

Thank you for providing the revised documents in support of your application to the Educational Research Human Ethics Committee. I am very pleased to inform you that your research proposal "The effects of using video self-modelling and computer/iPad application on self-efficacy and acquisition of basic math skills in 10 year old students" has been granted ethical approval.

Please note that this approval is subject to the incorporation of the amendments you have provided in your email.

Should circumstances relevant to this current application change you are required to reapply for ethical approval.

If you have any questions regarding this approval, please let me know.

We wish you well for your research.

Yours sincerely

A handwritten signature in dark ink, appearing to read 'N Surtees'.

Nicola Surtees
Chair
Educational Research Human Ethics Committee

"Please note that Ethical Approval and/or Clearance relates only to the ethical elements of the relationship between the researcher, research participants and other stakeholders. The granting of approval or clearance by the Ethical Clearance Committee should not be interpreted as comment on the methodology, legality, value or any other matters relating to this research."

APPENDIX B:

Telephone: +64 3 3667001 extn:43229

Email: kte14@uclive.ac.nz



The effects of using video self-modelling and computer/iPad applications on self-efficacy and acquisition of basic math skills in 10 year old students.

Information Sheet for Board of Trustees

I am currently a Child and Family Psychology Masters degree student at the College of Arts, University of Canterbury. I am currently undertaking my thesis project under the supervision of Lawrence Walker and Gaye Tyler-Merrick. I am interested in finding out about two teaching strategies: video self-modelling (VSM) and iPad apps (applications) to see if these improve the students learning of basic number facts. The VSM will be done by making a video tape of the student saying their basic number sentences, the video will be viewed on the iPad. An iPad will be used to deliver practice in basic number facts through an app (application running on the iPad). The purpose of this study is to see if video self-modelling is more effective than an iPad application in learning of basic number facts by children.

I would like to ask for your approval to work in the school. The project will take place during school time and will take approximately 10 to 15 minutes 3 times a week for a nine week period.

The students from your school will be asked to do the following:

- All of the students in a class will be asked to complete a screening test taking less than 10 minutes on basic number facts. This will be administered three times over the length of the project and the results will be given to the class teacher and will be used by me for initially selecting the eight students for the study. The tests will be arranged with their class teacher at a suitable time.
- The eight selected students will participate in both the video self modelling and iPad maths groups. The project will be administered three times a week over the nine week period, for approximately 10-15 minutes a session. If needed, some additional training and instruction will be provided to the selected students.
- The selected students will also be asked to complete a self evaluation, a test of self-efficacy: Patterns of Adaptive Learning Scales (PALS), which will take approximately 10 minutes. The PALS will be administered three times over the length of the project. This will be arranged with their class teacher at a suitable

time. PALS is a self-evaluation sheet which emoticon (ie, ☺, ☹) will be used for student to show how they feel about mathematics.

Students participation in this study is voluntary. The children have the right to withdraw from the study at any time without penalty. Having decided to withdraw I'll do my best to remove any information relating to the student, provided this is practically achievable.

The VSM will be viewed by the researcher, the child, supervisors, parents/caregiver and class teacher. Of course the parents and child may choose to show others as well. I will take particular care to ensure the confidentiality of all data gathered for this study and anonymity in publications of the findings, however I can not guarantee that student participation will be anonymous within the class as the children will be viewing or using iPads as part of the intervention. Normal classroom procedures will be used to ensure that the selected group will be treated with respect and dignity just like any other grouping within the class. Pseudonyms will be used and no identifying data published about the school and teacher. All the data will be securely stored in password protected facilities and locked storage at the University of Canterbury for five years following the study. It will then be destroyed.

The results of this project will be used in my thesis. The results may also be reported at conferences and in journals, Pseudonyms will be used for all names and locations. All participants will receive their individual results and video on CD at the end of the project.

If you would like to discuss any aspect of this study please feel free to contact me (details above), or my supervisor Lawrence Walker on ph: (03) 345 8153 (Lawrence.walker@canterbury.ac.nz) We would be happy to discuss any aspect of the research with you.

This project has received ethical approval from the University of Canterbury Educational Research Human Ethics Committee, and that participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

To give your permission for your child to participate in this study, please complete the attached consent form and return it to me in the envelope provided by 18th April 2013.

This information sheet is for you to keep.

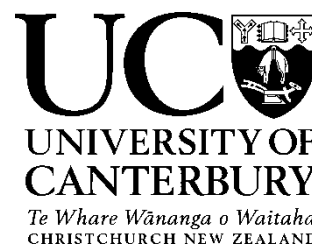
Yours sincerely

Kanta Techaphulphol

Kanta Techaphulphol

Phone: +64 3 3667001 extn:43229

Email: kte14@uclive.ac.nz



The effects of using video self-modelling and computer/iPad applications on self-efficacy and acquisition of basic math skills in 10 year old students.

Consent Form for Board of Trustees

I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.

I agree to give permission for the students from my school to take part in the above study and understand that the selected students may be asked to do the selected tasks. This will arrange with the class teacher at a suitable time.

I understand that the student's participation is voluntary and that they are free to withdraw at any time, without reason.

I agree that the students data gathered in this study may be stored (after it has been anonymised) in a specialist data centre and will be destroyed after five years.

I understand that the student test results from this study will have no effect on their academic/school grades.

I understand that the student video will be viewed by the researcher, the child, supervisors, parents/caregiver and the class teacher.

I understand that all of the student information collected during this project (with the exception of video) will only be viewed by the researcher and her supervisors, and remain strictly confidential.

I understand that I will receive a report on the finding of study. I have written my email address below for the report to be sent.

