INFLUENCE OF STUDENT ENGAGEMENT, MOODS AND COMPLETED ASSIGNMENTS WITH DIFFERENTIATED HOMEWORK ON NORMALIZED GAINS AND GROWTH IN READING LITERATURE USING iPADS

A dissertation submitted by

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ABSTRACT

The purpose of this study was to investigate how engagement, mood and number of assignments completed on computerized differentiated homework using an iPad in a one-to-one mobile device environment influence the growth index and normalized gain in reading literature benchmark assessments of students in grades five, six, and seven.

Furthermore, this study investigated if gender or special education status influences the growth index or normalized gain in reading literature benchmark assessment scores when using an iPad in a one-to-one mobile device environment on computerized differentiated homework.

Data from the Northwest Evaluation Association (NWEA) fall Measures of Academic (MAP) Progress assessment was analyzed for students’ areas of weakness in reading literature. Using assessment results, students were assigned differentiated homework to complete on an iPad, while reporting their level of engagement with the app and present mood. Growth and normalized gains were calculated following the spring administration of the NWEA MAP. Five hundred-twelve suburban public school students, grades five, six, and seven were given iPads containing differentiated homework assignments during the 2012-2013 academic year.

A one-way group analysis of variance (ANOVA) showed that there was a statistically significant difference for level of engagement with iPad applications among students in grades five, six, and seven. An independent t-test showed that special education students were significantly more engaged with their differentiated homework than non-classified special education students. An independent t-test showed that students
with a positive mood had a statistically significant higher growth index and normalized gain than students with a negative mood.

The findings in this study revealed that when using an iPad to complete differentiated homework, student assessment scores in reading literature were influenced by grade level and mood. The findings in this study revealed student grade level and present mood influenced their growth on reading literature assessment scores when completing differentiated homework using an iPad. Additional findings indicated that as they got older, students reported less engagement with iPad assignments. The study concluded with recommendations for improving; engagement level, percentage of assignments completed and teacher awareness of student mood.
DEDICATION

This dissertation is dedicated to my wife Suzanne and three children; Leigh, Parker, and Shane. Without their unwavering support, patience and love, my ability to complete this doctoral degree would not have been possible. Suzanne’s pledge to motherhood and marriage permitted me the time and resources necessary to accomplish this milestone.

As for my children, Leigh, Parker, and Shane, I encourage you to always strive for excellence in your academia, and to challenge yourself just further than you are capable, with every endeavor in which you embark.

I would also like to dedicate this dissertation to my parents, Andrew and Judi Hepworth who have always supported my educational goals while remaining committed to the success of my family, and of me.
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### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>DEDICATION</td>
<td>v</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xii</td>
</tr>
<tr>
<td>LIST OF GRAPHS</td>
<td>xv</td>
</tr>
<tr>
<td>CHAPTER I INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>- Introduction</td>
<td>1</td>
</tr>
<tr>
<td>- Purpose of the Study</td>
<td>4</td>
</tr>
<tr>
<td>- Statement of the Problem</td>
<td>5</td>
</tr>
<tr>
<td>- Research Questions</td>
<td>5</td>
</tr>
<tr>
<td>- Research Question One</td>
<td>5</td>
</tr>
<tr>
<td>- Research Question Two</td>
<td>5</td>
</tr>
<tr>
<td>- Research Question Three</td>
<td>5</td>
</tr>
<tr>
<td>- Research Question Four</td>
<td>5</td>
</tr>
<tr>
<td>- Research Question Five</td>
<td>6</td>
</tr>
<tr>
<td>- Research Question Six</td>
<td>6</td>
</tr>
<tr>
<td>- Research Question Seven</td>
<td>6</td>
</tr>
<tr>
<td>- Definition of Major Variables and Terms</td>
<td>6</td>
</tr>
<tr>
<td>- Computerized Differentiated Homework</td>
<td>6</td>
</tr>
<tr>
<td>- eSpark</td>
<td>7</td>
</tr>
<tr>
<td>- Benchmark Assessment</td>
<td>7</td>
</tr>
</tbody>
</table>
Statement of the Problem

Research Questions

Research Question One

Research Question Two

Research Question Three

Research Question Four

Research Question Five

Research Question Six

Research Question Seven

Selection of Subjects

Setting

Data Gathering Techniques

Northwest Evaluation Association

eSpark

Research Questions

Research Question One

Research Question Two

Research Question Three

Research Question Four

Research Question Five

Research Question Six

Research Question Seven

CHAPTER IV DATA ANALYSIS AND FINDINGS
Introduction ........................................................................................................... 61

Research Questions ............................................................................................... 61

Research Question One ............................................................................. 61
Research Question Two ............................................................................ 62
Research Question Three .......................................................................... 62
Research Question Four ............................................................................ 62
Research Question Five ............................................................................ 62
Research Question Six .............................................................................. 62
Research Question Seven .......................................................................... 62

Description of Subjects ......................................................................................... 63

Research Questions ............................................................................................... 64

Research Question One ........................................................................... 64
Research Question Two ............................................................................ 69
Research Question Three .......................................................................... 73
Research Question Four ............................................................................ 83
Research Question Five ............................................................................ 89
Research Question Six .............................................................................. 93
Research Question Seven .......................................................................... 95

CHAPTER 5 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS ............. 91

Introduction ........................................................................................................... 96

Summary ............................................................................................................... 96

Conclusions ......................................................................................................... 100

Research Question One ......................................................................................... 100
LIST OF TABLES

Table 4.1 Distribution of Students by Grade…………………………………………………..63
Table 4.2 Distribution of Students by Gender……………………………………………..63
Table 4.3 Distribution of Students by Special Education Status…………………………64
Table 4.4 Descriptive Statistics for Level of Engagement of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework………..65
Table 4.5 Descriptive Statistics for Percentage of Assignments Completed of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework……………………………………………………………..67
Table 4.6 Descriptive Statistics for Positive and Negative Moods Recorded of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework ..........................................................68
Table 4.7 Descriptive Statistics of Positive and Negative Mood Percentage Selected by Students Prior to Completing Differentiated Homework on iPad…………69
Table 4.8 Descriptive Statistics for Growth Index of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework .................................70
Table 4.9 Descriptive Statistics for Normalized Gain of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework ............................72
Table 4.10 Descriptive Statistics for Engagement Level of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework ...............74
Table 4.11 One-way between Groups Analysis of Variance (ANOVA) Comparing Engagement Level, Percentage of Completed Assignments, Positive Mood, and Negative Mood among Grade Five, Six, and Seven Students…….....75
Table 4.12 Post Hoc Test: Multiple Comparisons for Engagement Level by Grade…..76
Table 4.13 Descriptive Statistics for Percentage of Assignments Completed of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework……………………………………………………………..77
Table 4.14 Post Hoc Test: Multiple Comparisons for Percentage of Assignments Completed……………………………………………………………………………………78
Table 4.15 Descriptive Statistics of Positive and Negative Mood for All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework…………………………………………………………...79

Table 4.16 Post Hoc Test: Multiple Comparisons for Positive and Negative Mood……..80

Table 4.17 Independent Samples t-test Comparing Male and Female Engagement Level, Percentage Homework Assignments Completed, Positive Mood, and Negative Mood………………………………………………………………………………81

Table 4.18 Independent Samples t test Comparing Special Education Status Engagement Level, Percentage Homework Assignments Completed, Positive Mood, and Negative Mood………………………………………………………..….82

Table 4.19 One-way between Groups Analysis of Variance (ANOVA) Comparing Growth Index and Normalized Gain among Grade Five, Six, and Seven Students………………………………………………………………...…….84

Table 4.20 Descriptive Statistics for Growth Index of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework ………………… 85

Table 4.21 Descriptive Statistics for Normalized Gain of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework ……………… 85

Table 4.22 Post Hoc Test: Multiple Comparisons for Growth…………………………..86

Table 4.23 Post Hoc Test: Multiple Comparisons for Normalized Gain…………….…..87

Table 4.24 Independent Samples t test Comparing Male and Female Growth Index and Normalized Gain………………………………………………………….….87

Table 4.25 Independent Samples t test Comparing Special Education Status Growth Index and Normalized Gain……………………………………………….…88

Table 4.26 Pearson Correlation Matrix between Growth Index, Engagement Level, Percentage of Assignments Completed, Positive Mood, and Negative Mood……………………………………………………………………90

Table 4.27 Pearson Correlation Matrix between Normalized Gain, Engagement Level, Percentage of Assignments Completed, Positive Mood, and Negative Mood……………………………………………………………………92

Table 4.28 Pearson Correlation Matrix between Growth Index and Normalized Gain… 92

Table 4.29 Model Summary for Growth Index…………………………………………… 93
Table 4.30 Coefficients................................................................. 94
Table 4.31 Model Summary....................................................... 94
Table 4.32 Coefficients................................................................. 95
LIST OF GRAPHS

Graph 4.1 Graphical Representation for Engagement Level of Grade Five, Six, and Seven Students using iPads on Differentiated Homework ......................66

Graph 4.2 Graphical Representation of Growth Index Frequencies.........................71

Graph 4.3 Graphical Representation of Normalized Gain Frequencies......................73

Graph 4.4 Engagement Level of Grade Five, Six, and Seven Students Using an iPad on Computerized Differentiated Homework..............................77
LIST OF FIGURES

Figure 2.1 Cycle of Feedback ........................................................................................................27

Figure 2.2 Benchmark Assessments and Differentiated Instruction support of Student Achievement ........................................................................................................31
CHAPTER I
INTRODUCTION

Introduction

Throughout history, attempts to incorporate innovation within pedagogy are abundant, yet not necessarily well integrated into the profession (Schmoker, 1999). In the 1500s, Niccolo Machiavelli wrote, “The one who adapts his policy to the times prospers, and likewise that the one whose policy clashes with the demands of the times does not” (Machiavelli, 1513, trans. 2011). In the 1800s, the invention of the blackboard was “praised as a magical new technology of learning” (Tyack & Cuban, 1995, p. 55). Recent legislation in the United States has redirected the testing environment in public education to improve learning through the use of data-driven information. Emerging technology is making data-driven decision opportunities not previously available, achievable (Johnson, 1997).

Technology, differentiation, and data-driven instruction are powerful tools in developing school improvement policies that drive decisions, although sometimes those decisions are not directly associated with assessment results (Messelt, 2004). As data analysis becomes increasingly available, discerning school districts and leaders are applying data-driven decision-making techniques to both analyze assessment results and student achievement and to increase assessment results and student achievement (Messelt, 2004).
The importance of collecting “data on student learning that are both timely and accurate” has become a necessity in modern education (Johnson, 1997). This drive is further pushed as our global economy and flattened world has increased global competition (Friedman, 2005). According to Johnson (1997), using data to drive competitive instruction, decision-making judgments follow the use of accurate information by means of effective educationalists. Johnson considers technology the pragmatic tool to support the interpretation of data, and to identify differences between learners in a group. Richard Marzano affirms educators need to learn to use data “to guide decisions [as they] relate directly to student achievement” (Marzano, 2003, p. 56).

Data must be informative to guide instruction using frequent formative (benchmark) assessments to redirect and guide instruction, which are more valid than solitary summative assessments (Marzano, 2003). Teachers use benchmark assessment data to differentiate their instruction and allow them “to build upon a student’s current construct and skill ability, while considering the developmental ability of the individual child” (Feldman, 2010).

One of the most widely used and commercially available benchmark assessments for differentiating instruction and teacher planning is the Northwest Evaluation Association (NWEA) Measure of Academic Progress (MAP) program (MAP-US Dept. of Ed, 2012). The NWEA MAP program identifies specific national standardized skills individual students require to meet their needs for developmental growth through engaging computer adaptive testing.

The 2011 Horizon Report highlights the use of data-driven learning analytics and its promise to offer reliable and valid digital portfolios designed to help teachers redirect
instruction. Learning analytics is an information technological tool which uses statistical analysis of data to discover useful information, study engagement, predict and advise student performance, revise curricula, provide real-time feedback, spot potential issues, foster informed decisions, and better train staff (Berk, 2004; Johnson, Smith, Willis, Levine, & Haywood, 2011; Retalis, Georgiakakis, & Dimitriadis, 2006; Siemens, 2011).

The Horizon Report further states the use of data to assess student performance with technology will enable educators to predict and advise students with more specific information tailored “to each student’s level of need and ability” (Johnson et al., 2011, p. 28). The Horizon Report (2011) concludes learning analytics will “transform pedagogy in a more radical manner” than previous technology accomplished.

As districts and state mandates require more instruction of Collaboration, Problem Solving, Critical Thinking, and Communication as identified in the Partnership for 21st Century Skills, (www.p21.org, 2011), the need for more timely data enriched analytical tools for individual student reporting is becoming increasingly more necessary (Siemens, 2011). Using assessment data analysis for effective decision making can narrow the “achievement gaps between student subgroups” (Messelt, 2004, p. 1); and promote student improvement by educators, “leverage[ing] it as a tool for improvement rather than expecting [the] technology to drive improvement” (Nodine & Petrides, 2006, p. 51). Northwest Evaluation Association (NWEA) is a non-profit testing organization that provides formative data analysis by benchmarking students three times a year in a computer adaptive testing environment. The use of benchmark assessments for progress monitoring must be strategically designed to support an organizational shift towards an increase in student growth expectations (Li, Marion, Perie, & Gong, 2010).
The ability of a teacher to differentiate offers: “(1) a variety of ways for students to explore curriculum content, (2) a variety of sense-making activities or processes through which students can come to understand and "own" information and ideas, and (3) a variety of options through which students can demonstrate or exhibit what they have learned” (Tomlinson, 1995, p. 78). As such, differentiation consists of elemental pathways, assignments, assessments, and/or homework for students’ individualized instructional needs in a heterogeneously academic leveled class (Bambrick-Santoyo, 2010; Santangelo & Tomlinson, 2012).

Several methodologies exist for teachers to differentiate their class for individualized instruction. Tomlinson (2000) specifically sites “content and process” as two primary methodologies to differentiate for individualized instruction. eSpark is a third party vendor that assigns differentiated content applications to students on their iPad from interpretation of NWEA benchmark assessment results, creating a process specific for individualized instruction.

Purpose of the Study

The purpose of this study was to investigate how engagement, mood and number of assignments completed on computerized differentiated homework using an iPad in a one-to-one mobile device environment influence the growth index and normalized gain in reading literature benchmark assessments of students in grades five, six, and seven. Furthermore, this study investigated if gender or special education status influenced the growth index or normalized gain in reading literature benchmark assessment scores when using an iPad in a one-to-one mobile device environment with computerized differentiated homework.
Statement of the Problem

How did engagement, mood, and number of assignments completed on computerized differentiated homework influence grade five, six and seven students’ growth index and normalized gain in reading literature, as measured by the Northwest Evaluation Association benchmark assessment when using an iPad in a one-to-one mobile device environment.

Research Questions

Research question one

What were the engagement, moods, and percentage of assignments completed for grade five, six and seven students using an iPad for computerized differentiated homework?

Research question two

What was the growth index and normalized gain in reading literature for grade five, six and seven students using an iPad for computerized differentiated homework?

Research question three

How did students’ engagement, moods and percentage of assignments completed on computerized differentiated homework using an iPad relate to grade, gender and special education status?

Research question four

How did students’ growth index and normalized gain in reading literature compare by grade, gender, and special education status?
Research question five

What was the relationship between engagement, moods, percentage of assignments completed on computerized differentiated homework, growth index, and normalized gain on reading literature?

Research question six

How did students’ engagement, moods, percentage of assignments completed on computerized differentiated homework, grade, gender, and special education status predict the level of growth index and normalized gain in reading literature?

Research question seven

How did students’ engagement, moods, percentage of assignments completed on computerized differentiated homework, grade, gender, and special education status predict the level of normalized gain in reading literature?