I understand that I can get more information about this project from Kanta kte14@uclive.ac.nz or her supervisor Lawrence Walker on ph:(03) 345 8153 (Lawrence.walker@canterbury.ac.nz) , and that I can contact The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz) if I have any complaints about the research.

Board of Trustees

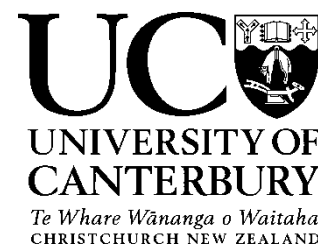
Date

Signature

Email address for report _____

Please return this consent form in the sealed envelope to Kanta Techaphulphol by 18th April 2013.

Telephone: +64 3 3667001 extn:43229
Email: kte14@uclive.ac.nz



11th April 2013

The effects of using video self-modelling and computer/iPad applications on self-efficacy and acquisition of basic math skills in 10 year old students.

Information Sheet for School Principal

I am currently a Child and Family Psychology Masters degree student at the College of Arts, University of Canterbury. I am currently undertaking my thesis project under the supervision of Lawrence Walker and Gaye Tyler-Merrick. I am interested in finding out about two teaching strategies: video self-modelling (VSM) and iPad apps (applications) to see if these improve the students learning of basic number facts. The VSM will be done by making a video tape of the student saying their basic number sentences, the video will be viewed on the iPad. An iPad will be used to deliver practice in basic number facts through an app (application running on the iPad). The purpose of this study is to see if video self-modelling is more effective than an iPad application in acquisition and fluency of basic number facts by children.

I would like to ask you for your permission to work with a teacher and students at your school, and to use your students' data for my project. I will provide the class teacher with the screening test and the Patterns of Adaptive Learning Scales (PALS) to administer, approximately 10-15 minutes. I will mark these tests and return the results to the class teacher for our discussion in selecting the participants in the project. Please note the screening test and PALS will be administered three times over the 9 week period of the project.

Your students will be asked to do the following:

- All of your students in a selected class will be asked to complete a screening test taking less than 10 minutes on basic number facts. This test will be administered three times over the length of the project. The results will be given to the class teacher and will be used by me for initially selecting the eight students for the study and gauging their progress in the project. This will be arranged with the class teacher at a suitable time.
- The eight selected students will participate in both the video self modelling and iPad maths project. The project will administered three times a week over the four weeks (2 weeks iPad, 2 weeks VSM,) for approximately 10-15 minutes per session. If needed, some additional training and instruction will be provided to the selected students.
- The selected students will also be asked to complete a self evaluation, a test of self-efficacy: Patterns of Adaptive Learning Scales (PALS), which will take approximately 10 minutes. The PALS will be administered three times over the

length of the project (it will be administered on the week of 2nd, 6th, 9th). This will be arranged with the class teacher at a suitable time. PALS is a self-evaluation sheet which emoticon (ie, ☺, ☹) will be used for student to show how they feel about mathematics.

Students participation in this study is voluntary. The students have the right to withdraw from the study at any time without penalty. Having decided to withdraw I'll do my best to remove any information relating to the student, provided this is practically achievable.

The VSM will be viewed by the researcher, the child, supervisors, parents/caregiver and class teacher. Of course the parents and child may choose to show others as well. I will take particular care to ensure the confidentiality of all data gathered for this study and anonymity in publications of the findings, however I cannot guarantee that student participation will be anonymous within the class as the children will be viewing or using iPads as part of the intervention. Normal classroom procedures will be used to ensure that the selected group will be treated with respect and dignity just like any other grouping within the class. Pseudonyms will be used and no identifying data published about the school and teacher. All the data will be securely stored in password protected facilities and locked storage at the University of Canterbury for five years following the study. It will then be destroyed.

The results of this project will be used in my thesis. The results may also be reported at conferences and in journals, Pseudonyms will be used for all names and locations. All participants will receive their individual results and video on CD at the end of the project.

If you would like to discuss any aspect of this study please feel free to contact me (details above), or my supervisor Lawrence Walker on ph: (03) 345 8153 (Lawrence.walker@canterbury.ac.nz) We would be happy to discuss any aspect of the research with you.

This project has received ethical approval from the University of Canterbury Educational Research Human Ethics Committee, and that participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

To give your permission for your students to participate in this study, please complete the attached consent form and return it to me in the envelope provided by 18th April 2013.

Thank you for taking the time to consider this.
This information sheet is for you to keep.

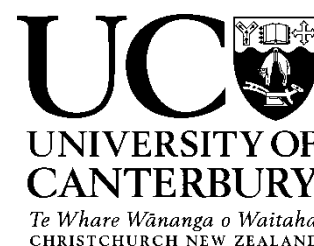
Yours sincerely

Kanta Techaphulphol

Kanta Techaphulphol

Phone: +64 3 3667001 extn:43229

Email: kte14@uclive.ac.nz



**The effects of using video self-modelling and computer/iPad applications on self-
efficacy and acquisition of basic math skills in 10 year old students.**

Consent Form for School Principal

I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.

I agree to give permission for my students to take part in the above study and understand that the selected students may be asked to do the selected tasks. This will arrange with the class teacher at a suitable time.

I understand that the student's participation is voluntary and that they are free to withdraw at any time, without reason.

I agree that the students data gathered in this study may be stored (after it has been anonymised) in a specialist data centre and will be destroyed after five years.

I understand that the student test results from this study will have no effect on their academic/school grades.

I understand that my students video will be viewed by the researcher, the child, supervisors, parents/caregiver and the class teacher.

I understand that all of the students information collected during this project (with the exception of video) will only be viewed by the researcher and her supervisors, and remain strictly confidential

I understand that I will receive a report on the finding of study. I have written my email address below for the report to be sent.