Definition of Major Variables and Terms

Computerized Differentiated Homework

Differentiation is defined as the use of different learning styles, readiness, and interest in planning instruction to reach a heterogeneous group (Tomlinson, 1995). Tomlinson explains differentiation is not “an instructional strategy” rather it is what a teacher does, a way of thinking and is a philosophy inherent in a set of beliefs (Tomlinson, 2000). Strategies embedded in differentiation require intentional learning for individual students through the assignment of specific targeted tasks to maximize student growth and improve student achievement (Tomlinson & Allan, 2000, p. 4; Goddard, Goddard, & Tschannen-Moran, 2007). For the purpose of this study, computerized differentiated homework will refer to an array of iPad applications purposefully assigned
by a third party vendor (eSpark) for homework to students on a mobile platform (iPad); designed to support skill development in the area of reading literature as determined by analysis of a computer adaptive testing benchmark assessment tool, Measures of Academic Progress (MAP) by the Northwest Evaluation Association (NWEA).

**eSpark**

eSpark is a third party vendor that assigns differentiated Common Core standards based educational apps to students on the iPad from interpretation of NWEA benchmark assessment results; creating a profile specific for individualized learning. Students are assigned sets of eight to 10 student–centric goal applications identified to develop deeper understanding of content. Teams of educators continuously monitor the app store for educational apps that reflect five dimensions. The dimensions include:

1. Alignment to Common Core Learning Standards
2. Ability to relate to real world problem solving environment.
3. Intuitiveness of app to support the students in their learning.
4. Level of engagement and interactivity.
5. Scaffolding of Learning through feedback and multiple attempts.

(https://esparklearning.com/educational-apps-101-how-do-i-find-the-best-apps-for-students/, 2013). Apps are downloaded to the students’ iPads, in specific reading areas of literature, informational text, and/or foundational text, and vocabulary for skill development.

**Benchmark Assessment**

Benchmark (formative) assessments are “tests administered at scheduled times during the year…to evaluate students progression on a specific set of standards that students
must master to be on track to reach end-of-year learning goals.” (MAP-US Dept. of Ed, 2012). Benchmark assessment data can be used to differentiate instruction for students by providing a concrete framework for homogeneously grouping of assignments through instructional delivery. For the purpose of this study, benchmark assessments will reference the computerized adaptive test, Measures of Academic Progress (MAP) administered by the Northwest Evaluation Association (NWEA) in the Fall and Spring to all students for the intent of establishing a student’s current achievement level in the area of reading literature and identifying areas necessary for growth.

Growth Index

The Northwest Evaluation Association Growth Index represents the number of points by which the student[s] exceeded the average growth (plus values), fell short of the average growth (minus values), or equaled the average growth (0), as determined by the point growth norms (www.nwea.org/node/4355, 2013).

NWEA analyzes each student’s benchmark assessment using the Rausch Unit (RIT scale). The RIT scale “assigns a value of difficulty to each item, and with an equal interval measurement, so the difference between scores is the same regardless of whether a student is at the top, bottom, or middle of the scale” (http://www.nwea.org/node/98, 2013). The RIT scale measures understanding of content regardless of grade level, so the information helps to track a student’s progress from year to year based on Common Core Learning Standards (http://www.nwea.org/about-nwea/faq/Measures%20of%20Academic%20Progress%20(MAP)#faq-192, 2013). RIT points refer to the individual student progress growth on their reading skills assessment as measured and analyzed by NWEA. For the purpose of this study, growth index will refer to the deviation from a student’s expected growth score on the Spring benchmark.
assessment administered and predetermined by NWEA either above (positive), below (negative) or equaled (zero) to their actual achievement score on the Spring benchmark assessment.

**Normalized Gain**

Growth measures often use a pre and post assessment to show an increase or decrease over time (dependent upon the variable) when a condition has been established with subjects. In 1998, Richard Hake identified the normalized change for a large subject pool of physics students using pre- and post test data using “interactive engagement methods at $g_{IE} \approx 0.48$” (Dellwo, 2010). He defined student’s normalized gain “as the ratio of the actual average gain to the maximum possible average gain” (Hake, 1998). This study will define normalized gain by using Hake’s ratio formula.

$$g = \frac{(post-test) - (pre-test)}{(maximum \ test \ score) - (pre-test)} \quad (Hake, \ 1998)$$

For the purpose of this study, normalized gain will be defined as the following, Fall benchmark assessment results will serve as pre-test, Spring benchmark assessment results will serve as post-test, and a Rausch Unit (RIT) score of 281 will be used as the maximum test score for all student where N=573.

$$ex. \ g = \frac{(218) - (201)}{(255) - (201)} = \frac{17}{54} = .3148$$

**Mobile Device**

Information acquisition is immediately available as a result of modern technology (Rasmussen, Nichols, & Ferguson, 2006). The mobile technology most people globally carry around is more powerful than that of the first computers that landed on our moon only a half a century ago (Prensky, 2012). As such these mobile devices, such as the
Apple iPad, allow the user to read, write, record, film, and interact with applications in a nearly unlimited ability (Prensky, 2012). For the purpose of this study, mobile devices will be identified as student issued Apple iPads provided by the school district in a one-to-one environment. Students will be issued a 3rd Generation 16GB iPad for the entire academic year to use on and off school campus. Specific applications will be assigned to each student’s iPad for differentiated homework assignments as predetermined by third party computerized differentiated homework vendor eSpark.

Engagement

“Student engagement has come to refer to how involved or interested students appear to be in their learning and how connected they are to their classes” (Axelson, 2011). Students report more engagement in learning when they have more autonomy (Park, 2013). Park explains students feel more freedom, competency, and motivation when provided autonomy. Greene, Marti, and McClenney (2008) defined engagement as “the effort, both in time and energy, students commit to educationally purposeful activities” (p. 514). For the purpose of this study, engagement will refer to a student reporting their engagement with an application as either thumbs up (+1) or thumbs down (-1) when prompted to after completion of each differentiated homework assignment on the iPad. An average of each student’s engagement level will be calculated using the arithmetic mean.

Mood

Mood clearly affects a student learning (Verleur, Verhagen, & Heuvelman, 2007). Mood charting involves students recording their moods to help identify “contributing factors to their emotional state” (Matthews, Doherty, Sharry, & Fitzpatrick, 2008). When
completing computerized differentiated homework assignments, information is recorded by each student when they log into eSpark. Students are asked: “How do you feel right now?” Students are prompted to identify which of twelve emoticons best describes their current mood. Mood emoticons include: bored, bullied, cool, excited, fine, frustrated, happy, lonely, mad, proud, sad, and scared. For the purpose of this study, mood will be defined as the emotional state selected by a student when initiating eSpark assignments. Positive and Negative Moods will be summarized to better represent the individual differences amongst students. Positive moods include: cool, excited, fine, happy and proud. Negative Moods include: bored, bullied, frustrated, lonely, mad, sad, and scared.

Conceptual Rationale

In the twenty-first century, legislative action and improvements in technological innovation have altered how school leaders make decisions aimed at improving student achievement. Technology, differentiation, and data-driven instruction are being used as powerful tools in developing school improvement policies and driving decisions (Messelt, 2004). As timely and individualized data analysis becomes increasingly available, school districts are applying data-driven decision making techniques to increase scores and student achievement (Messelt, 2004).

Educators’ ability to use technological innovation, such as the iPad, to support computerized differentiation is emerging in abundance; the depth of success in these reform movements however is not as well understood (Schmoker, 1999). Schmoker explicitly states, “we need [more] data to improve teaching” (1999, p. 37). iPads specifically, “will continue to dominate, especially in the K-12 space” (Raths, 2012).
Differentiation is an educational approach designed to reach all learners’ specific needs in a heterogeneously mixed environment. Benchmark assessment data provides a concrete framework for identifying specific goals to differentiate learners. Differentiation can be applied more easily to an individual using technology once benchmarks have been established to specify goals for increased achievement. Technology integration such as mobile devices (iPad), online assignments, and individualized software programs (eSpark) can support timely data analysis and differentiation.

Benefits of mobile learning include: “immediate feedback and the ability to make a renewed attempt at solving problems” (Butler & Zerr, 2005, p. 58). Additionally, students report more enjoyment when given immediate feedback and differentiated opportunities. Butler and Zerr (2005) state a need to further research level of engagement and student differentiation. Mobile device platforms have proven to help students learn and participants report: “activities were both enjoyable and interesting, as well as stimulating of useful interactions (Cheng, Hwang, Wu, Shadiev, & Xie, 2010).

This study presented educational leader’s information for consideration to improve reading literature skills with computerized differentiated homework assignments using individualized mobile device technology. Digital natives represent young twenty-first century learners maturing with computers and the Internet (Biladeau, 2009). The immersion of technology by digital natives is driving this major shift in education more so than in any other point in history (Richardson, 2008). The use of mobile device technology and computerized differentiated homework to support learning should be seen as reasoning towards the acquisition of data-driven information within the educational
process and provide opportunities to differentiate and meet student needs more effectively (Prensky, 2004; Akintude, 2006).

Significance of Study

As data is increasingly used to initiate pedagogical reform in the era of No Child Left Behind and Race to the Top (RTTT), educators are applying the disaggregation of data to increase student achievement through differentiation in the classroom and by means of homework. While differentiation is something educators acknowledge as a valuable pedagogical approach, the ability to deliver it is often fraught with challenges. This study provides validation for engaging digital natives in differentiated homework using mobile device technology to increase reading literature achievement. This study could also help support administrators, teachers, parents, and students to understand factors that contribute to increasing reading literature achievement through the application of computerized differentiated homework.

Limitations

The participants in this study were grade five, six, and seven students at one middle school in the Northeast of the United States. All participants were given personal iPad’s to retain at the beginning of the school year to use with all subject areas and specifically English Language Arts reading differentiated applications based homework. All iPads were preloaded with software and prevented from downloading any additional applications other than school approved and designated apps. This study is limited to skills measured by the Northwest Evaluation Association Measures of Academic Progress assessment in Reading Literature.
CHAPTER II
REVIEW OF RELATED LITERATURE

Introduction

The authors of *Tinkering Toward Utopia: A Century of Public School Reform*, recognize educators are constantly seeking the Holy Grail to guide instruction, further enrichment, and ensure no child is left behind through the application of greater innovation for the purpose of achievement (Tyack & Cuban, 1995). Tyack and Cuban (1995) acknowledge that although hardly anyone currently considers the invention of the blackboard to be a “highly successful innovation” (p. 55), it was once “praised as a magical new technology of learning” (p. 55). Tyack and Cuban stated specifically, people in 1841 hailed the blackboard inventor as one of “the best contributors to learning and science, if not among the greatest benefactors of mankind” (p. 121).

Throughout history, attempts to develop teacher propensity for innovation and new pedagogy exist. The depth of success in these reform movements however is not as well understood (Schmoker, 1999). President Bush and Congress enacted the most significant reform effort in modern education by passing the No Child Left Behind (NCLB) Act in 2001 (No Child Left Behind [NCLB], 2002). The implementation of NCLB drastically altered testing in schools and how school leaders would make decisions related to improving school performance.

Recognition that data is a useful tool to implement improving school performance does not stem from the passing of NCLB. Educational researchers have been recognizing
data analysis is a crucial component of educational reform for decades. Schmoker (1999) references the previous works of Ron Edmonds, Grant Wiggins, Jacqueline and Martin Brooks, Bruce Joyce, Henry Levin, and Michael Fullan, as well as others, in his book *Results: The Key to Continuous School Improvement*, as researchers who have recognized data is essential to effective change in education. Prior to President Bush and NCLB legislation, all of the aforementioned authors “recognize we need data to improve teaching” (Schmoker, 1999, p. 37). Schmoker reports an era of data-driven information driving instruction can unintentionally create inherent fear as a result of the successes and failures revealed in the data analysis.

Data-driven instruction through the application of technology is a powerful tool to develop school improvement policies, albeit assessment results are not the sole source of the analyzed data (Messelt, 2004). Distinctive, timely, and appropriate data analysis is becoming increasingly and promptly available. Messelt (2004) reports that discriminating educational leaders are applying data-driven decision-making techniques, to promote increase student achievement.

*A Nation at Risk*

*A Nation at Risk* (1983), by the National Commission on Excellence in Education, documented the educational paradigm, as it existed at the time of its publication, in our nation’s history. The report cites educational researcher Paul Hurd as exclaiming, "We are raising a new generation of Americans that [are] scientifically and technologically illiterate" (p. 10). In the decades since the publication of *A Nation at Risk*, public schools have been continuously disaggregating data and attempting to incorporate systemic change to promote increased student achievement (Messelt, 2004).
The Commission (1983) established by the United States government to publish *A Nation at Risk* identified five recommendations towards implementing “promise lasting reform” (p. 23). The recommendations by the Commission included attention and restructuring of content, standards and expectations, time, teaching, and leadership and fiscal support. Two decades later, President Bush and Congress, enacted similar recommendations by adopting the No Child Left Behind (NCLB) Act in 2001 (No Child Left Behind [NCLB], 2002). The implementation of NCLB further emphasized the benchmark recommendations supported in *A Nation at Risk*. Specifically how school leaders have a duty to make decisions related to improving school performance. A major factor in improving school performance and educational reform is rooted with recognizing data analysis is a crucial component (Johnson, 1997).

The importance of collecting “data on student learning that are both timely and accurate” has become a necessity in modern education (Johnson, 1997). Johnson (1997) notes that traditionally data informed students’ of their progress and now under the guise of NCLB, data can be an essential component to drive curriculum and inform educators of better instructional delivery. The drive towards increased data-driven instruction has been aligned with global competition (Friedman, 2005).

Friedman (2005) specified, 21st century educators and their students must become increasingly competitive in a flattened worldwide economy. Friedman (2005) explains with the free-trade pact signed between China and the United States, Americans traditionally employed in low-skilled jobs have a problem seeking employment since most of those opportunities have moved over seas. As such, Americans seeking to
“maintain or improve their living standards” (Freidman, 2005, p. 153) are required to develop their skill set and improve their educational knowledge.

**Data-driven Instruction**

Using data to drive instruction, according to Johnson (1997), requires decision-making based on the use of accurate information by effective educators. He acknowledges technology is a useful tool to identify the differences between varied learners in a group. The collection of data is not the issue; it is the use of the data that is usually lacking (Charman, 2009).

Charman (2009) explains the wealth of data available to educators is abundant; data rich, information poor (DRIP) is the conundrum. The United Kingdom Charman (2009) reports collects data regarding students from primary schooling through secondary schooling and maintains the information through employment and higher education. The data is maintained with agencies including the school and government by means of national data collections (Charman, 2009, p. 4).

All educators need to learn to use the data “to guide decisions [as they] relate directly to student achievement” (Marzano, 2003). Marzano affirms that data must be informative to guide the instructional delivery and not manipulate the success of the student’s growth. Regular formative assessments that redirect and guide instruction are more valid than a single summative assessment (Marzano, 2003).

In 1989, Shapiro and Riley proposed data-driven approaches “tend to focus on the short term improvements…that are produced by data-emphasis programs” (p. 69). Albeit, this challenge, James H. Johnson concluded using data to drive instruction requires decision-making based on the use of accurate information by effective educators (1997,
Johnson further states data can be used to improve education if it is collected on student learning in a timely and accurate manner (1997, p. 16). Student Management Systems (SMS) offer approaches to timely and accurate data collection in public education. Johnson (1997) references several resources (Student Management Systems) offer “immediacy of the results and the involvement…often provide tangible benefits to…the students” (p. 18).

Data-driven instruction is “one of the most widely discussed concepts in {modern] education” (Bambrick-Santoyo, 2010 p. xxii). Bambrick-Santoyo defines a set of four principles, which are essential to creating an “effective pathway to academic excellence (p. xxii). These principles are:

1. Assessment: Create rigorous interim assessments that provide meaningful data.
2. Analysis: Examine the results of assessments to identify the causes of both strengths and shortcomings.
3. Action: Teach effectively what students need to learn.
4. Culture: Create an environment in which data-driven instruction can survive and thrive. (Bambrick-Santoyo, 2010 p. xxvi)

Arthur Costa and Robert Marzano (1987) state, “by providing data as input for children to process, teachers will encourage them to act more autonomously (p. 31). As educators encourage children to act more autonomously through the use of data, student achievement will be more recognizable (Marzano, 2003).