I understand that I can get more information about this project from Kanta kte14@uclive.ac.nz or her supervisor Lawrence Walker on ph: (03) 345 8153 (Lawrence.walker@canterbury.ac.nz) , and that I can contact The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz) if I have any complaints about the research.

Name of School Principal

Date

Signature

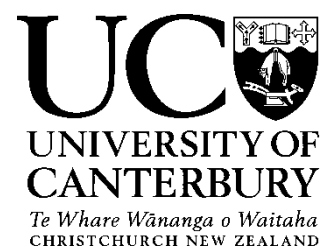
Email address for report

***Please return this consent form in the sealed envelope to Kanta Techaphulphol by
18th April 2013.***

Telephone: +64 3 3667001 extn:43229

Email: kte14@uclive.ac.nz

11th April 2013



The effects of using video self-modelling and computer/iPad applications on self-efficacy and acquisition of basic math skills in 10 year old students.

Information Sheet for Teacher

I am currently a Child and Family Psychology Masters degree student at the College of Arts, University of Canterbury. I am currently undertaking my thesis project under the supervision of Lawrence Walker and Gaye Tyler-Merrick. I am interested in finding out about two teaching strategies: video self-modelling (VSM) and iPad apps (applications) to see if these improve the students learning of basic number facts. The VSM will be done by making a video tape of the student saying their basic number sentences, the video will be viewed on the iPad. An iPad will be used to deliver practice in basic number facts through an app (application running on the iPad). The purpose of this study is to see if video self-modelling is more effective than an iPad application in acquisition and fluency of basic number facts by children.

I would like to ask you for your permission to participate in my project. I will provide you with the screening test and the Patterns of Adaptive Learning Scales (PALS) to administer, approximately 10-15 minutes. I will mark these tests and return the results to you as class teacher for our discussion in selecting the participants in the project. Please note the screening test and PALS will be administered three times over the 9 week period of the project.

Your students will be asked to do the following:

- All of your students in a selected class will be asked to complete a screening test taking less than 10 minutes on basic number facts. This test will be administered three times over the length of the project. The results will be given to you and will be used by me for initially selecting the eight students for the study and gauging their progress in the project. This will be arranged with you at a suitable time.
- The eight selected students will participate in both the video self modelling and iPad maths project. The project will administered three times a week over the four weeks (2 weeks iPad, 2 weeks VSM,) for approximately 10-15 minutes per session. If needed, some additional training and instruction will be provided to the selected students.
- The selected students will also be asked to complete a self-evaluation, a test of self-efficacy: Patterns of Adaptive Learning Scales (PALS), which will take approximately 10 minutes. The PALS will be administered three times over the length of the project (it will be administered on the week of 2nd, 6th, 9th). This will be arranged with you at a suitable time. PALS is a self-evaluation sheet

which emoticon (ie, ☺, ☹) will be used for student to show how they feel about mathematics.

Students participation in this study is voluntary. You and your students have the right to withdraw from the study at any time without penalty. Having decided to withdraw I'll do my best to remove any information relating to you and your students, provided this is practically achievable.

The VSM will be viewed by the researcher, the child, supervisors, parents/caregiver and class teacher. Of course the parents and child may choose to show others as well. I will take particular care to ensure the confidentiality of all data gathered for this study and anonymity in publications of the findings, however I can not guarantee that student participation will be anonymous within the class as the children will be viewing or using iPads as part of the intervention. Normal classroom procedures will be used to ensure that the selected group will be treated with respect and dignity just like any other grouping within the class. Pseudonyms will be used and no identifying data published about the school and teacher. All the data will be securely stored in password protected facilities and locked storage at the University of Canterbury for five years following the study. It will then be destroyed.

The results of this project will be used in my thesis. The results may also be reported at conferences and in journals, Pseudonyms will be used for all names and locations. All participants will receive their individual results and video on CD at the end of the project.

If you would like to discuss any aspect of this study please feel free to contact me (details above), or my supervisor Lawrence Walker on ph: (03) 345 8153 (Lawrence.walker@canterbury.ac.nz) We would be happy to discuss any aspect of the research with you.

This project has received ethical approval from the University of Canterbury Educational Research Human Ethics Committee, and that participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

To give permission for your students to participate in this study, please complete the attached consent form and return it to me in the envelope provided by 18th April 2013.

Thank you for taking the time to consider this study.

This information sheet is for you to keep.

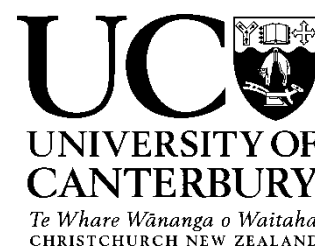
Yours sincerely

Kanta Techaphulphol

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Email: kte14@uclive.ac.nz



**The effects of using video self-modelling and computer/iPad applications on self-
efficacy and acquisition of basic math skills in 10 year old students.**

Consent Form for Teacher

I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.

I agree to participate and give my permission for my students to take part in the above study and understand that the selected students may be asked to do the selected tasks. This will be arranged with me at a suitable time.

I understand the students' participation is voluntary and that they are free to withdraw at any time, without giving a reason.

I agree that the students data gathered in this study may be stored (after it has been anonymised) in a specialist data centre and will be destroyed after five years.

I understand that the student test results from this study will have no effect on their academic/school grades.

I understand that the students video will be viewed by the researcher, the child, supervisors, parents/caregiver and me.

I understand that all of the students information collected during this project (with the exception of video) will only be viewed by the researcher and her supervisors, and remain strictly confidential.