Driving improvement requires a cycle of continuous monitoring through assessment, analysis and action (Bambrick-Santoyo, 2010; Johnson, 1997). John Messelt (2004) defines data-driven instruction as a tool used to:

- narrow achievement gaps,
- improve teacher quality,
- improve curriculum development,
- promote better communication with key stakeholders,
- motivate students and enhance parental involvement in the education process, [in addition
to help districts maximize the use of limited funds to achieve the best impact possible on student achievement. (p. 1)

Data-driven-decision making can be utilized to narrow the achievement gap and improve planning process[es] related to district programs, decision-making and curricular matters achieving student success (Messelt, 2004; Panettieri, 2006). In his book *Data-Driven Decision Making: A Powerful Tool for School Improvement*, John Messelt (2004) acknowledges “states and districts need an effective technology infrastructure not only to meet NCLB’s data management and analysis expectations, but also to identify and fix operational inefficiencies and drive improvements in student performance” (p. 2).

Additional applications of data analysis, understand technology infrastructure needs and making informed objective decisions and not costly subjective ones (Messelt, 2004).

As timely and appropriate data analysis becomes increasingly more readily available, discerning school districts and leaders are applying data-driven decision making techniques to analyzing test scores, identifying gaps in student achievement and the improvement of both curriculum and teacher quality. Messelt reiterates Johnson’s concept that technology is a useful tool to identify the differences between varied learners in a group. Using technology to acquire information should not be considered “a deterrent to the educational process” (Akintude, 2006). The collection of data is not the issue; it is the use of the data that is usually lacking (Charman, 2009).

“Data helps us monitor and assess performance” (Schmoker, 1999). Since the inception of NCLB, data-driven instruction has increasingly become one of the primary concepts of educational discussions (Bambrick-Santoyo, 2010). Driving student improvement requires a cycle of continuous monitoring through assessment, analysis and action (Bambrick-Santoyo, 2010; Johnson, 1997). Bambrick-Santoyo also acknowledge
the culture or environment in which the data-driven instruction is being implemented can be a key principle. In an interview with school district personnel, Johnson documented how minimal effort is used to interpret data and it is often used in a punitive manner rather than to drive continuous improvement (1997).

Johnson (1997) suggests, despite the interpretation by individuals’ beliefs that providing data is often interpreted for punitive actions; data should be utilized exclusively for addressing the needs of the organization [or individual]. When the goals of using data for improvement are clearly identified, there is greater agreement and support for the initiative. According to the New York State Department of Education website, engageny, data-driven instruction is “a precise and systematic approach to improving student learning throughout the year” (http://engageny.org/data-driven-instruction, 2013).

Learning Analytics

The implementation strategies toward data-driven instruction require the understanding and development of learning analytics. The 2013 Horizon Report annually publishes innovative technologies that “will have significant impact on education over the next one to five years” (Johnson et al., 2014). The 2013 Horizon Report highlights the use of learning analytics and its promise to offer reliable and valid data-driven digital portfolios so teachers can redirect instruction.

Learning analytics is an information technological tool which uses statistical analysis of data to discover useful information, study engagement, predict and advise student performance, revise curricula, provide real time feedback, spot potential issues, foster informed decisions, and better train staff (Berk, 2004; Johnson et al., 2011; Retalis, Georgiakakis, & Dimitriadis, 2006; Siemens, 2011). Learning analytics were defined as
the “measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs” at the Learning Analytics and Knowledge conference held April 29 through May 2, 2012, in Vancouver, BC, Canada.

Learning analytics is becoming increasingly necessary for systemic change in organizations to foster improved decision-making through the use of technology by providing real time feedback (Berk, 2004). In an in-depth quantitative survey exploring key elements such as technology and learning analytics, Berk reports respondents elaborate on the necessity of data reporting to be “user-friendly and flexible” for administrators so they can make more informed decisions regarding the specifics of the disaggregated data and be utilized less for managerial information and data collection (p. 35). Consequently, the survey results found “resources dedicated to learning analytics spend an average of only 20% of their time performing data analysis” (p.35).

The results of this research clearly show a strong movement toward more formal measurement…however, it solidifies the notion that organizations have scarce financial, physical and human resources to spend on highly precise data…Best-practice learning organizations have and will continue to deliver reasonable indicators …but these organizations will leverage automation and technology to wrap solid industry-accepted methodology around their measurement strategy. That enables them to deliver comprehensive measurement results… (Berk, 2004, p. 37)

To maximize data implementation, it is essential to monitor the data collection process such that significantly less administrative time is spent on gathering the data and more time is allocated to develop informed decisions (Berk, 2004, p. 36). In a study co-funded by the European Commission e-learning program, Retalis et al. (2006) analyzed several Web log analysis tools which educators use for digital learning environments to evaluate students. Their findings concluded “educators are in need for non-intrusive and
automatic ways to get feedback from learners’ progress in order to better follow their learning process” (p. 6).

In a survey study of organizations representing ten industries, inclusive of consumer products, financial services, government, and healthcare, Jeffrey Berk (2004) concluded: “the amount of time spent on administration, data entry, and data analysis is greatly reduced after moving to an electronic data collection format” (p.43). The managerial respondents in the survey reported a preference for online or email evaluation data more than paper methods, despite employee preference for completing evaluations in paper methods. Berk (2004) suggests data collection and analysis methods may be more beneficial if positive reinforcement is applied, fewer but more meaningful questions are asked, and the data collection process is fully automated.

Bianco (2010) case studied a school district whose teachers submitted electronic tracking forms measuring student progress in a reading program for special education students. The results of the study indicated about 90 percent of the staff felt the academic gains by the students would not have been achieved without the electronic progress monitoring and data collection. Subsequently, most teachers reported being concerned for the time expenditure progress monitoring required despite the student achievement (Bianco, 2010).

As districts and state mandates adopt the difficulties of data-driven instruction, the need for more effective analytical tools to collect and analyze student data is more necessary (Siemens, 2011). In a study conducted by Henning (2006), 17 veteran elementary teachers and seven veteran middle school teachers enrolled in a graduate program for teacher leaders analyzed scores from the Iowa Test of Basic Skills. The
teams were directed to identify perceived building needs. Two conclusions drawn from the study were, “student achievement data is not yet accessible enough for teachers” and “the storage and organization of school data may contribute to the development of historical baselines against which current data can be compared more effectively” (Henning, 2006, p. 736).

The 2012 Horizon Report stated that the use of data to assess student performance, through a multitude of technological features, will enable educators to predict and advise students with more informed specific information that is tailored “to each student’s level of need and ability” in the next two to three years (Johnson et al., 2011, p. 28). Additionally, the 2012 Horizon Report anticipates the power of learning analytics to “transform pedagogy in a more radical manner” therefore supporting greater analysis of data than previously possible.

Data-driven School Reforms

Using technology to acquire information should not be considered “a deterrent to the educational process” (Akintude, 2006). Young 21st century learners, maturing with increased access to computers and Internet use, are often referred to as digital natives (Biladeau, 2009). As digital natives and institutions revolutionize to 21st century education, the foundational inclusion of social media and technology are essential. The essential integration of technology in pedagogy has motivated many educational institutions to require technology courses for graduation or certification (Gaudelli, 2006). Gaudelli (2006) conducted a longitudinal study of beginning teachers using a qualitative approach of interviews, observations, instruction, and email communications; participants in a web-based distance-learning environment reported how challenging incorporation of
technology in their pedagogy had been despite having initial high hopes. The teachers reported their enthusiasm for the technology waned and frustration settled in as a result of difficulty implementing their intended plans, mostly due to hardware complications. Gaudelli (2006) further reported that the National Council for Accreditation of Teacher Education (NCATE) is addressing technology instruction and inclusion in P-12 curricula. NCATE has developed 65 references to technology infusion in their standards for accreditation (Gaudelli, 2006).

John Messelt (2004) acknowledges “states and districts need an effective technology infrastructure not only to meet NCLB’s data management and analysis expectations, but also to identify and fix operational inefficiencies and drive improvements in student performance” (p. 2). Messelt’s conclusion is drawn from a targeted assistance model study conducted in 2002 in which a staff analyzed test data nightly as part of an extensive data-driven decision making implementation pilot program. Through the use of real time data, staff was able to make critical and specific review the following day to support instructional gaps. Following the pilot study recommendations, efforts were implemented to establish the protocol district wide (Messelt, 2004).

Establishment of efficient and effective data analysis processes requires an understanding of technology infrastructure needs and the ability to make informed objective decisions and not costly subjective ones (Messelt, 2004). As timely and appropriate data analysis becomes increasingly more readily available, discerning school districts and leaders are applying data-driven decision-making techniques to analyzing test scores, identifying gaps in student achievement and the improvement of both
curriculum and teacher quality. Data-driven-decision making can be utilized to narrow the “achievement gaps between student subgroups” by identifying where those gaps exist and target specific regrouping based on identifiable standards (Messelt, 2004).

In a qualitative and descriptive study prepared by the National Center for Education Evaluation and Regional Assistance (2009), causal validity of instructional programs and practices were reviewed. The study examined the effectiveness of data use interventions through evaluation of case studies, observations, and expert review (Hamilton, Halverson, Jackson, Mandinach, Supovitz, & Wayman, 2009). The recommendations of the study were:

1. Make data part of an ongoing cycle of instructional improvement.
2. Teach students to examine their own data and set learning goals.
3. Establish a clear vision for school-wide data use.
4. Provide supports that foster a data-driven culture within the school.
5. Develop and maintain a districtwide data system. (p. 9)

Teaching students to examine their own data and to set learning goals (recommendation two), requires students develop the skill to examine their own data and an ability to identify appropriate learning goals. These conclusions were reached through examination of two case studies incorporating qualitative and descriptive analysis. In one case, Hamilton et al. (2009) inferred positive effects were achieved using an online tool when students examined their own data, however, Hamilton et al. determined the significance to be minimal due to the weak level of significance. An additional case study revealed multiple variables in the predictive model prohibiting casual evidence attributed to students analyzing their own data.

To facilitate student’s identification of their learning goals, Hamilton et al. (2009) suggest educators explain to their students the standards they are being assessed on
periodically. One suggestion mentioned in the report is to provide methods for students to maintain a log of the standards they are being assessed on, specifically following formative assessments (Hamilton et al., 2009).

Sharon Davis Bianco (2010) explains in Improving Student Outcomes: Data-Driven Instruction and Fidelity of Implementation in a Response to Intervention (RtI), schools need to establish a policy that benchmarks all students’ skill levels three times a year, independent of their classification. In her evaluation of schools using reading assessments to monitor students, Bianco (2010) reported the administration needed to “find a measure designed to elicit the data necessary to make informed decisions about student progress in early reading” (p. 5). This paradigm shift required more effort by all educators, but the “process caught students before they failed a subject and referred them for further assessment or more intense instruction” when necessary (Bianco, 2010).

Policies incorporating technological data-driven instruction are found increasingly common throughout public school institutions across the country. The inclusion of technology to drive student improvement by educators requires that “leaders leverage it as a tool for improvement rather than expecting technology to drive improvement” (Nodine & Petrides, 2006, p. 51). Nodine and Petrides’ (2006) evaluation of public schools in Boston, Massachusetts yielded the development of a data portal where educators, teachers, and students could access and share information related to student achievement.

Figure 1 below represents how Nodine and Petrides see the “cycle of feedback connect individual school performance with a district's broader goals for student achievement (p. 48).
Benchmark Assessments

Benchmark assessments are “tests administered at scheduled times during the year…to evaluate students progression on a specific set of standards or benchmarks that students must master to be on track to reach end-of-year learning goals” (MAP-US Dept. of Ed, 2012). Benchmark assessments are referred to as interim assessments since they are used more frequently to assess student understanding than summative evaluation. Teachers use benchmark, formative, or interim assessment data to differentiate their instruction and allow “teachers to build upon a student’s current construct and skill ability, while considering the developmental ability of the individual child (Feldman, 2010).
Benchmark assessments provide teacher data that can be used to measure teacher effectiveness for Annual Peer Performance Review (Pelligrino & Quellmalz, 2011). One of the most widely used and commercially available benchmark assessments for differentiating and teacher planning is the Northwest Evaluation Association (NWEA) Measure of Academic Progress (MAP) program (MAP-US Dept. of Ed, 2012).

“Assessment is the first core principle of data-driven instruction” (Bambrick-Santoyo, 2010, p. 6). Black and Wiliam (1996) affirm, “any assessment must elicit evidence of performance, which is capable of being interpreted” (p. 544). Marzano (2003) states data from assessments must be informative to guide instructional delivery and relate directly to student performance. “The standards-based reform movement has resulted in the wide-spread use of summative assessments designed to measure students’ performance at specific points in time” (Perie, Marion, Gong, & Wertzel, 2007, p. i). Perie et al. report that these assessments are not inherently wrong, but are not providing the instructional guidance they were developed or intended to. Intrinsic limitations of summative assessments require educators seeking informed data-driven decision making to use benchmark assessments that redirect and guide instruction as more valid than a single summative assessment (Marzano, 2003).

Interim assessment is the term we suggest for the assessments that fall between formative and summative assessment, including the medium-scale, medium-cycle assessments currently in wide use. Interim assessments (1) evaluate students’ knowledge and skills relative to a specific set of academic goals, typically within a limited time frame, and (2) are designed to inform decisions at both the classroom and beyond the classroom level, such as the school or district level. Thus, they may be given at the classroom level to provide information for the teacher, but unlike true formative assessments, the results of interim assessments can be meaningfully aggregated and reported at a broader level. As such, the timing of the administration is likely to be controlled by the school or district rather than by the teacher, which therefore makes these
assessments less instructionally relevant than formative assessments. These assessments may serve a variety of purposes, including predicting a student’s ability to succeed on a large-scale summative assessment, evaluating a particular educational program or pedagogy, or diagnosing gaps in a student’s learning. Many of the assessments currently in use that are labeled “benchmark,” “formative,” “diagnostic,” or “predictive” fall within our definition of interim assessments. (Perie et al., 2007, p. 1)

The ability of a benchmark assessment to effectively evaluate the learning achievement of a student through disaggregated data is essential “to provide actionable information” permitting “strategies for improving instruction” (Perie et al., 2007, p. 1). Benchmark assessments, such as interim assessments, are “tests administered at scheduled times during the year…to evaluate student progression on a specific set of standards or benchmarks that students must master to be on track to reach end-of-year learning goals” (MAP-US Dept. of Ed, 2012).

A seminal meta-analysis conducted by Paul Black and Dylan Wiliam in 1998 reviewed the effectiveness of benchmark assessments from at least 20 quantitative studies. The studies were conducted in many countries with students in elementary through higher education in a variety of subject areas. Many of the studies concluded benchmark assessments were significant in supporting increased achievement in low achieving students more than high achieving, thus reducing the achievement gap. Additionally, many of the studies showed when teachers provided specific benchmark feedback to special education students, more significant increases in their learning followed (Black & Wiliam, 1998, p. 141). Additionally, Black and Wiliam (1998) report the value of students understanding their own strengths and weaknesses provided by the benchmark assessments. They report when students who are low achievers are informed
of their data, they perform better because the information is specific to their needs and avoids comparisons (1998, p. 143).

Teachers use benchmark or interim assessment data to differentiate their instruction and allow them “to build upon a student’s current construct and skill ability, while considering the developmental ability of the individual child” (Feldman, 2010). Hence, as students understand the main idea of their learning needs they will be better informed to guide their development and achievement. Black and Wiliam state formative assessment are “essentially interactive and adaptive” and “promote the active involvement of students in generating their own learning” to facilitate the raising of standards of achievement (2007, p. 5). Black and Wiliam (2007) determine the use of formative assessments will provide useful guidance for both the teacher and student.