I understand that I will receive a report on the finding of study. I have written my email address below for the report to be sent.

I understand that I can get more information about this project from Kanta kte14@uclive.ac.nz or her supervisor Lawrence Walker on ph: (03) 345 8153 (Lawrence.walker@canterbury.ac.nz), and that I can contact The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz) if I have any complaints about the research.

Thank you.

Name of Teacher

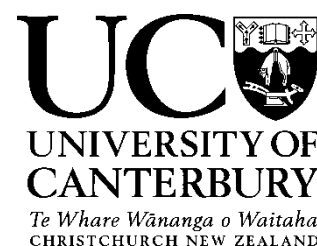
Date

Signature

Email address for report

***Please return this consent form in the sealed envelope to Kanta Techaphulphol by
18th April 2013.***

Telephone: +64 3 3667001 extn:43229
Email: kte14@uclive.ac.nz



11th May 2013

**The effects of using video self-modelling and computer/iPad applications on self-
efficacy and acquisition of basic math skills in 10 year old students.**

Information Sheet for Parent/caregiver

I am currently a Child and Family Psychology Masters degree student at the College of Arts, University of Canterbury. I am currently undertaking my thesis project under the supervision of Lawrence Walker and Gaye Tyler-Merrick. I am interested in finding out about two teaching strategies: video self-modelling (VSM) and iPad apps (applications) to see if these improve students learning of basic number facts. The VSM will be done by making a video tape of the student saying their basic number sentences, the video will be viewed on the iPad. An iPad will be used to deliver practice in basic number facts through an app (application running on the iPad). The purpose of this study is to see if video self-modelling is more effective than an iPad application in acquisition and fluency of basic number facts by children.

Your child is invited to participate in my project. If you agree for your child's participation your child will be asked to do the following:

- All of your child's class will be asked to complete a test taking less than 10 minutes on basic number facts. This test will be administered three times over 9 weeks period of the project. The results will be given to the class teacher and will be used by me for initially selecting the eight students for the study and gauging their progress in the project. Based on the results your child may be invited to join a further study, a separate consent form and information sheet will be required. The tests will be arranged with their class teacher at a suitable time.

Please note that participation in this study is voluntary. You and your child have the right to withdraw from the study at any time without penalty. Having decided to withdraw I'll do my best to remove any information relating to your child, provided this is practically achievable.

I will take particular care to ensure the confidentiality of all data gathered for this study. I will also take care to ensure anonymity in publications of the findings. All the data will be securely stored in password protected facilities and locked storage at the University of Canterbury for five years following the study. It will then be destroyed.

The results of this project will be used in my thesis. The results may also be reported at conferences and in journals, Pseudonyms will be used for all name and locations. All participants will receive their individual results at the end of the project.

If you would like to discuss any aspect of this study please feel free to contact me (details above), or my supervisor Lawrence Walker on ph: (03) 345 8153

(Lawrence.walker@canterbury.ac.nz) We would be happy to discuss any aspect of the research with you.

This project has received ethical approval from the University of Canterbury Educational Research Human Ethics Committee, and that participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

To give permission for your child to participate in this study, please complete the attached consent form and return it to your child class teacher in the envelope provided by 16th May 2013.

Thank you for taking the time to consider this study.
This information sheet is for you to keep.

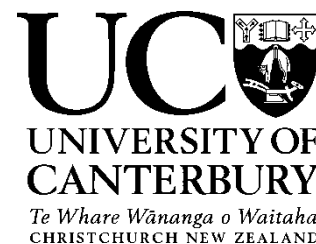
Yours sincerely

Kanta Techaphulphol

Kanta Techaphulphol

Phone: +64 3 3667001 extn:43229

Email: kte14@uclive.ac.nz



The effects of using video self-modelling and computer/iPad applications on self-efficacy and acquisition of basic math skills in 10 year old students.

Consent Form for Parent/caregiver

I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.

I understand that my child's participation is voluntary and that he/she is free to withdraw at any time, without giving a reason.

I agree that my child's data in this study may be stored (after it has been anonymised) as a file on a UC computer and will be destroyed after five years.

I understand that my child's test results from this study will have no effect on my child's academic/school grades.

I understand that I will receive a report on the finding of the study. I have written my email address below for the report to be sent.

I understand that I can get more information about this project from Kanta kte14@uclive.ac.nz or her supervisor Lawrence Walker on ph: (03) 345 8153 (Lawrence.walker@canterbury.ac.nz) , and that I can contact The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz) if I have any complaints about the research. I agree to give permission for my child to take part in the above study. Thank you.

Name of Parent/caregiver

Date

Signature

Name of your child

Email address for
report

Please return this consent form in the sealed envelope to your child class teacher by 16th May 2013.

APPENDIX C:

Telephone: +64 3 3667001 extn:43229

Email: kte14@uclive.ac.nz



17th May 2013

The effects of using video self-modelling and computer/iPad applications on self- efficacy and acquisition of basic math skills in 10 year old students.

Information Sheet for Parent/caregiver (selected students)

I am currently a Child and Family Psychology Masters degree student at the College of Arts, University of Canterbury. I am currently undertaking my thesis project under the supervision of Lawrence Walker and Gaye Tyler-Merrick. I am interested in finding out about two teaching strategies: video self-modelling (VSM) and iPad apps (applications) to see if these improve students learning of basic number facts. The VSM will be done by making a video tape of the student saying their basic number sentences, the video will be viewed on the iPad. An iPad will be used to deliver practice in basic number facts through an app (application running on the iPad). The purpose of this study is to see if video self-modelling is more effective than an iPad application in acquisition and fluency of basic number facts by children.

Your child is invited to participate as one of eight students in my project, as your child has scored on basic number facts test lower than the average of the class. If you agree for your child's participation your child will be asked to do the following:

- In addition to the three screen tests and the three Patterns of Adaptive Learning Scales (PALS) your child will participate in both the video self modelling and iPad maths project. PALS is a self-evaluation sheet which emoticon (ie, ☺, ☹) will be used for student to show how they feel about mathematics. The project will be administered three times a week over the four weeks (2 weeks iPad, 2 weeks VSM,) for approximately 10-15 minutes per session. Additional training and instruction will be provided to your child during the project. The project will be arranged with the class teacher at a suitable time.

Your child participation in this study is voluntary. You and your child have the right to withdraw from the study at any time without penalty. Having decided to withdraw I'll do my best to remove any information relating to your child, provided this is practically achievable.

The VSM will be viewed by the researcher, the child, supervisors, parents/caregiver and class teacher. Of course the parents and child may choose to show others as well. I will take particular care to ensure the confidentiality of all data gathered for this study and anonymity in publications of the findings, however I can not guarantee that student participation will be anonymous within the class as the children will be viewing or using iPads as part of the intervention. Normal classroom procedures will

be used to ensure that the selected group will be treated with respect and dignity just like any other grouping within the class. Pseudonyms will be used and no identifying data published about the school and teacher. All the data will be securely stored in password protected facilities and locked storage at the University of Canterbury for five years following the study. It will then be destroyed.

The results of this project will be used in my thesis. The results may also be reported at conferences and in journals, Pseudonyms will be used for all names and locations. All participants will receive their individual results and video on CD at the end of the project.

If you would like to discuss any aspect of this study please feel free to contact me (details above), or my supervisor Lawrence Walker on ph: (03) 345 8153 (Lawrence.walker@canterbury.ac.nz) We would be happy to discuss any aspect of the research with you.

This project has received ethical approval from the University of Canterbury Educational Research Human Ethics Committee, and that participants should address any complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

To give permission for your child to participate in this study, please complete the attached consent form and return it to your child class teacher in the envelope provided by 20th May 2013.

Thank you for taking the time to consider this study.

This information sheet is for you to keep.

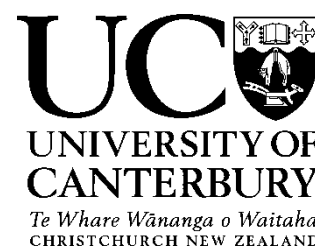
Yours sincerely

Kanta Techaphulphol

Kanta Techaphulphol

Phone: +64 3 3667001 extn:43229

Email: kte14@uclive.ac.nz



**The effects of using video self-modelling and computer/iPad applications on self-
efficacy and acquisition of basic math skills in 10 year old students.**

Consent Form for Parent/caregiver (Selected Students)

I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.

I understand that my child's participation is voluntary and that he/she is free to withdraw at any time, without giving a reason.

I agree that my child's data in this study may be stored (after it has been anonymised) as a file on a UC computer and will be destroyed after five years.

I understand that my child's test results from this study will have no effect on my child's academic/school grades.

I understand that my child's video will be viewed by the researcher, my child, supervisors, parents/caregiver and the class teacher.

I understand that any information collected during this project (with the exception of video) will only be viewed by the researcher and her supervisors, and remain strictly confidential.

I understand that I will receive a report on the finding of the study and also will receive my child video on CD at the end of the study. I have written my email address below for the report to be sent.

I understand that I can get more information about this project from Kanta kte14@uclive.ac.nz or her supervisor Lawrence Walker on ph: (03) 345 8153 (Lawrence.walker@canterbury.ac.nz), and that I can contact The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz) if I have any complaints about the research.

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

Thank you.

Name of Parent/caregiver _____

Date _____

Signature _____

Name of your child _____

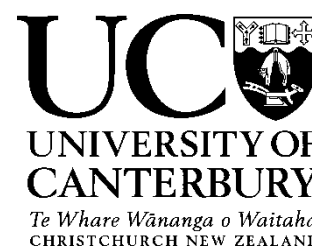
Email address for report _____

Please return this consent form in the sealed envelope to your child class teacher by 20th May 2013.

Telephone: +64 3 3667001 extn:43229

Email: kte14@uclive.ac.nz

17th May 2013



**The effects of using video self-modelling and computer/iPad applications on self-
efficacy and acquisition of basic math skills in 10 year old students.**

Information Sheet for Students

My name is Kanta Techaphulphol and I am a student with Child and Family Psychology Masters degree at the College of Arts, University of Canterbury. I would like to work with you on my research project where I am going to test your basic maths three times during my project. I will look at the results and talk with your class teacher and I may invite you to work with me further.

My project involves: testing your basic number facts knowledge and how fast you can do these. If I can help you, then you will be invited to join the iPad programme to use video self-modelling and iPad application to see if I can increase your basic number facts knowledge and speed. This project will not effective your school marks. After I have finished doing that, I will give the results of this project to your class teacher and yourself and to your parents/caregiver.

As you have been selected, you will be given a code name so that no one will know your name and school, your parents/caregiver name nor the name of your teacher.

Your parents/caregiver and teacher have also been asked to help. If you have any questions, you can talk to your parents/caregiver/teacher or to me. If you change your mind about being in the project, that's fine, too. All you have to do is to tell me, your parents/caregiver or teacher and you can withdraw. I will do my very best to remove any information relating to you, provided this is reasonably achievable.