**Northwest Evaluation Association**

Northwest Evaluation Association (NWEA) is a non-profit testing organization that provides formative data analysis by benchmarking three times a year in a computer adaptive testing experience similar to the model previously referenced by Bianco in her book *Improving Student Outcomes*. NWEA offers over 2,200 districts and over three million students trimester standardized formative assessment data in English Language Arts, Math and Science. Li (2010) conducted an analysis of interim assessment review for seven test generating companies by analyzing testing manuals. Tests were reviewed to confirm:

> the stated purpose of the assessment was consistent with the intended purposes of the users, the school or district, [they] should check other properties of the test using the criteria such as Test Development and Documentation, Administration and Inclusion, and Test Scores and Reports to ensure that the assessment design is consistent with both the stated and intended test purposes. (Li, 2010, p. 184)
Northwest Evaluation Association (NWEA) Measure of Academic Progress (MAP) program is one of the most widely nationally used and commercially available benchmark assessments for benchmarking reading literature (MAP-US Dept. of Ed, 2012).

The MAP assessments are a collection of computer-adaptive tests in reading, language usage, mathematics, and science that place individual students on a continuum of learning from grade 3 to grade 10 in each discipline. Each MAP assessment uses a continuous interval scale, called the Rasch (RIT) unit scale score, to evaluate student growth and student mastery of various strand-defined skills within disciplines. NWEA has conducted scale alignment studies linking the MAP assessment’s RIT scale to proficiency levels from standardized assessments in all 50 states and the District of Columbia. These studies provide evidence of an association between the MAP assessments and each state’s standardized test (Brown and Coughlin 2007; Northwest Evaluation Association 2005). In addition, studies provide evidence that MAP assessments predict performance on assessments… Relying on this evidence, schools and teachers use MAP results to monitor their students’ progress toward state proficiency standards. NWEA recommends that schools administer each MAP subject area test to students three times during the school year (in the fall, winter, and spring), with a fourth administration suggested during summer school. (Cordray, Pion, Brandt, Molefe, & Toby, 2012, p. 5)

The incorporation of MAP assessment data is “supposed to enhance teachers’ use of differentiated instructional practices, use of which is supposed to enhance student achievement (Cordray et al., 2012, p. 5). This is represented in figure 2 below.

Figure 2.2

Benchmark Assessments and Differentiated Instruction support of Student Achievement
Differentiated Instruction

Classrooms in public schools vary in student learning. The use of data from state assessments and local assessments informs teachers and administrators that there is a mix of prior knowledge amongst their students. Differentiated instruction recognizes there are options for teachers to reach the different learning styles, readiness, and interest of their population (Tomlinson, 1995). Studies in the 1980s began to look at students’ performance when groups were assigned different tasks based on high and low achieving performance. A qualitative study conducted by Hahn and Smith looked at “good and poor fifth-grade comprehenders’ use of strategic text behaviors” (1983, p. 333). The study looked at 80 suburban, middle class students of mixed reading proficiency levels. The results of the study showed significant differences in reader proficiency when differentiation strategies were implemented.

Tomlinson explains the ability of a teacher to differentiate offers:

(1) a variety of ways for students to explore curriculum content, (2) a variety of sense-making activities or processes through which students can come to understand and "own" information and ideas, and (3) a variety of options through which students can demonstrate or exhibit what they have learned. (p. 78)

Tomlinson (1995) further describes what a differentiated classroom is stating it is not one in which, “assignments are the same for all learners and the adjustments consist of varying the level of difficulty of questions for certain students, grading some students harder than others, or letting students who finish early play games for enrichment” (p. 77). These approaches to differentiate are merely more work for faster paced students and do not qualify as options that vary style, readiness or interest. The notion of challenging a
student with more work rather than differentiated work can seem punitive and unfair (Tomlinson, 1995).

Tomlinson (2000) reiterates her definition of differentiation does not include it as “an instructional strategy.” She refers to it as what a teacher does; a way of thinking and a philosophy inherent in a set of beliefs, and further states that differentiation cannot be seen as a method of delivering instruction, rather it needs to be understood as a philosophy in thinking about how to approach a heterogeneous group of learners when delivering instruction. As such, Bambrick-Santoyo (2010) agree with Tomlinson (2012) whereas differentiation consists of elemental pathways, assignments, assessments, and/or homework for students individualized needs in a heterogeneously academic leveled class.

Several approaches exist for the teacher to differentiate their class through instructional approaches. Tomlinson (2000) cites specifically content, process, products, and environment as the main elements that should be addressed when differentiating. She identifies them as:

(1) content--what the student needs to learn or how the student will get access to the information; (2) process--activities in which the student engages in order to make sense of or master the content; (3) products--culminating projects that ask the student to rehearse, apply, and extend what he or she has learned in a unit; and (4) learning environment--the way the classroom works and feels. (p. 1)

Differentiation while recognizing student differences in style, readiness, and interest, does not alter the level, content or expectations of curriculum intended for all students in the class to learn (Tomlinson, 2000). It simply creates varied paths for students to demonstrate their knowledge learned whether they are identified as special education students of a gifted or remedial status (Goddard, 2010). The responsibility to
differentiate relies on the teacher to implement effective tiered strategies for the varied learners in their class (MAP-US Dept. of Ed, 2012).

Tomlinson (2012) reports teachers understand the value of differentiation in the classroom, although they are often fraught with a lack of ability to implement it effectively. She further reports teachers see the benefits to differentiate but may not know how to implement it effectively (Tomlinson, 2012). Tomlinson (2012) cites judgments for this conclusion include teachers have reported differentiation requires significant time investment in planning. Teachers have also reported that textbooks, student enrollment, and class size have a limiting opportunity to differentiate (Tomlinson, 2012). Data offers the invaluable tool of providing teachers with the information of what is working and not working so they can modify their instruction to create the improvement necessary for properly monitoring student progress (Schmoker, 1999).

Differentiation therefore is defined as the use of different learning styles, readiness, and interest in planning instruction to reach a heterogeneous group (Tomlinson, 1995). Tomlinson clarifies differentiation is not “an instructional strategy” rather it is what a teacher does, a way of thinking and is a philosophy inherent in a set of beliefs (Tomlinson, 2000). The subjects in this study were provided with differentiated homework in a digital application format on an iPad.

Digital Learners

The children in classrooms today are often referred to as “digital natives” and “are no longer the people our educational system was designed to teach (Prensky, 2001). The immersion of technology in the 21st century is driving a major shift led by the students in education more so than in any other point in history (Richardson, 2008). With digital
natives, the inclusion of emergent technology in pedagogy is essential. Information acquisition is constantly and instantaneously available as a result of our comprehensive immersion in technology (Rasmussen, Nichols, & Ferguson, 2006). Knowingly, the use of technology to acquire information should not be seen as “a deterrent to the educational process” (Akintude, 2006).

According to Padilla-Walker, Coyne, and Fraser (2012), the ubiquitous infusion of technology has changed the way we use multimedia. Padilla-Walker et al., contend family structure and demographics influence the way we exploit technology and how often. Using both quantitative and qualitative analysis, families were interviewed and surveyed over a period of almost two years. Family members were asked independently how often they used specific features of technology such as email, texting, and social media. Specifically, adolescents in each family were appraised for how they felt their parent-child connection measured “using the warmth/support subscale (five items) of the Parenting Styles and Dimensions Questionnaire-Short Version (Padilla-Walker et al., 2012, p. 431).

Results of the study from Padilla-Walker et al. (2012) indicated weak correlations between how family members distinguished their use of media technology. Several of the findings suggested differences exist between age and use of cell phones amongst adolescents, where older adolescents use cell phones more and younger adolescents use email more. Additionally, gender differences were found to show females used texting more than males.

The study by Padilla-Walker et al. (2012) also found significantly higher levels of cell phone, email, and social networking use amongst adolescents in single-parent and
less educated homes than adolescents in two-parent and more educated homes (Padilla-Walker et al., 2012, p. 431). These findings indicate a possible gap in the creative processing with tablet devices by less educated homes as a result of their dependency on cell phones for communication and limited exposure to more expensive technology. The association of technology and communication lead Padilla-Walker et al. to conclude, “it is likely that positive communication may be associated with family connection whereas negative or intrusive communication via cell phones may actually reduce any positive effects (2012, p. 435).

In conclusion, significant findings by Padilla-Walker et al. (2012) appear to exist between high cell phone usage when family connections of warmth and support were reported at higher levels as measured by the Parenting Styles and Dimensions Questionnaire. Distinctively, although the frequency of adolescent males playing video games was higher than female adolescents, there was no gender differences reported between the amounts of engagement both sexes described when playing with their parents (co-playing) (Padilla-Walker et al., 2012).

In a study conducted by Froese, Carpenter, Inman, Schooley, Barnes, Brecht, and Chacon (2012), prior research was reviewed for noting cell phone usage in school was often considered to be a distractor to the learning process. A statistically significant decline to learning was realized of approximately 25-40 percent when cell phones were ringing and causing distraction to the participants. In Froese et al. study, 693 students in college and universities were asked to complete a survey in six minutes. Of the participants, 90 percent reported themselves as moderate to avid users of their cell phone and more than 75 percent reported carrying their cell phones at all times.
Following the survey, students listened to one of two PowerPoint presentations about a novel they had all indicated previously having no knowledge of. Upon completion of the PowerPoint, all subjects were assessed for their knowledge and understanding of the novels. Participants in one room were permitted to use their cell phone during instruction while in another room participants were not. Participants reported expecting their academic success to be lower if they used their cell phone during instruction for text messaging. A Tukey *post hoc* test confirmed low-frequency cell phone users differed significantly from higher-frequency cell phone users when a random sample of the participants (N=82) were given brief multiple choice quizzes. Specifically, students who did not text during administration scored 27 percent better than those that did text during assessment (Froese et al., 2012). These findings contribute to the consideration and application of mobile device technology within classroom environments and outside of the classroom when completing homework.

The Pew Research Center:

is a nonpartisan fact tank that informs the public about the issues, attitudes and trends shaping America and the world. It conducts public opinion polling, demographic research, media content analysis and other empirical social science research. Pew Research does not take policy positions. (Pew Research Center, www.pewresearch.org, 2014)

A study conducted by the Pew Research Center, in 2012 revealed more than three quarters of all teenagers have a cell phone and about one quarter of them report having a phone with smart capabilities, or features capable of computing and texting (Madden, Cortesi, Gasser, Lenhart, Duggan, & Pew Internet & American Life, 2012). A follow up study in 2013 revealed an increase in the number of teenagers with smartphones increased to nearly half of all teenagers reporting owning a cell phone with smart capabilities,
forty-seven percent (Madden, Lenhart, Duggan, Cortesi, Gasser, & Pew Internet & American Life, 2013). The Pew report also revealed students are almost twice as likely to communicate with a friend using a mobile device, than spend time with people in person or doing social activities outside of school (p. 16). Correspondingly, 49 percent of respondents report using their cell phone to access information within the last thirty days from the Internet. As such, digital immigrants (current educators), those who have not been born into the digital communicative world, but adopted much of the innovation, are required to change how they expect their digital natives to acquire information and deliver their instruction (Prensky, 2001).

Prensky (2012) explains more than two-thirds of our planet is carrying around a hand-held computer that contains “more complex and powerful chips than the 1969 on-board computer that landed a spaceship on the moon” (Prensky, 2004, p. 1). The trepidation is not whether these powerful tools should be used by 21st century digital natives, but rather “how and when” (Prensky, 2004). Prensky, in his book, *Teaching Digital Natives: Partnering for Real Listening*, recommends the ideal one-to-one mobile device for students is the iPhone/iPad with its ability to read and write on, use a camera or video, and interact with 100,000 plus applications within the classroom.

Peluso (2012) states: “technological era of iPads… [is] the most intuitive and engaging…ever available.” Peluso states despite these innovative tools being ubiquitous in the backpacks of students and staff, iPads are only recently becoming essential to classroom instruction. He reports much recent research has been conducted on the benefits of iPads and the use of apps for education. Peluso looked at groundbreaking
studies measuring the influence of iPad applications and the impact of digital technology with adolescents by researchers Jenkins, and Dickens and Churches.

Jenkins, John, and MacArthur (2006) reported on media education in the 21st century. Jenkins et al. concluded the younger students engage with technological media, the better they will be able to multitask in an information landscape and collaborate with diverse groups of people. Jenkins et al. conclusions are based on Pew Research Institute publications that found no significant differences amongst ethnicity or race when comparing media usage. Although teenage girls (27%) were moderately more likely than teenage boys (17%) to use social media sources online (Jenkins et al., 2006, p. 20).

Dickens and Churches published a three-book series [which] offers a wealth of strategies for integrating 40 of the most effective applications--or apps--for the iPad, iPod Touch, and iPhone into K-12 classrooms to cultivate 21st century fluencies. The series of books intended for each school level (elementary, middle, and high) explain how educators can “enhance teaching and learning and address curricular objectives in an engaging, relevant, real-world environment” (2012).

In a study conducted by Rath (2012) in association with T.H.E. Journal, a panel of experts were convened “who spend their days in the trenches helping school districts understand the impact of technology and learning” (Raths, 2012). Several of the experts Rath interviewed reported iPads as the tool that will “finally infiltrate learning and make technology a more integrated tool for teaching and learning” and “continue to dominate the tablet market,” and with the dominance of educational apps, the Apple iPad will make it difficult for other tablet makers to break into the educational market (2012).
observations Rath conducted, the panel of interviewees reported over 90 percent of the Bring Your Own Device (BYOD) tablets, were iPads.

In a qualitative case-study by Hutchinson, Beschorner, and Schmidt-Crawford, (2012), the iPad was referred to as the ubiquitous mobile learning device designed to promote learning, especially in literacy, because the device “not only support[s] student learning, but students were also highly engaged.” Hutchinson et al. (2012), conducted their study of an elementary classroom, with 23 students. Students were given iPads during their literacy block to enhance their learning opportunities by incorporating 21st century skills primarily through the use of apps. The students were offered a selection of apps to choose from to support their learning goals. Through interviews, the students reported they felt more engaged and understood the content they read better as a result of interacting with the apps. Additionally, students learned content not directly related to the learning goals as a result of the required interactivity of the app, such as sequencing, size, and placement. However, Hutchinson et al. (2012) concluded further research is necessary to examine how iPads can help meet literacy curricular goals while supporting technology integration.

iPad technology hopes to further learning opportunities by integrating curricular content through extending practice opportunities (Haydon, Hawkins, Denune, Kimener, McCoy, & Basham, 2012). In one of the earliest case studies involving iPad implementation and students level of engagement, students with Emotional Disturbance were analyzed (Haydon et al., 2012). During the course of study the three students showed significantly higher mean correct responses on math content when using iPads for learning. The subjects mean score for correct answers per minute with a worksheet
was 0.66 and 3.24 correct per minute with the iPad. Similarly, the iPad condition increased student mean engagement levels from 81.4 percent when working on the worksheet to 98.9 percent when using the iPad. This case study is focused exclusively on three Emotionally Disturbed students using an iPad to measure their correct responses and engagement levels in math content and should be limited to its generalizations for all special education students.

In a study conducted by Rossing, Miller, Cecil, and Stamper in 2012, researchers investigated higher education student’s perceptions of positive engagement and comfort of doing classwork and learning with the iPad. Subjects were college students enrolled in course work where their participation in the study had no bearing on their status enrollment or grade. The research analyzed how engaged the students were with the iPad and used survey analysis to investigate students perceptions. Additionally, free response feedback was recorded and used to report findings.

The Rossing et al. (2012) study revealed, when subjects were asked questions related to their perceived learning, students responded lowest (N=208, M=3.923, SD=0.89) to “The iPad activity helped me develop confidence in the subject area.” Students responded highest (N=204, M=4.343, SD=0.792) to “The iPad activity helped me connect ideas in new ways.” Rossing et al. (2012) report students appear to rank their ability to use the iPad to collect information as slightly higher than their confidence in developing content knowledge using the iPad, thus, not yielding the desired learning outcome students had hoped for.