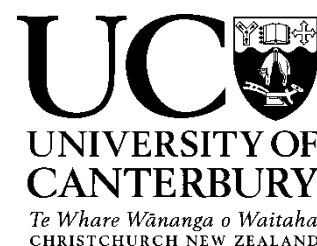
Thank you for helping with the project

Kanta Techaphulphol

Kanta Techaphulphol

Telephone: +64 3 3667001 extn:43229

Email: kte14@uclive.ac.nz



**The effects of using video self-modelling and computer/iPad applications on self-
efficacy and acquisition of basic math skills in 10 year old students.**

Consent Form for Students - Screening

	Please initial box
I confirm that I have understood the information sheet for the above study and have had the opportunity to ask questions.	
I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason.	
I understand that my test result from this study will have no effect to my academic/school grades.	
I agree that my data gathered in this study may be stored (after my name has changed to the code name) as a file on UC computer and will be destroyed after five years.	
I agree to take part in the above study and understand that I will do the tasks during the school time.	
I understand that I can get more information about this project from Kanta kte14@uclive.ac.nz or her supervisor Lawrence Walker on ph: (03) 345 8153 (Lawrence.walker@canterbury.ac.nz), and that I can contact The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz) if I have any complaints about the research.	
I agree to participate in this study and my parents have also given consent on their consent form.	

Your name

Date

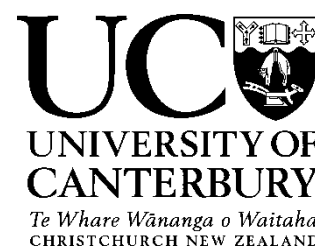
Signature

Please return this consent form in the sealed envelope to your class teacher by 20th May 2013

Telephone: +64 3 3667001 extn:43229

Email: kte14@uclive.ac.nz

17th May 2013



**The effects of using video self-modelling and computer/iPad applications on self-
efficacy and acquisition of basic math skills in 10 year old students.**

Information Sheet for Selected Students

My name is Kanta Techaphulphol and I am a student with Child and Family Psychology Masters degree at the College of Arts, University of Canterbury. I would like to work with you on my research project where I am going to test your basic maths three times during my project. I will look at the results and talk with your classroom teacher and I may invite you to work with me further.

My project involves: testing your basic number facts knowledge and how fast you can do these. You are invited to join the iPad teaching strategy. This will include two teaching strategies: video self-modelling (VSM) and iPad apps (application). The VSM will be done by (making a video tape of you saying the basic number sentences, the video will be viewed on the iPad), and iPad apps (an iPad will be used to deliver practice in basic number facts). To see if I can increase your basic number facts knowledge and speed. You will also be asked to complete a test called Patterns of Adaptive Learning Scales (PALS). PALS is a self-evaluation sheet which uses emoticons (ie, 😊, 😞) will be used for you to show how you feel about mathematics. This test will tell me how you have been enjoying working with the video self-modelling and iPad application. Additional training and instruction will be provided to you during my project. This project will not affect your school marks. After I have finished doing that, I will send the results of this project to your class teacher and your parents/caregiver by e-mail. You will also receive your video on CD by the end of the project.

As you have been selected, you will be given a code name so that no one will know your name and school, your parents name or the name of your teacher.

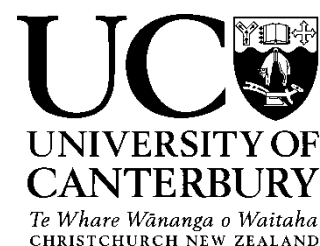
Your parents/caregiver and teacher have also been asked to help. If you have any questions, you can talk to your parents/caregiver/teacher or to me. If you change your mind about being in the project, that's fine, too. All you have to do is to tell me, your parents/caregiver or teacher and you can withdraw. I will do my very best to remove any information relating to you, provided this is reasonably achievable.

Thank you for helping with the project
Kanta Techaphulphol

Kanta Techaphulphol

Telephone: +64 3 3511753

Email: kte14@uclive.ac.nz



The effects of using video self-modelling and computer/iPad applications on self-efficacy and acquisition of basic math skills in 10 year old students.

Consent Form for Selected Students	Please tick the box
I confirm that I have understood the information sheet for the above study and have had the opportunity to ask questions.	
I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason.	
I agree that my data gathered in this study may be stored (after my name has changed to the code name) as a file on UC computer and will be destroyed after five years.	
I understand that my test result from this study will have no effect to my academic/school grades.	
I understand that my video will be viewed by the researcher, myself, supervisors, parents/caregiver and the class teacher.	
I understand that all information collected during this project (with the exception of video) will only be viewed by the researcher and her supervisors, and remain strictly confidential.	
I understand my parents/caregiver will receive a report on the finding of the study and also will receive my video on CD at the end of the study.	
I agree to take part in the above study and understand that I will do the tasks during the school time.	
I understand that I can get more information about this project from Kanta kte14@uclive.ac.nz or her supervisor Lawrence Walker on ph: (03) 3458153 (Lawrence.walker@canterbury.ac.nz) , and that I can contact The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz) if I have any complaints about the research.	
I agree to participate in this study and my parents have also given consent on their consent form.	

Your name

Date

Signature

Please return this consent form in the sealed envelope to your class teacher by 20th May 2013.

APPENDIX D:

The Test

Name: _____

Date: _____

Practice Attempt

$$\begin{array}{r} 4 \\ - 1 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ + 5 \\ \hline \\ \hline \end{array}$$

$$2 \overline{) 10}$$

$$\begin{array}{r} 9 \\ \times 2 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ \times 2 \\ \hline \\ \hline \end{array}$$

Find the sum.

$$\begin{array}{r} 4 \\ + 3 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ + 8 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ + 2 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ + 3 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ + 6 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ + 5 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ + 5 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ + 4 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ + 5 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 1 \\ + 4 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ + 4 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ + 9 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ + 4 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ + 2 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ + 1 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ + 8 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ + 4 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ + 7 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ + 2 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ + 3 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ + 5 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ + 4 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ + 7 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ + 4 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ + 7 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ + 6 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ + 2 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ + 8 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ + 8 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ + 1 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ + 7 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ + 5 \\ \hline \\ \hline \end{array}$$

Find the difference.

$$\begin{array}{r} 9 \\ - 4 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ - 5 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ - 7 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ - 3 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ - 4 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 1 \\ - 1 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ - 2 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ - 4 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ - 9 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ - 2 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ - 3 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ - 1 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ - 5 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ - 5 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ - 8 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ - 4 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ - 4 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ - 1 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ - 1 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ - 3 \\ \hline \\ \hline \end{array}$$

Name: _____

Date: _____

Find the product.

1	3	5	6	5	3	9	4	6
$\times 8$	$\times 6$	$\times 7$	$\times 7$	$\times 4$	$\times 2$	$\times 2$	$\times 3$	$\times 2$
_____	_____	_____	_____	_____	_____	_____	_____	_____

8	8	3	5	8	6	4	7	4
$\times 6$	$\times 8$	$\times 1$	$\times 5$	$\times 7$	$\times 5$	$\times 7$	$\times 5$	$\times 4$
_____	_____	_____	_____	_____	_____	_____	_____	_____

6	2	5	9	1	5	4	4	1
$\times 9$	$\times 2$	$\times 6$	$\times 4$	$\times 9$	$\times 9$	$\times 1$	$\times 6$	$\times 7$
_____	_____	_____	_____	_____	_____	_____	_____	_____

6	6	1	2	4	9	3	7	5
$\times 3$	$\times 8$	$\times 3$	$\times 8$	$\times 9$	$\times 5$	$\times 8$	$\times 2$	$\times 8$
_____	_____	_____	_____	_____	_____	_____	_____	_____

Find the quotient.

$5 \overline{) 10}$	$1 \overline{) 2}$	$8 \overline{) 8}$	$6 \overline{) 12}$	$8 \overline{) 56}$	$3 \overline{) 27}$	$8 \overline{) 64}$	$7 \overline{) 7}$
---------------------	--------------------	--------------------	---------------------	---------------------	---------------------	---------------------	--------------------

$8 \overline{) 16}$	$1 \overline{) 5}$	$2 \overline{) 10}$	$7 \overline{) 49}$	$2 \overline{) 12}$	$8 \overline{) 32}$	$5 \overline{) 25}$
---------------------	--------------------	---------------------	---------------------	---------------------	---------------------	---------------------

Name: _____

Date: _____

Start and stop when told. Work as fast as you can, circle any you don't know and move on.
Come back to them if there is time.

1	10	7	5	6	2	6
+ 7	+ 9	+ 8	+ 9	+ 6	+ 8	+ 7
_____	_____	_____	_____	_____	_____	_____

9	2	1	3	6	3	4
+ 9	+ 5	+ 2	+ 5	+ 3	+ 6	+ 7
_____	_____	_____	_____	_____	_____	_____

4	1	1	3	5	9	9
+ 2	+ 5	+ 4	+ 4	+ 4	+ 3	+ 8
_____	_____	_____	_____	_____	_____	_____

7	8	7	2	7	5	6
+ 7	+ 8	+ 3	+ 7	+ 2	+ 8	+ 5
_____	_____	_____	_____	_____	_____	_____

6	3	6	7	10	8	8
+ 2	+ 10	+ 8	+ 6	+ 2	+ 6	+ 5
_____	_____	_____	_____	_____	_____	_____

7	9	3	3	3	7	2
+ 4	+ 2	+ 9	+ 7	+ 2	+ 5	+ 4
_____	_____	_____	_____	_____	_____	_____

2	7	8	5	4	4	5
+ 2	+ 1	+ 2	+ 7	+ 1	+ 9	+ 5
_____	_____	_____	_____	_____	_____	_____

8	3	10	9	8	6	9
+ 3	+ 8	+ 7	+ 5	+ 4	+ 10	+ 4
_____	_____	_____	_____	_____	_____	_____

Name:

Date:

$\begin{array}{r} 8 \\ + 9 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ + 3 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ + 5 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ + 10 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ + 1 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ + 4 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ + 10 \\ \hline \end{array}$
$\begin{array}{r} 3 \\ + 3 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ + 2 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ + 6 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ + 10 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ + 8 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ + 6 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ + 3 \\ \hline \end{array}$
$\begin{array}{r} 4 \\ + 8 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ + 5 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ + 4 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ + 6 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ + 9 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ + 9 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ + 10 \\ \hline \end{array}$
$\begin{array}{r} 2 \\ + 9 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ + 3 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ + 4 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ + 1 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ + 1 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ + 10 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ + 6 \\ \hline \end{array}$
$\begin{array}{r} 3 \\ + 1 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ + 10 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ + 10 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ + 6 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ + 7 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ + 3 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ + 9 \\ \hline \end{array}$
$\begin{array}{r} 8 \\ + 7 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ + 6 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ + 1 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ + 1 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ + 8 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ + 1 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ + 3 \\ \hline \end{array}$
$\begin{array}{r} 9 \\ + 1 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ + 10 \\ \hline \end{array}$					

Name: _____

7/05/2013

Start and stop when told, work as fast as you can. Circle any you don't know and move onto the next.