In the same study by Rossing et al. (2012), students were asked about their perceived engagement and perceived learning when using the iPad on a survey
instrument of 10 questions each with a range from one to five. The mean score for all engagement survey questions was 3.648. The mean score for all perceived learning questions was 4.128. The Rossing et al. study concludes students report their perceived learning is greater than their actual engagement level when using the iPad. A downside reported were students reported often getting distracted, losing attention and found the device made it hard to focus (Rossing et al., 2012). In summary, the iPad is considered generally useful because of its convenience, portability, interactivity, and engagement for academia, especially to improve reading literacy, despite its apparent ability to serve as a distractor (Cameron & Bush, 2011; Hutchinson et al., 2012).

In a more recent study by O'Malley, Jenkins, Wesley, Donehower, Rabuck, and Lewis (2013), found teachers report the iPad to be an effective instructional tool for students with disabilities. They employed a single-case reversal design with 10 seventh and eighth grade students. Students were measured over the course of several weeks for math fluency gains through observation and quantitative analysis. The findings of the study indicated the iPad intervention had no significant measurable gain over fluency from pre-test to post-test as measured by the CIBS-II, despite 100 percent of teachers reporting “the program was worth the time and effort invested” (p. 10) as it has “enhanced their teaching skills and improved students’ interest in the content” (p. 12) (O’Malley et al., 2013). Teachers reported the iPad initiative appeared to assist the students achieve progress “that they had not yet been able to master using traditional instructional methods” (O’Malley et al., 2013, p. 12).
Engagement

Engagement “has come to refer to how involved or interested students appear to be in their learning and how connected they are to their classes” (Axelson, 2011). Early work by McIntyre (1983) looked at how students are engaged in learning during a school day and week. The study looked at all grade three, five, and seven math classes in a small midwestern school district. Students were randomly selected from the classes to be observed for engagement behavior over the course of six weeks. Teachers were not informed which students had been identified in their class as the object of study. Engaged behaviors were compared to non-engaged behaviors for each student and a pattern of engagement was analyzed. Results of the analysis show student engagement remained relatively consistent Monday through Thursday, but significantly declined on Friday. Additionally, grade three and five students reported significantly higher levels of engagement during the week than grade seven students, except for Friday. This study found grade seven students are much less engaged in classroom behaviors than grade three and five students for all days of the school week except Friday.

In a study by Butler and Zerr (2005), nearly 500 college freshman level students were analyzed for their engagement and mood with online assignments in two state university environments. The study intended to provide students with immediate achievement feedback and increased engagement levels with learning. Additionally, the homework assignments were designed to be more student-directed and less teacher-managed. Students were given the chance to retry questions they answered incorrectly on their first attempt. Evidence collected from the data analysis indicated significant “positive attitudes about the use of online course components” and students who engaged
more in the online course components “improved their outcomes on examinations” (Butler & Zerr, 2005).

The iPad is considered a very desirable and engaging device that is well received by a majority of students in primary and middle level educational settings; although upper-secondary students report difficulty in finding an educational application for an iPad (Crichton, Pegler, & White, 2012). Students report the novel use of the iPad contributes “positively to learning… result[ing] in better student learning and engagement” (Rossing et al., 2012). Rossing et al. further, educators need to understand how the anytime and anywhere mobile learning device (iPad) can increase engagement to maximize its benefits for students (Rossing et al., 2012). Rossing et al. suggest encouraging students to teach their peers applications or share their recently acquired knowledge are such examples of how the mobile device platform can increase engagement with learners. The authors conclude essential understanding of learner engagement with the iPad is contingent upon clear expectations; if not, the iPad often becomes more of an educational distraction and hindrance to learning. As such, a specific discipline study to analyze the iPads’ impact on learner outcomes is suggested.

In another study used by Rossing, et.al, higher education college students were analyzed for their level of engagement in online learning environments, hybrid environments, and only face-to-face learning environments. The results of the study concluded:

Comparing results from the models for first-year students to those for seniors also suggests that use of technology has a stronger impact earlier in the college experience. Perhaps integrating technology into entry-level courses could be beneficial in encouraging engagement in other ways and learning in college. (Chen, Lambert, & Guidry, 2010, p. 18)
Overall, the results of this study point to a positive relationship between course-related technology use and student engagement. Not only do students who utilize the Internet and online technology in their learning tend to score higher in the traditional student engagement measures (e.g. level of academic challenge, active and collaborative learning, student-faculty interaction, and supportive campus environment), they also are more likely to make use of deep learning approaches like higher order thinking, reflective learning, and integrative learning in their study. They also reported higher gains in general education, practical competence, and personal and social development. These results are encouraging signs that technology has a positive impact on student learning and engagement. (Chen, Lambert, & Guidry, 2010, p. 19)

As such, higher levels of students reporting engagement from the use of technology integration with their learning, implies the use of technology would increase a student’s positive self-evaluation of their mood, henceforth fostering increased learning (Chen et al., 2010).

Hutchinson et al. (2012) set up a series of learning experiences using iPads in a case study classroom with 24 fourth graders to measure engagement with reading comprehension. Skills assessed included independent reading, sequencing, visualization, retelling, cause and effect, and main idea and detail. When using a mind-mapping and brainstorming application, the teacher reported students were “able to create more boxes as they go along and they didn’t feel like there were any limits to them like a worksheet that I would have to give them” (Hutchinson et al., 2012, p. 19). During the learning experiences students were “assigned to independently read books at their independent reading level, whereas other students were involved in different literacy activities” (Hutchinson et al., 2012, p. 20). Students stated they felt “lucky” by having these experiences. By means of the learning experiences in this case study, literacy instruction was found to engender more engagement amongst students when using the iPad by
fostering creativity and unique opportunities of expression (Hutchinson et al., 2012).

In a meta-analysis of Web 2.0 technologies, Park (2013) determined students report increased levels of engagement with their learning when they have more autonomy. Park cites “college students in a hospitality course showed an enhanced engagement with their reflection paper assignments when they posted them on their blog, as compared to those instances in which they typed them in papers (2013, p. 49). Park also cites Web 2.0 technologies provide digital natives “a personal learning space filled with a student’s work that is publicly available to other people,” which “enables students to experience autonomy and take ownership and responsibility” (2013, p. 50). Additionally, Web 2.0 technologies offer greater feelings of familiarity with student’s instructors while providing immediate feedback traditionally not experienced in conventional learning (Park, 2013).

In a qualitative and quantitative longitudinal study of nine middle schools from September 2011 to July 2013, Clarke, Svanaes, Zimmermann, and Crowther (2013), researched the impact of one-to-one mobile device technology, including five with iPads. Students reported low engagement in the mobile technology use because “the devices were not being used enough and that there were large differences between teachers in their use of and attitude towards the tablets” (Clarke et al., 2013). Following professional development and many teachers purchasing their own iPads, interviews with staff concluded:

The iPad is integral to how they [teachers] teach Math … they’re [students] learning at their own pace, they’ve got video clips where they
can then go and look at things and rather than a teacher saying this is how you do a graph, they will go and find out how they do one, they will create the ideas and do things. (Clarke et al., 2013, p. 36)

The researchers found many of the students followed the teachers lead in their use and integration of the digital technology as an instructional tool following professional development (Clarke et al., 2013).

Clarke et al. (2013) concluded: “independent learning is one of the first visible effects of [iPad] use, which has been observed to lead to increased pupil motivation and engagement” (p. 11). Parents also reported feeling more engagement in their child’s learning and ability to discuss their learning with them as a result of their interaction with the iPad; while students reported feeling more engagement and motivation caused by the independence the iPad as an instructional tool (Clarke et al., 2012).

Mood

Present mood may serve as an essential learning component for students. Hettena, and Ballif (1981) studied 105 college students from an urban university by providing them sentences from Time Magazine and measured their elicited mood. Subjects were given thirty seconds to identify the sentence as either pleasant or unpleasant on a scale from one to ten. Following their scoring of the sentence, subjects were asked to write down from memory as much information as they could recall. The results of an analysis of variance between recall and mood were significant. Subjects in positive moods recalled significantly more (N=100, r=.20) information than those in negative moods Hettena and Ballif (1981). Hettena and Ballif report the findings of the study suggest students with positive moods “ will more likely discriminate clearly between aspects of
the task that are found pleasant and those that are unpleasant” if they are in a negative mood (p. 508).

Sjoberg, Svensson, and Persson (1982) studied mood and expected achievement quantitatively with 56 students of psychology. Subjects were asked to fill out a mood questionnaire prior to taking a class assessment. The survey results were used to place the subjects into one of four groups based on capacity they felt to do well and mood as either pleasant or unpleasant; high capacity/unpleasant mood, high capacity/pleasant mood, low capacity/unpleasant mood, and low capacity/pleasant mood (Sjoberg et al., 1982, p. 8).

Results from the Sjoberg et al. (1982) study revealed a strong correlation between ones capacity to do well and their mood as pleasant (mean r = .76). A unique finding of the study was a correlation was also found to exist between a low capacity and a neutral mood (Sjoberg, 1982). Sjoberg et al. suggest more research is necessary to determine the impact of neutral moods on achievement expectations, especially for individuals and not cohorts.

Baumeister et al. (2001) conducted an evidence review:

Pertaining to the general hypothesis that bad is stronger than good. The findings suggest many good events can outweigh a negative one, however, when the number of positive and negative events are similar, the negative will outweigh the positive. This concept has been confirmed since the seminal work of Anderson (1965) defining the concept of ‘positive-negative asymmetry effect. (p. 325)

In addition, people expend a greater proportion of their energy attempting to eliminate their negative moods than they do when they have positive moods (Baumeister, 2001). This study furthers what the previous research of Esses and Zanna concluded in 1995, “bad [negative] moods had a bigger impact than good [positive] moods, in terms of
the discrepancies from the neutral mood condition (Baumeister, 2001, p. 332). One suggestion is that negative moods lead to snap decisions and may curtail learning. Since assessments require careful decision-making, negative moods may lead to greater difficulty with learning and academic growth than positive mood reporting. Inherently, students whom self-report their mood as negative may benefit from limiting self-defeating behaviors leading to limited understanding and learning.

Pekrun, Frenzel, Goetz, and Perry (2007) assessed sixth grade students’ mood (N=2059) before, during, and after a mathematics achievement test. Data from the student’s mood was compared to their math achievement and their ability to reason abstractly. Results from an analysis of variance yielded statistically significant differences exist between achievement levels and mood. Students who showed high negative mood were associated with low achievement and abstract reasoning while students with positive mood (enjoyment) achieved highest and had the most abstract reasoning (Pekrun et al., 2007).

Research surrounding positive mood and high task productivity yielded high correlations (r=0.39) while negative moods and high task productivity yielded basically no correlation (r=0.02) (Bindl, Parker, Totterdell, & Hagger-Johnson, 2012). Bindl et al. (2012) study indicates how work productivity can be high “irrespective of their [learners] commitment to the organization” as long as a positive mood exists. As such, educators attempt to create a positive mood should support increased learning, even if students are not necessarily excited or motivated by the assignment.
The impact of a positive mood can challenge the impact raw ability has for yielding success (Yeager, Walton, & Cohen, 2013). Yeager and Walton (2011) conducted a theoretical review by analyzing studies published in highly cited relevant journals focused on “social-psychological interventions to improve student achievement.” The findings of the research indicate experiences in school that cause a student to feel negative (i.e. worrying about a poor test grade), can be reduced by the brain if students are given an opportunity to express and/or recognize their cause of negativity. However, if students perceive their teacher is attempting to elicit their negative mood unwillingly, it may further exacerbate the problem (p. 285).

Student mood has been associated with cognitive ability, memory recall, and coding (Bohn-Gettler & Rapp, 2011). Bohn-Gettler and Rapp (2011) concluded: “mood has been associated with achievement, such that positive emotions tend to increase learning” (p. 564). Bohn-Gettler and Rapp studied 110 native English–speaking undergraduates by randomly assigning subject groups and directed them to watch a series of movies previously established as eliciting a specific mood. Before and after viewing the movie, mood was assessed using a survey instrument. Participants were then instructed to read a brief passage of about 700 words on a problem found in nature. Once complete, subjects were given a series of recall questions based on the reading. The findings of the study by Bohn-Gettler and Rapp (2011) demonstrated “mood may influence the processes that readers rely on during comprehension and can influence post-reading memory.” However, contrary to much of the findings identified thus far, the
findings of Bohn-Gettler and Rapp detailed positive and negative mood participant’s yielded statistically significant higher recall than students with neutral moods.

In a study sample of 82 seventh graders, analysis indicates their moods as positive more frequently than negative, but those students that do report feeling negative, also report exclusion from their peers (Rusby, Westling, Crowley, & Light, 2013). Research suggests negative moods have a more significant impact on gaps in learning than does having a positive mood (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001, p. 332). Positive moods were most often associated with students who felt their peers were popular and did not tease them while negative moods were most often reported by students who reported their peers excluded them or caused anxious feelings Rusby et al., 2013).

The influence and understanding of engagement and present mood students report may benefit their awareness for increased literature achievement. As such, students reporting negative moods may benefit from delaying completion of their homework until their present mood changes to a more positive one, knowing the use of integrating mobile device technology such as the iPad as a tool for differentiated homework affords the student the opportunity to access global resources for information acquisition anytime and anywhere. This study intends to investigate the relationship between a student’s positive and negative mood, level of engagement, and completion of differentiated homework assignments as an influence on their growth in reading literature when using an iPad.
CHAPTER III
RESEARCH DESIGN AND METHODOLOGY

Introduction

The implementation of NCLB drastically altered testing in public education and promoted differentiation and data-driven instruction through technology to analyze test scores and student achievement (Messelt, 2004). Timely and accurate data is essential to drive curriculum and inform educators of better decision-making and instructional delivery. Learning analytics uses statistical analysis and can foster improved decision-making that is tailored “to each student’s level of need and ability” (Johnson et al., 2011, p. 28) with the use of technology. Northwest Evaluation Association (NWEA) provides assessment data to progress monitor and support student differentiated instruction by specifying individual concepts a student has mastered, and the areas necessary for academic growth.

This purpose of this study was to provide information to predict a student’s growth index and normalized gain on reading literature when completing computerized differentiated homework in a one-to-one mobile device environment. Data will be collected through a web-based analytical tool, eSpark, which provides iPad app based differentiated homework assignments for each student based on specific learning goals and projected student growth in reading literature as previously determined by the NWEA reading skills Measures of Academic Progress assessment. Additionally, level of engagement and present mood while completing differentiated homework applications
will be analyzed by grade, gender and special education status as a predictor of growth index and normalized gain.

Purpose of the Study

The purpose of this study was to investigate how engagement, mood and number of assignments completed on computerized differentiated homework using an iPad in a one-to-one mobile device environment influence the growth index and normalized gain in reading literature benchmark assessments of students in grades five, six, and seven. Furthermore, this study investigated if gender or special education status influenced the growth index or normalized gain in reading literature benchmark assessment scores when using an iPad in a one-to-one mobile device environment with computerized differentiated homework.

Statement of the Problem

How did level of engagement, moods and number of assignments completed on computerized differentiated homework impact grade five, six and seven students growth index and normalized gain in reading literature, as measured by the Northwest Evaluation Association Measures of Academic Progress assessment when using an iPad in a one-to-one mobile device environment.

Research Questions

Research Question One

What were the engagement, moods and percentage of assignments completed for grade five, six and seven students using an iPad for computerized differentiated homework?

Research Question Two

What was the growth index and normalized gain in reading literature for grade five, six and seven students using an iPad for computerized differentiated homework?
Research Question Three

How did students’ engagement, moods and percentage of assignments completed on computerized differentiated homework using an iPad relate to grade, gender and special education status?

Research Question Four

How did students’ growth index and normalized gain in reading literature compare by grade, gender and special education status?

Research Question Five

What was the relationship between engagement, moods, percentage of assignments completed on computerized differentiated homework, growth index, and normalized gain on reading literature?

Research Question Six

How did students’ engagement, moods, percentage of assignments completed on computerized differentiated homework, grade, gender, and special education status predict the level of growth index and normalized gain in reading literature?

Research Question Seven

How did students’ engagement, moods, percentage of assignments completed on computerized differentiated homework, grade, gender, and special education status predict the level of normalized gain in reading literature?

Selection of Subjects

The participants in this study were middle level students in grades five, six, and seven at a suburban school in the Northeast of the United States with one-to-one mobile devices in their educational setting. Approximately 600 participants maintain individual
iPads provided by the district for the 2012-2013 academic year, in all subject areas and assigned homework. There are 148 fifth, 166 sixth, and 190 seventh grade students.

Setting

The students in this study were middle level students in grades five, six, and seven at one school in a suburban community in the Northeast of the United States. Each child receives an iPad during the first month of school annually. iPad’s are formatted at the district level to include specific apps and students are prohibited from altering the system preferences. All iPads and classrooms are Wi-Fi enabled. The district has contracted with eSpark, a progress monitoring app company that uses an “assessment engine [to] interpret NWEA test scores to diagnose student learning needs and create a personal learning profile for each student” (http://esparklearning.com/what-is-espark/, retrieved April 28, 2013). Each student iPad is provided with differentiated apps and assignments for homework following data analysis of the fall administered NWEA results. Students are tested on NWEA in the early fall, mid-winter, and late spring to measure individualized levels of achievement and readiness. Goals are established by NWEA for each student based on their expected growth outcome.

Data Gathering Techniques

Permission to conduct this study was granted from the Institutional Review Board of Dowling College. Permission was granted by the superintendent of the participating district, regarding access to all archival data from the local assessment (NWEA) and third party contracted vendor managing computerized differentiated homework (eSpark). Demographic data collected will include grade, gender and special education status. No personal student identifiable information will be collected. A web-based assessment tool,
Northwest Evaluation Association, and iPad application personalized learning profile generator, eSpark, will be used for data collection.

**Northwest Evaluation Association**

Northwest Evaluation Association (NWEA) is non-profit organization measuring student academic achievement with computer adaptive testing since 1974 with millions of assessments, student reports and common core infused questions. Data from NWEA assessments provide individualized measures of student growth that align to state and national standards through progress monitoring by computer adaptive testing. Computer adaptive tests are designed to address the platform that “one size doesn’t fit all” (http://www.nwea.org/node/97, retrieved April 28, 2013). NWEA further reports computer adaptive tests are rich in data because programming permits educators to see students as individuals “each with their own base of knowledge.” The tests are designed to adapt to the student by presenting each student:

> with engaging, age-appropriate content. As a student responds to questions, the test responds to the student, adjusting up or down in difficulty. The result is a rewarding experience for the student, and a wealth of detailed information for teachers, parents and administrators. (http://www.nwea.org/node/97, retrieved April 28, 2013)

NWEA data is provided to classroom teachers, building leaders and district administrators in a multitude of disaggregated reports. Reports options include:

- **Class by RIT level**: identifies groups of students for targeted instruction.
- **Class by Goal**: Displays academic diversity within a goal strand, identifying skills and concepts that student may be ready to learn.
- **Class Overview**: identifies where students are in each of the three core subject-areas, thereby guiding appropriate instruction for each child.
• Class Report: identifies student scores and achievement at the goal strand level as they align to state standards.

• Achievement Status and Growth Report: view individual student and class growth over the course of the year.

(http://www.nwea.org/products-services/data-and-reporting/classroom-reports, retrieved April 28, 2013). All individual student data is electronically shared with eSpark, including RIT levels, goal strand achievement level and expected growth score on spring assessment.

eSpark

eSpark assigns differentiated Common Core standards based educational apps to students on the iPad based on data provided by Northwest Evaluation Association Measures of Academic Progress assessment. eSpark offers diagnostic individualized learning goals through the interpretation of NWEA assessment results to create individualized “learning profiles for each student” (https://esparklearning.com/what-is-espark/#detailed, retrieved April 28, 2013). Specific applications are assigned for each student to complete that require accuracy and diagnostic quests to advance further ahead with their assignments. Students log onto eSpark to access their applications on individually issued iPads. Students are required to identify their current mood by selecting one of twelve emoticons before beginning homework. After completion of their assignment, students are required to identify their level of engagement in the application as either thumb up or thumb down.

Data was collected wirelessly for each student following completion of their assignment when they connected to a Wi-Fi zone. Students who did not have Wi-Fi zones
at home were connected automatically when in school. District personnel provided data spreadsheets via NWEA, and eSpark in excel spreadsheets. Data for moods and levels of engagement consisted of individual data entries for each student upon every login. The data for each student engagement level was calculated arithmetically and mood frequencies were tabulated.

Research Questions

Research Question One

What were the engagement, moods and percentage of assignments completed for grade five, six and seven students using an iPad for computerized differentiated homework?

A descriptive analysis (mean and standard deviation) will be conducted to analyze the engagement, moods and percentage of assignments completed for grade five, six and seven students.

Research Question Two

What was the growth index and normalized gain in reading literature for grade five, six and seven students using an iPad for computerized differentiated homework?

A descriptive analysis (mean and standard deviation) will be conducted to analyze the growth index and normalized gain in reading literature for grade five, six and seven students.

Research Question Three

How did students’ engagement, moods and percentage of assignments completed on computerized differentiated homework using an iPad relate to grade, gender and special education status?
A one-way between groups analysis of variance (ANOVA) will be conducted to analyze if engagement, moods and percentage of assignments completed are a factor when using grade. A paired samples t-test will be conducted to evaluate if gender and special education status are factors in student’s engagement, moods and percentage of assignments completed on computerized differentiated homework using an iPad.

*Research Question Four*

How did students’ growth index and normalized gain in reading literature compare by grade, gender and special education status?

An ANOVA and two independent sample t-tests will be conducted to analyze the growth index and normalized gain in reading literature by grade, gender and special education status.

*Research Question Five*

What was the relationship between engagement, moods, percentage of assignments completed on computerized differentiated homework, growth index and normalized gain on reading literature?

A correlation will be performed between engagement, moods, percentage of assignments completed on computerized differentiated homework, growth index and normalized gain.

*Research Question Six*

How did students’ engagement, moods, percentage of assignments completed on computerized differentiated homework, grade, gender, and special education status predict the level of growth index and normalized gain in reading literature?
Multiple regressions will be conducted to measure the predictability of students’ growth index as the dependent variable for engagement, moods, percentage of assignments completed on computerized differentiated homework, grade gender and special education status. A second multiple regression will be interpreted to predict students normalized gain as a dependent variable for level of engagement, moods, percentage of assignments completed on computerized differentiated homework, grade gender and special education status.

Research Question Seven

How did students’ engagement, moods, percentage of assignments completed on computerized differentiated homework, grade, gender, and special education status predict the level of normalized gain in reading literature?

Normalized gain will be divided in three factors: Significant Gain, Average gain, and No gain. Discriminant analysis will be used to learn a profile of a student in relationship with the normalized gain.
CHAPTER IV
INTRODUCTION

Introduction

This study investigated how grade five, six, and seven students’ engagement, mood and number of assignments completed on computerized differentiated homework using an iPad in a one-to-one mobile device environment influenced their growth index and normalized gain in reading literature. Additionally, this study intended to determine if gender or special education status influenced the growth index or normalized gain in reading literature when using an iPad in a one-to-one mobile device environment on computerized differentiated homework. The data collected for analysis included student Fall and Spring growth on Northwest Evaluation Association benchmark assessment and eSpark application data based on student mood during homework, level of engagement with applications, and percentage of completed assignments when using their iPad in a one-to-one mobile device environment.

Research Questions

Research Question One

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Research Question Three
How did students’ engagement, moods and percentage of assignments completed on computerized differentiated homework using an iPad relate to grade, gender and special education status?

Research Question Four
How did students’ growth index and normalized gain in reading literature compare by grade, gender and special education status?

Research Question Five
What was the relationship between engagement, moods, percentage of assignments completed on computerized differentiated homework, growth index and normalized gain on reading literature?

Research Question Six
How did students’ engagement, moods, percentage of assignments completed on computerized differentiated homework, grade, gender, and special education status predict the level of growth index and normalized gain in reading literature?

Research Question Seven
How did students’ engagement, moods, percentage of assignments completed on computerized differentiated homework, grade, gender, and special education status predict the level of normalized gain in reading literature?
Description of Subjects

Students from a public middle school in the northeast of the United States enrolled in grades five, six, and seven whom were given through district funding personalized iPads for the purposes of completing differentiated homework applications outside of the school day. There were a total of 512 subjects whose data was analyzed. Each grade reported students who were absent from either the fall or spring NWEA administration, prohibited from having iPad taken home, or had iPad personally damaged prohibiting full data collection. As a result, the number of valid students whose data was analyzed was 512: 150 5th graders, 171 6th graders, and 191 7th graders. Table 4.1 reports the distribution of students by grade.

Table 4.1

<table>
<thead>
<tr>
<th>Grade</th>
<th>N</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>150</td>
<td>29.3</td>
</tr>
<tr>
<td>6</td>
<td>171</td>
<td>33.4</td>
</tr>
<tr>
<td>7</td>
<td>191</td>
<td>37.3</td>
</tr>
<tr>
<td>Total</td>
<td>512</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Of the 512 students, 273 were male (53.3%) and 239 were female (46.7%). The distribution of males and females is shown in Table 4.2.

Table 4.2

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>273</td>
<td>53.3</td>
</tr>
<tr>
<td>Female</td>
<td>239</td>
<td>46.7</td>
</tr>
<tr>
<td>Total</td>
<td>512</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Of the students identified as special education, 427 (83.4%) are not special education while 85 (16.6%) are identified as special education. The distribution of special education status is shown in Table 4.3

Table 4.3

Distribution of Students by Special Education Status

<table>
<thead>
<tr>
<th>Special Education Status</th>
<th>N</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Spec. Ed.</td>
<td>427</td>
<td>83.4</td>
</tr>
<tr>
<td>Yes Spec. Ed.</td>
<td>85</td>
<td>16.6</td>
</tr>
<tr>
<td>Total</td>
<td>512</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Initial analysis of the data identified eight students whose average moods were more than five standard deviations above the mean and qualified as outliers. Most of the students that were recognized as outliers selected all one mood for every data entry. As such, their data was removed from the data set for all further analysis reflecting an N value of 504 subjects for analysis.

Research Questions

Research Question One

What were the engagement level, moods, and percentage of assignments completed for grade five, six and seven students using an iPad for computerized differentiated homework?

Measures of central tendency were computed to summarize the data for level of engagement, percentage of assignments completed, positive mood, and negative mood among grade five, six, and seven students. Measures of dispersion were computed to understand the variability of scores for engagement level, percentage of assignments completed, positive mood, and negative mood among grade five, six, and seven students.
The following are the results of this analysis for all students engagement level; N=504, M=.34, SD=.57. This is shown in Table 4.4 below.

Table 4.4

<table>
<thead>
<tr>
<th>Grade</th>
<th>N</th>
<th>Range</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>504</td>
<td>-1.0 – +1.0</td>
<td>.34</td>
<td>.57</td>
</tr>
<tr>
<td>5</td>
<td>148</td>
<td>-0.8 – +1.0</td>
<td>.52</td>
<td>.48</td>
</tr>
<tr>
<td>6</td>
<td>166</td>
<td>-1.0 – +1.0</td>
<td>.38</td>
<td>.51</td>
</tr>
<tr>
<td>7</td>
<td>190</td>
<td>-1.0 – +1.0</td>
<td>.15</td>
<td>.62</td>
</tr>
</tbody>
</table>

Table 4.4 also shows the descriptive data for each grade level of engagement. The following are the results of this analysis for grade five; N=148, M=.52, SD=.48. The following are the results of this analysis for grade six; N=166, M=.38, SD=.51. The following are the results of this analysis for grade seven; N=190, M=.15, SD=.62. The mean level of engagement in grade five suggests they were more engaged with their differentiated homework when using the iPad relative to grade six and seven.

Additionally, the grade six mean value appears to show more engagement when considering their reported mean engagement level than grade seven students. As such, as grade level increases from fifth to seventh, the mean level of engagement declines. The variability among the scores appears to reflect, with increased grade, a decrease in engagement level. This is represented in Graph 4.1.
The maximum and minimum range for engagement level is -1.0 to +1.0. Grade six and seven mean engagement level range was from -1.0 to +1.0, while grade five students mean engagement level range was from -0.8 to +1.0. Analysis shows no sixth grade student recorded a mean engagement level less than -0.8. The data appears to support fifth grade students are generally more engaged than grade six and seven students when completing differentiated homework using an iPad. As shown in Table 4.4, the mean engagement level for grade five students is .52, .14 points above grade six and .37 points above grade seven.
Measures of central tendency were computed to summarize the data for percentage of assignments completed among grade five, six, and seven students. Measures of dispersion were computed to understand the variability of scores for percentage of assignments completed among grade five, six, and seven students. The following are the results of this analysis for all students engagement level; N=504, M=.76, SD=.27. This is shown in Table 4.5 below.

Table 4.5

<table>
<thead>
<tr>
<th>Grade</th>
<th>N</th>
<th>Range</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>504</td>
<td>0-1.0</td>
<td>.76</td>
<td>.27</td>
</tr>
<tr>
<td>5</td>
<td>148</td>
<td>0-1.0</td>
<td>.66</td>
<td>.30</td>
</tr>
<tr>
<td>6</td>
<td>166</td>
<td>0-1.0</td>
<td>.82</td>
<td>.22</td>
</tr>
<tr>
<td>7</td>
<td>190</td>
<td>0-1.0</td>
<td>.78</td>
<td>.28</td>
</tr>
</tbody>
</table>

Note. Range scores reflect a percent out of 100 from 0 to +1.0.

Table 4.5 also shows the analysis for each grade percentage of assignments completed. The following are the results of this analysis for grade five; N=148, M=.66, SD=.30. The following are the results of this analysis for grade six; N=166, M=.82, SD=.22. The following are the results of this analysis for grade seven; N=190, M=.78, SD=.28. The mean indicates most students in grade five completed the least amount of homework on their iPad when assigned differentiated assignments as compared to grade six and seven. Additionally, grade six students appear to have completed the most amount of homework on their iPad when assigned differentiated homework.

A descriptive analysis was conducted to report the various moods students recorded on their iPad when completing their differentiated homework. The moods students could choose from included; bored, bullied, cool, excited, fine, frustrated, happy,
lonely, mad, proud, sad and scared. Measures of central tendency were computed to summarize the data for all moods. This is shown in the Appendix Table A.1.

For purposes of this study, raw scores of all twelve moods were consolidated where positive moods were considered cool, excited, fine, happy, and proud; and negative moods were considered bored, bullied, frustrated, lonely, mad, sad, and scared. Positive and negative moods measures of central tendency were computed to summarize the data for all students. This set of data is shown in Table 4.6. The following are the results of this analysis; positive mood N=504, M=5.61, SD=8.54; negative mood N=504, M=0.39. The mean score for positive moods is appears far greater than the mean score for negative moods indicating students are more likely to feel positive when initiating differentiated homework. The mean for positive moods is greater for all grade five, six, and seven students.

Table 4.6

Descriptive Statistics for Positive and Negative Moods Recorded of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework

<table>
<thead>
<tr>
<th>Grade</th>
<th>Mood</th>
<th>N</th>
<th>Range</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Positive</td>
<td>504</td>
<td>0-236</td>
<td>47.51</td>
<td>31.98</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>504</td>
<td>0-70</td>
<td>10.94</td>
<td>12.10</td>
</tr>
<tr>
<td>5</td>
<td>Positive</td>
<td>504</td>
<td>0-143</td>
<td>52.50</td>
<td>22.45</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>504</td>
<td>0-55</td>
<td>9.94</td>
<td>11.60</td>
</tr>
<tr>
<td>6</td>
<td>Positive</td>
<td>504</td>
<td>0-231</td>
<td>72.83</td>
<td>32.39</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>504</td>
<td>0-70</td>
<td>15.04</td>
<td>15.22</td>
</tr>
<tr>
<td>7</td>
<td>Positive</td>
<td>504</td>
<td>0-62</td>
<td>21.49</td>
<td>12.30</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>504</td>
<td>0-35</td>
<td>8.15</td>
<td>7.70</td>
</tr>
</tbody>
</table>

Note. Positive Moods include cool, excited, fin, happy, and proud. Negative Moods include bored, bullied, frustrated, lonely, mad, sad, and scared.