$\begin{array}{r} 5 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \times 2 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ \times 5 \\ \hline \end{array}$
$\begin{array}{r} 2 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ \times 2 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ \times 8 \\ \hline \end{array}$
$\begin{array}{r} 9 \\ \times 1 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ \times 2 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \times 5 \\ \hline \end{array}$
$\begin{array}{r} 8 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ \times 2 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ \times 2 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ \times 5 \\ \hline \end{array}$
$\begin{array}{r} 3 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ \times 1 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \times 1 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ \times 3 \\ \hline \end{array}$
$\begin{array}{r} 6 \\ \times 1 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ \times 2 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ \times 5 \\ \hline \end{array}$
$\begin{array}{r} 7 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ \times 2 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ \times 2 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ \times 6 \\ \hline \end{array}$
$\begin{array}{r} 5 \\ \times 1 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \times 1 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ \times 4 \\ \hline \end{array}$
$\begin{array}{r} 3 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ \times 1 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ \times 1 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \times 2 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ \times 5 \\ \hline \end{array}$

Name:

7/05/2013

$\begin{array}{r} 1 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ \times 1 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ \times 9 \\ \hline \end{array}$
$\begin{array}{r} 8 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ \times 8 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \times 7 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ \times 4 \\ \hline \end{array}$
$\begin{array}{r} 6 \\ \times 9 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ \times 3 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ \times 5 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ \times 5 \\ \hline \end{array}$
$\begin{array}{r} 3 \\ \times 2 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ \times 4 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ \times 7 \\ \hline \end{array}$				

APPENDIX E:
Specific level test

Name _____

-Page 1 of 6-

$$\begin{array}{r} 7 \\ + 8 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ + 7 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ + 9 \\ \hline \end{array}$$

$$\begin{array}{r} 11 \\ + 9 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ + 7 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ + 6 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ + 8 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ + 10 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ + 7 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ + 5 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ + 9 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ + 4 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ + 4 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ + 2 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ + 10 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ + 9 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ + 5 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ + 8 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ + 1 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ + 7 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ -9 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ -2 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ -5 \\ \hline \end{array}$$

$$\begin{array}{r} 11 \\ -4 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ -1 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ -6 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ -6 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ -7 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \\ -6 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ -3 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ -4 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ -2 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ -4 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ -3 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ -1 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ -3 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ -2 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ -3 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ -8 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ -2 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} 1 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 1 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ \times 11 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ \times 1 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ \times 0 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ \times 6 \\ \hline \end{array}$$

$9 + 9 = \dots$

$81 + 9 = \dots$

$12 + 2 = \dots$

$64 + 8 = \dots$

$63 + 7 = \dots$

$100 + 10 = \dots$

$16 + 8 = \dots$

$8 + 8 = \dots$

$25 + 5 = \dots$

$32 + 8 = \dots$

$56 + 8 = \dots$

$5 + 1 = \dots$

$27 + 3 = \dots$

$32 + 4 = \dots$

$12 + 6 = \dots$

$2 + 1 = \dots$

$10 + 5 = \dots$

$49 + 7 = \dots$

$10 + 2 = \dots$

$7 + 7 = \dots$

$15 \div 3 = \dots$

$9 \div 3 = \dots$

$21 \div 3 = \dots$

$63 \div 9 = \dots$

$30 \div 6 = \dots$

$42 \div 7 = \dots$

$54 \div 9 = \dots$

$72 \div 8 = \dots$

$35 \div 5 = \dots$

$16 \div 4 = \dots$

$27 \div 3 = \dots$

$18 \div 3 = \dots$

$40 \div 10 = \dots$

$8 \div 4 = \dots$






$42 \div 6 = \dots$

$16 \div 4 = \dots$

APPENDIX F: Self-efficacy test (PALS)

The first question is an example






I like chocolate ice cream

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5






PLEASE CIRCLE THE NUMBER THAT BEST DESCRIBES WHAT YOU THINK OR FEEL. NO ONE AT SCHOOL OR HOME WILL SEE YOUR ANSWERS.

1. Personal Achievement Goal Orientations (mastery goal orientation)






It's important to me that I learn a lot of new concepts this year.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5






One of my goals in class is to learn as much as I can.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5






One of my goals is to master a lot of new skills this year.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5

It's important to me that thoroughly understand my class work.






				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5

It's important to me that I improve my skill this year.






				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5

2. Personal Achievement Goal Orientations (performance-approach goal orientation)






It's important to me that other students in my class think I am good at my class work.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5






One of my goals is to show others that I'm good at my class work.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5






One of my goals is to show others that class work is easy for me.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5

One of my goals is to look smart in comparison to the others students in my class.






				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5

It's important to me that I look smart compared to others in my class.






				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5

3. Personal Achievement Goal Orientations (performance-avoid goal orientation)






It's important to me that I don't look stupid in class.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5






One of my goals is to keep others from thinking I am not smart in class.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5

It's important to me that my teacher doesn't think that I know less than others in class.






				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5

One of my goals in class is to avoid looking like I have trouble doing the work.






				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5

4. Academic-Related Perceptions, Beliefs, and Strategies (academic efficacy)






I'm certain I can master the skills taught in class this year.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5






I'm certain I can figure out how to do the most difficult class work.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5






I can do almost all the work in class if I don't give up.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5

Even if the work is hard, I can learn it.






				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5

I can do even the hardest work in this class if I try.






				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5

5. Academic-Related Perceptions, Beliefs, and Strategies (avoiding novelty)






I would prefer to do class work that is familiar to me, rather than work I would have to learn how to do.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5






I don't like to learn a lot of new concepts in class.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5






I prefer to do work as I have always done it, rather than trying something new.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5

I like academic concepts that all familiar to me, rather than those I haven't thought about before.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5

I would choose class work I knew I could do, rather than work I haven't done before.

				
Not at all 1	A little 2	Some what true 3	True 4	Very true 5