Descriptive statistics for individual mood percentages are shown in Table A.2 in the appendix. Students identified their moods as positive (N=23944, M=47.51) 81.28
percent of the time and negative (N=5516, M=10.94) 18.72 percent of the time when completing their homework on the iPad. This is reported in Table 4.7. The variation in mean percentage indicates students much more often feel positive moods while initiating differentiated homework than negative moods.

Table 4.7

Descriptive Statistics of Positive and Negative Mood Percentage Selected by Students Prior to Completing Differentiated Homework on iPad

<table>
<thead>
<tr>
<th>Mood</th>
<th>N</th>
<th>Mean</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>23944</td>
<td>47.51</td>
<td>81.28</td>
</tr>
<tr>
<td>Negative</td>
<td>5516</td>
<td>10.94</td>
<td>18.72</td>
</tr>
<tr>
<td>Total</td>
<td>29460</td>
<td>58.45</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Research Question Two

What was the growth index and normalized gain in reading literature for grade five, six and seven students using an iPad for computerized differentiated homework?

Measures of central tendency were computed to summarize the data for Growth Index and Normalized Gain among grade five, six, and seven students. Measures of dispersion were computed to understand the variability of scores for Growth Index and Normalized Gain among grade five, six, and seven students. The following are the results of this analysis for all students Growth Index; N=504, M=3.97, SD=7.97. This is shown in Table 4.8 below. The table shows all students averaged almost four points higher on the Spring NWEA assessment than their anticipated score on the Spring NWEA assessment. The range for all Growth Indexes reported is 60, values ranged from -21 to +39 for students in grades five through seven. A mean of zero would indicate all students exactly met their Growth Index. A positive Growth Index reflects surpassing your expected score, while a negative Growth Index reflects not meeting expectations.
Table 4.8

Descriptive Statistics for Growth Index of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework

<table>
<thead>
<tr>
<th>Grade</th>
<th>N</th>
<th>Range</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>504</td>
<td>-21 - +39</td>
<td>3.97</td>
<td>7.97</td>
</tr>
<tr>
<td>5</td>
<td>148</td>
<td>-21 - +28</td>
<td>5.00</td>
<td>8.64</td>
</tr>
<tr>
<td>6</td>
<td>166</td>
<td>-10 - +39</td>
<td>5.49</td>
<td>7.72</td>
</tr>
<tr>
<td>7</td>
<td>190</td>
<td>-18 - +38</td>
<td>1.84</td>
<td>7.19</td>
</tr>
</tbody>
</table>

Table 4.8 also shows the analysis for each grade Growth Index. The following are the results of this analysis for grade five; N=148, M=5.00, SD=8.64. The following are the results of this analysis for grade six; N=166, M=5.49, SD=7.72. The following are the results of this analysis for grade seven; N=190, M=1.84, SD=7.19. When you look at the mean Growth Index, it appears that most students in grade seven were much less likely to show high Growth Index scores on their as compared to grade five and six students. As such, it appears as grade level increases from fifth to seventh the mean growth index declines. This is represented in Graph 4.2 below.
Measures of central tendency were computed to summarize the data for Normalized Gain Index and Normalized Gain among grade five, six, and seven students. Measures of dispersion were computed to understand the variability of scores for Normalized Gain among grade five, six, and seven students. The following are the results of this analysis for all students Normalized Gain; N = 504, M = .15, SD = .16. This is shown in Table 4.9 below. The table shows all students mean normalized gain was .15
higher on the Spring NWEA assessment than their anticipated score on the Spring NWEA assessment.

Table 4.9

Descriptive Statistics for Normalized Gain of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework

<table>
<thead>
<tr>
<th>Grade</th>
<th>N</th>
<th>Range</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>504</td>
<td>-.44 - +1.0</td>
<td>.15</td>
<td>.16</td>
</tr>
<tr>
<td>5</td>
<td>148</td>
<td>-.39 - +1.0</td>
<td>.19</td>
<td>.18</td>
</tr>
<tr>
<td>6</td>
<td>166</td>
<td>-.30 - +.98</td>
<td>.18</td>
<td>.15</td>
</tr>
<tr>
<td>7</td>
<td>190</td>
<td>-.44 - +.42</td>
<td>.10</td>
<td>.15</td>
</tr>
</tbody>
</table>

Table 4.9 also shows the analysis for each grade Normalized Gain. The following are the results of this analysis for grade five; N=148, M=.19, SD=.18. The following are the results of this analysis for grade six; N=166, M=.18, SD=.15. The following are the results of this analysis for grade seven; N=190, M=.10, SD=.15. Analysis of the data in Table 4.9 indicates the Normalized Gain decreases with an increase in grade from fifth to seventh. The dispersion of variance also appears to have a greater range around the mean Normalized Gain among grade five students. This indicates grade five students have a larger range of Normalized Gain values than grade six and seven students. As such, it seems as grade level increases from fifth to seventh the mean Normalized Gain declines. This is represented in Graph 4.3 on the next page.
Graph 4.3

*Graphical representation of Normalized Gain Frequencies*

Research Question Three

How did students’ engagement, moods and percentage of assignments completed on computerized differentiated homework using an iPad relate to grade, gender and special education status?

The engagement level mean score and standard deviation for all students (M=.34, SD=.57) and those only in grades five (M=.52, SD=.48), six (M=.51, SD=.38), and seven (M=.15, SD=.62) are shown in Table 4.10.
Table 4.10

Descriptive Statistics for Engagement Level of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework

<table>
<thead>
<tr>
<th>Grade</th>
<th>N</th>
<th>Range</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>504</td>
<td>-1.0 – +1.0</td>
<td>.34</td>
<td>.57</td>
</tr>
<tr>
<td>5</td>
<td>148</td>
<td>-0.8 – +1.0</td>
<td>.52</td>
<td>.48</td>
</tr>
<tr>
<td>6</td>
<td>166</td>
<td>-1.0 – +1.0</td>
<td>.51</td>
<td>.38</td>
</tr>
<tr>
<td>7</td>
<td>190</td>
<td>-1.0 – +1.0</td>
<td>.15</td>
<td>.62</td>
</tr>
</tbody>
</table>

A one-way between subjects Analysis of Variance (ANOVA) was conducted to compare the effect of grade on engagement level, percentage of assignments completed, positive mood, and negative mood on computerized differentiated homework as measured by the difference between a students’ predicted spring assessment score and their actual spring assessment score on the Northwest Evaluation Assessment (NWEA). There was a significant effect of grade on engagement level at the p<.05 level for the three grades [F(2,501)=20.07, p=.000], percentage of completed assignments at the p<.05 level for the three grades [F(2,501)=15.49, p=.000], positive moods at the p<.05 level for the three grades [F(2,501)=216.82, p=.000], and negative moods at the p<.05 level for the three grades [F(2,501)=16.01, p=.000]. The ANOVA, as shown in Table 4.11, shows there was a significant difference in the mean value for Engagement Level, Percentage of Assignments Completed, Positive Mood, and Negative Mood among all three grades requiring a post hoc test.
Table 4.11

One-way between Groups Analysis of Variance (ANOVA) Comparing Engagement Level, Percentage of Completed Assignments, Positive Mood, and Negative Mood among Grade Five, Six, and Seven Students

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engagement level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>11.97</td>
<td>2</td>
<td>5.99</td>
<td>20.07</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>149.41</td>
<td>501</td>
<td>.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>161.37</td>
<td>503</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Percentage of Completed Assignments</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>2.21</td>
<td>2</td>
<td>1.11</td>
<td>15.49</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>35.82</td>
<td>501</td>
<td>.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>38.04</td>
<td>503</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mood Positive</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>238710.20</td>
<td>2</td>
<td>119355.10</td>
<td>216.82</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>275789.77</td>
<td>501</td>
<td>550.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>514499.97</td>
<td>503</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mood Negative</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>4423.41</td>
<td>2</td>
<td>2211.71</td>
<td>16.01</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>69193.03</td>
<td>501</td>
<td>138.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>73616.44</td>
<td>503</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the F level of significance, a post hoc comparison was performed using a Scheffé where equal variances were assumed to determine where the differences in mean value existed for engagement level, percentage of assignments completed, positive mood, and negative mood with all three grades.
The Post hoc comparisons using the Scheffe test, shown in Table 4.12, indicate that the mean engagement level for grade five (M=.52, SD=.48), was marginally significant (p=.066) compared to grade six (M=.51, SD=.38). However, the mean engagement level for grade seven students (M=.15, SD=.62) was significantly lower relative from grade five (p=.000) and grade six (p=.001) students. These results suggest that grade five and six students do not differ from each other with respect to their engagement level; while grade five and six students do report a significantly higher mean engagement level than students in grade seven.

Table 4.12

*Post Hoc Test: Multiple Comparisons for Engagement Level by Grade (Scheffe)*

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>(I) Grade</th>
<th>(J) Grade</th>
<th>(I-J)</th>
<th>Std. Error</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement level</td>
<td>5</td>
<td>6</td>
<td>.14</td>
<td>.06</td>
<td>.066</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>.37*</td>
<td>.06</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>.23*</td>
<td>.06</td>
<td>.001</td>
</tr>
</tbody>
</table>

*. The mean difference is significant at the p=.05 level.

The data appears to suggest as grade level increases from fifth to seventh, the engagement level students report following completion of their computerized differentiated homework decreases. This is shown in Graph 4.4.
Graph 4.4

*Engagement Level of Grade Five, Six, and Seven Students Using an iPad on Computerized Differentiated Homework*

The percentage of assignments completed mean score and standard deviation for all students (M=.76, SD=.27) and those only in grades five (M=.66, SD=.30), six (M=.82, SD=.22), and seven (M=.78, SD=.28) are shown below in Table 4.13.

Table 4.13

<table>
<thead>
<tr>
<th>Grade</th>
<th>N</th>
<th>Range</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>504</td>
<td>0-1.0</td>
<td>.76</td>
<td>.27</td>
</tr>
<tr>
<td>5</td>
<td>148</td>
<td>0-1.0</td>
<td>.66</td>
<td>.30</td>
</tr>
<tr>
<td>6</td>
<td>166</td>
<td>0-1.0</td>
<td>.82</td>
<td>.22</td>
</tr>
<tr>
<td>7</td>
<td>190</td>
<td>0-1.0</td>
<td>.78</td>
<td>.28</td>
</tr>
</tbody>
</table>

Note. Range scores reflect a percent out of 100 from 0 to +1.0.
The data appears to suggest fifth graders completed the least amount of
differentiated homework assigned on their iPads. Specifically, Table 4.13 shows grade
six students appear to have the greatest percentage of completed assignments on their
iPad when doing computerized differentiated homework. Based on the F level of
significance, a post hoc comparison was performed using a Scheffe where equal
variances were assumed to determine where the differences in mean value existed for
percentage of assignments completed with grade five, six, and seven students. Table 4.14
shows the Post Hoc Test comparisons for engagement level.

Table 4.14

*Post Hoc Test: Multiple Comparisons for Percentage of Assignments Completed
(Scheffe)*

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>(I) Grade</th>
<th>(J) Grade</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>% HW completed</td>
<td>5</td>
<td>6</td>
<td>-.16*</td>
<td>.03</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>6</td>
<td>-.12*</td>
<td>.03</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>.04</td>
<td>.03</td>
<td>.381</td>
</tr>
</tbody>
</table>

* The mean difference is significant at the 0.05 level.

The Post hoc comparisons using the Scheffe test, shown in Table 4.14, indicate
that the mean percentage of completed assignments for grade five (M=.66, SD=.30), was
significant compared to grade six and seven (p=.000). However, the mean percentage of
completed assignments for grade seven students (M=.78, SD=.28) did not differ
significantly from grade six (p=.001) students. These results suggest that grade five was
significantly lower relative to grade six and seven with respect to their percentage of
completed assignments.
The positive mood mean score and standard deviation for all students (M=47.51, SD=31.98) and those only in grades five (M=52.50, SD=22.45), six (M=72.83, SD=32.39), and seven (M=21.49, SD=12.31) are shown below in Table 4.8. The negative mood mean score and standard deviation for all students (M=10.94, SD=12.10) and those only in grades five (M=9.94, SD=11.60), six (M=15.04, SD=15.22), and seven (M=8.15, SD=7.70) are also shown in Table 4.15.

Table 4.15

<table>
<thead>
<tr>
<th>Mood</th>
<th>Grade</th>
<th>N</th>
<th>Range</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>All</td>
<td>504</td>
<td>236</td>
<td>47.51</td>
<td>31.98</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>148</td>
<td>143</td>
<td>52.50</td>
<td>22.45</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>166</td>
<td>231</td>
<td>72.83</td>
<td>32.39</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>190</td>
<td>62</td>
<td>21.49</td>
<td>12.31</td>
</tr>
<tr>
<td>Negative</td>
<td>All</td>
<td>504</td>
<td>70</td>
<td>10.94</td>
<td>12.10</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>148</td>
<td>55</td>
<td>9.94</td>
<td>11.60</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>166</td>
<td>70</td>
<td>15.04</td>
<td>15.22</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>190</td>
<td>35</td>
<td>8.15</td>
<td>7.70</td>
</tr>
</tbody>
</table>

The Post hoc comparisons using the Scheffe test, shown in Table 4.16, indicate that the mean positive mood among grade five (M=52.50, SD=22.45), six (M=72.83, SD=32.39), and seven (M=21.49, SD=12.31) was significant (p=.000). These results suggest the variance of positive mood reported among all grade levels is significant. The mean negative mood among grade six (M=15.04, SD=15.22) students and both grade five (M=9.94, SD=11.60) and seven (M=8.15, SD=7.70) students is very significant (p=.000), while the variance among grade five and seven students is not significant (p=.381).
Table 4.16

*Post Hoc Test: Multiple Comparisons for Positive and Negative Mood (Scheffe)*

<table>
<thead>
<tr>
<th></th>
<th>(I) Grade</th>
<th>(J) Grade</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Mood</td>
<td>5</td>
<td>6</td>
<td>-20.33*</td>
<td>2.65</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>6</td>
<td>31.01*</td>
<td>2.57</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>51.34</td>
<td>2.49</td>
<td>.000</td>
</tr>
<tr>
<td>Negative Mood</td>
<td>5</td>
<td>6</td>
<td>-5.10*</td>
<td>1.33</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>6</td>
<td>1.79</td>
<td>1.29</td>
<td>.381</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>6.89</td>
<td>1.25</td>
<td>.000</td>
</tr>
</tbody>
</table>

*. The mean difference is significant at the 0.05 level.

These results indicate grade six were more likely to have positive and negative moods relative to the fifth and seventh graders.

An independent samples t-test was conducted to compare engagement level, percentage of completed assignments, positive mood, and negative mood as shown in Table 4.17, if males and females differed in their engagement level, percentage of completed assignments, positive mood, and negative mood. The independent Samples t test shows there was a significant difference between males (M=.73, SD=.29) and females (M=.78, SD=.25) only when comparing percentage of completed assignments conditions t(502)=-2.14, p=.033). These results indicate females significantly completed more homework assignments than males of the same grade when using an iPad for differentiated homework. The analysis as shown in Table 4.17 shows no significant difference between males (M=.37, SD=.58) and females (M=.29, SD=.55) for engagement level conditions; t(502)=1.61, p=.108. The analysis shows no significant difference between males (M=11.32, SD=12.24) and females (M=10.52, SD=11.95) for negative mood conditions; t(502)=.743, p=.458. However, the analysis does indicate an marginally significant difference between males (M=45.24, SD=30.98) and females
(M=5.05, SD=32.95) for positive mood conditions; t(502)=−1.69, p=.09. This implies gender differences do not significantly vary among males and females level of engagement and overall mood when completing differentiated homework using an iPad, although the females do tend to complete their homework more often and with a slightly more positive mood during the experience.

Table 4.17

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement</td>
<td>male</td>
<td>266</td>
<td>.37</td>
<td>.58</td>
<td>502</td>
<td>1.61</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>238</td>
<td>.29</td>
<td>.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% HW</td>
<td>male</td>
<td>266</td>
<td>.73</td>
<td>.29</td>
<td>502</td>
<td>-2.14</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>238</td>
<td>.78</td>
<td>.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mood</td>
<td>male</td>
<td>266</td>
<td>45.24</td>
<td>30.98</td>
<td>502</td>
<td>-1.69</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>238</td>
<td>50.05</td>
<td>32.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mood</td>
<td>male</td>
<td>266</td>
<td>11.32</td>
<td>12.24</td>
<td>502</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>female</td>
<td>238</td>
<td>10.52</td>
<td>11.95</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An independent samples t-test was conducted to compare engagement level, percentage of completed assignments, positive mood, and negative mood as shown in Table 4.17, if status as a special education student differed in student’s engagement level, percentage of completed assignments, positive mood, and negative mood when completing differentiated homework using an iPad. The independent Samples t test shows there was a significant difference between engagement level conditions; t(502)=−2.540, p=.011 of students who are not classified as special education (M=.31, SD=.56) and those that are classified as special education (M=.48, SD=.57) when completing differentiated homework on their iPad. This analysis suggests students who are classified as special education tend to be significantly more engaged in their differentiated
homework on the iPad compared to their classmates who are not classified as special education.

*Table 4.18*

*Independent Samples t test Comparing Special Education Status Engagement Level, Percentage Homework Assignments Completed, Positive Mood, and Negative Mood*

<table>
<thead>
<tr>
<th>Special Ed. Status</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement level</td>
<td>No</td>
<td>422</td>
<td>.31</td>
<td>.56</td>
<td>-2.54</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>82</td>
<td>.48</td>
<td>.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% HW completed</td>
<td>No</td>
<td>422</td>
<td>.76</td>
<td>.27</td>
<td>.172</td>
<td>.86</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>82</td>
<td>.75</td>
<td>.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mood</td>
<td>No</td>
<td>422</td>
<td>47.64</td>
<td>32.55</td>
<td>502</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>82</td>
<td>46.82</td>
<td>29.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive Mood</td>
<td>No</td>
<td>422</td>
<td>11.21</td>
<td>11.88</td>
<td>502</td>
<td>1.13</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>82</td>
<td>9.56</td>
<td>13.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Mood</td>
<td>No</td>
<td>422</td>
<td>10.40</td>
<td>11.88</td>
<td>502</td>
<td>1.13</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>82</td>
<td>9.56</td>
<td>13.17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results in Table 4.18 show no significant difference between non-classified special education students (M=.76, SD=.27) and classified special education students (M=.75, SD=.30) for percentage of assignments completed conditions; t(502)=.172, p=.864. The analysis also shows no significant difference between non-classified special education students (M=47.64, SD=32.55) and classified special education students (M=46.82, SD=29.04) for positive mood conditions; t(502)=.214, p=.831, and non-classified special education students (M=11.21, SD=11.88) and classified special education students (M=9.56, SD=13.17) for negative mood conditions; t(502)=1.132, p=.258.

This suggests student’s ability to complete differentiated homework when using an iPad status does not differ among special education students and those not classified as special education. This analysis suggests classified special education students complete
an equal percentage of assignments as non-classified special education students while being more significantly engaged when completing differentiated homework on an iPad. Additionally, moods as either positive or negative for all students independent of special education status have no significant variance. It also implies students classified as special education are no more likely to report feeling more positive or negative than their non-classified special education peers.

**Research Question Four**

How did students’ growth index and normalized gain in reading literature compare by grade, gender and special education status?

A one-way between subjects Analysis of Variance (ANOVA) was conducted to compare the effect of grade level on Growth Index and Normalized Gain in reading literature as measured by the difference between a students’ predicted spring assessment score and their actual spring assessment score on the Northwest Evaluation Assessment (NWEA). There was a significant effect of grade on Growth Index at the p<.05 level for the three conditions [F(2,501)=11.50, p=0.000] and Normalized Gain at the p<.05 level for the three conditions [F(2,501)=16.87, p=0.000]. The ANOVA, as shown in Table 4.19, shows there was a significant difference in Growth Index and Normalized Gain requiring a post hoc test.
Table 4.19

One-way between Groups Analysis of Variance (ANOVA) Comparing Growth Index and Normalized Gain among Grade Five, Six, and Seven Students

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth Index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>1402.85</td>
<td>2</td>
<td>701.42</td>
<td>11.50</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>30570.75</td>
<td>501</td>
<td>61.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>31973.61</td>
<td>503</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normalized Gain</td>
<td>.857</td>
<td>2</td>
<td>.428</td>
<td>16.87</td>
<td>.000</td>
</tr>
<tr>
<td>Between Groups</td>
<td>12.726</td>
<td>501</td>
<td>.025</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within Groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>13.583</td>
<td>503</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the F level of significance, a post hoc comparison using a Dunnett T3 test was conducted to determine where the differences in mean score were. The mean score and standard deviation for all students (M=3.97, SD=7.97) and those only in grades five, six, and seven for Growth Index are shown below in Table 4.20. Grade five students have a mean growth index (M=5.00, SD=8.64), grade six students have a mean growth index (M=5.98, SD=7.72), and grade seven students have a mean growth index (M=1.84, SD=7.19). The data appears to suggest as grade level increases from fifth to seventh, the Growth Index score generally decrease with a minor increase in grade six.
Table 4.20

*Descriptive Statistics for Growth Index of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework*

<table>
<thead>
<tr>
<th>Grade</th>
<th>N</th>
<th>Range</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>504</td>
<td>-21 - +39</td>
<td>3.97</td>
<td>7.97</td>
</tr>
<tr>
<td>5</td>
<td>148</td>
<td>-21 - +28</td>
<td>5.00</td>
<td>8.64</td>
</tr>
<tr>
<td>6</td>
<td>166</td>
<td>-10 - +39</td>
<td>5.49</td>
<td>7.72</td>
</tr>
<tr>
<td>7</td>
<td>190</td>
<td>-18 - +38</td>
<td>1.84</td>
<td>7.19</td>
</tr>
</tbody>
</table>

The mean score and standard deviation for all students (M=.15, SD=.16) and those only in grades five, six, and seven for Normalized Gain are shown below in Table 4.21. Grade five students have a mean Normalized Gain (M=.19, SD=.18), grade six students have a mean Normalized Gain (M=.18, SD=.15), and grade seven students have a mean Normalized Gain (M=.10, SD=.15). The data appears to suggest as grade level increases from fifth to seventh, the Normalized Gain value decreases.

Table 4.21

*Descriptive Statistics for Normalized Gain of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework*

<table>
<thead>
<tr>
<th>Grade</th>
<th>N</th>
<th>Range</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>504</td>
<td>-.44 - +1.0</td>
<td>.15</td>
<td>.16</td>
</tr>
<tr>
<td>5</td>
<td>148</td>
<td>-.39 - +1.0</td>
<td>.19</td>
<td>.18</td>
</tr>
<tr>
<td>6</td>
<td>166</td>
<td>-.30 - +.98</td>
<td>.18</td>
<td>.15</td>
</tr>
<tr>
<td>7</td>
<td>190</td>
<td>-.44 - +.42</td>
<td>.10</td>
<td>.15</td>
</tr>
</tbody>
</table>

The Dunnett T3 test indicated that the mean Growth Index for grade five (M=5.00, SD=8.64) was not significantly different than grade six (M=5.49, SD=7.72). However, the mean Growth Index for grade seven students (M=1.84, SD=7.19) did significantly differ from grade five and six students. These results suggest that grade five and six students do not differ from each other with respect to their Growth Index; while
grade five and six students do see a significantly higher mean Growth Index score than students in grade seven. This is shown in Table 4.22.

*Table 4.22*

*Post Hoc Test: Multiple Comparisons for Growth Index (Dunnett T3)*

<table>
<thead>
<tr>
<th>(I) Grade</th>
<th>(J) Grade</th>
<th>(I-J) Mean Difference</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>5</td>
<td>6</td>
<td>-.49</td>
<td>.929</td>
</tr>
<tr>
<td>Index</td>
<td>7</td>
<td>3.16*</td>
<td>.881</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>3.65*</td>
<td>.795</td>
</tr>
</tbody>
</table>

* The mean difference is significant at the 0.05 level.

The Dunnett T3 test yielded similar results as the post hoc test for Growth Index where the mean Normalized Gain for grade five (M=19, SD=.18) was not significantly different than grade six (M=.18, SD=.15). However, the mean Normalized Gain for grade seven students (M=.10, SD=.15) did significantly differ from grade five and six students. These results suggest that grade five and six students do not differ from each other with respect to their Normalized Gain; while grade five and six students do see a significantly higher mean Normalized Gain score than students in grade seven. This is shown in Table 4.23.
Table 4.23

Post Hoc Test: Multiple Comparisons for Normalized Gain (Dunnett T3)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>(I) Grade</th>
<th>(J) Grade</th>
<th>Mean Difference (I-J)</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normalized Gain</td>
<td>5</td>
<td>6</td>
<td>.01</td>
<td>.019</td>
<td>.966</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>6</td>
<td>.09*</td>
<td>.018</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>.08*</td>
<td>.016</td>
<td>.000</td>
</tr>
</tbody>
</table>

*. The mean difference is significant at the p<.05 level.

An independent samples t-test was conducted to compare Growth Index and Normalized Gain in males and females as shown in Table 4.24, to determine if males and females differed in their Growth Index and Normalized Gain as measured by the difference between a students’ predicted spring assessment score and their actual spring assessment score on the NWEA. There was no significant difference in the Growth Index scores for males (M=4.00, SD=8.12) and females (M=3.94, SD=7.82) conditions; t(502)=.094, p=0.925. Table 4.12a shows there was no significant difference in the Normalized Gain for males (M=.15, SD=.16) and females (M=.16, SD=.17) conditions; t(502)=-.661, p=0.509.

Table 4.24

Independent Samples t test Comparing Male and Female Growth Index and Normalized Gain

<table>
<thead>
<tr>
<th>Gender</th>
<th>Growth Index</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>male</td>
<td></td>
<td>266</td>
<td>4.00</td>
<td>8.12</td>
<td>502.00</td>
<td>.09</td>
<td>.93</td>
</tr>
<tr>
<td>female</td>
<td></td>
<td>238</td>
<td>3.94</td>
<td>7.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>Normalized Gain</td>
<td>266</td>
<td>.15</td>
<td>.16</td>
<td>502.00</td>
<td>-.66</td>
<td>.51</td>
</tr>
<tr>
<td>female</td>
<td></td>
<td>238</td>
<td>.16</td>
<td>.17</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
These results suggest that gender does not have any effect on the Growth Index or Normalized Gain. Specifically, the results suggest when students take an assessment their Growth Index and Normalized Gain are not dependent on if they are male or female.

An independent samples t-test was conducted to compare Growth Index and Normalized Gain in students classified as special education and those that are not classified as special education to determine if special education status differed for students Growth Index and Normalized Gain. These results are shown in Table 4.25.

**Table 4.25**

*Independent Samples t test Comparing Special Education Status Growth Index and Normalized Gain*

<table>
<thead>
<tr>
<th>Special Ed. Status</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth Index</td>
<td>No</td>
<td>422</td>
<td>3.87</td>
<td>7.77</td>
<td>.66</td>
<td>.51</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>82</td>
<td>4.50</td>
<td>8.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normalized Gain</td>
<td>No</td>
<td>422</td>
<td>.16</td>
<td>.17</td>
<td>.78</td>
<td>.44</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>82</td>
<td>.14</td>
<td>.15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There was no significant difference in the Growth Index scores for students not classified as special education (M=3.87, SD=7.77) and students classified as special education (M=4.50, SD=8.98) conditions; t(502)=.655, p=0.513. Table 4.26 shows there was no significant difference in the Normalized Gain for students not classified as special education (M=.16, SD=.17) and students classified as special education (M=.14, SD=.15) conditions; t(502)=.781, p=0.435.

These results suggest that status as a special education student do not have any effect on the Growth Index or Normalized Gain when being assessed during the course of a year when using an iPad for differentiated homework. Specifically, the results suggest
when special education students take an end of the year benchmark assessment; their Growth Index and Normalized Gain scores are not different from non-special education students when using an iPad on differentiated homework.

**Research Question Five**

What was the relationship between engagement level, moods, percentage of assignments completed on computerized differentiated homework, gender, special education status and grade level with growth index and normalized gain on reading literature?

A correlation analysis statistical procedure using the Pearson product moment correlation coefficient was used to determine the relationship between Growth Index and variables engagement level, percentage of assignments completed, positive mood, and negative mood for grade five, six, and seven students when completing differentiated homework on an iPad. The results of this analysis are shown in Table 4.26.

Table 4.26 illustrates, the correlation procedure using the Pearson product moment correlation coefficient yielded a positive correlation between Growth Index and positive mood ($r^2=.193$, $N=504$, $p=.000$). Growth Index shows no significant correlation with engagement level ($r^2=.002$, $N=504$, $p=.309$), percentage of assignments completed ($r^2=.021$, $N=504$, $p=.640$), and negative mood ($r^2=.017$, $N=504$, $p=.703$). This analysis indicates students who have a high Growth Index tend to exhibit a more positive mood when working on differentiated homework using an iPad. Additionally, engagement level is positively correlated with positive mood ($r^2=.061$, $N=504$, $p=.000$) while negatively correlated with negative mood ($r^2=.069$, $N=504$, $p=.000$). This indicates students who exhibit positive moods tend to be more engaged in their differentiated homework while
working on an iPad, while students who exhibit negative moods tend to be less engaged in their differentiated homework while working on an iPad. This implies, happy students are more engaged than unhappy students when using an iPad to complete differentiated homework.

*Table 4.26*

*Pearson Correlation Matrix between Growth Index, Engagement Level, Percentage of Assignments Completed, Positive Mood, and Negative Mood*

<table>
<thead>
<tr>
<th></th>
<th>Growth Index</th>
<th>Engage. Level</th>
<th>% Assign. Complete</th>
<th>Positive Mood</th>
<th>Negative Mood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth Index</td>
<td>r 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>r²</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N 504</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engagement level</td>
<td>r .045</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>r² .002</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N 504 504</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage of Assign. Complete</td>
<td>r .021</td>
<td>-.033</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>r² .000 .001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N 504 504 504</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive Mood</td>
<td>r .193**</td>
<td>.247**</td>
<td>.238**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>r² .037 .061</td>
<td></td>
<td>.056</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N 504 504 504</td>
<td></td>
<td>504</td>
<td></td>
<td>504</td>
</tr>
<tr>
<td>Negative Mood</td>
<td>r .017</td>
<td>-.263**</td>
<td>.099*</td>
<td>-.104*</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>r² .000 .069</td>
<td></td>
<td>.010</td>
<td>.011</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N 504 504 504</td>
<td></td>
<td>504</td>
<td>504</td>
<td>504</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Students who show high levels of percentage of assignments completed are positively correlated with positive mood ($r^2=.056$, $N=504$, $p=.000$) and negatively correlated with negative mood ($r^2=.010$, $N=504$, $p=.026$). This shows there is a relationship where the more positive moods a student reports, the more assignments they are likely to complete. Conversely, the more negative moods a student reports, the less likely they are to complete their differentiated homework assignments on their iPad.
As previously stated, there is no significant correlation between Growth Index and negative mood ($r^2=.017$, $N=504$, $p=.703$). This indicates when students report feeling unhappy, their performance on benchmark assessments are not hindered, however, when students report feeling in a positive mood, they achieve higher Growth Index scores on benchmark assessments, especially when using an iPad for differentiated homework. Therefore, the more positive a student reports feeling, the better they do.

A second Pearson product moment correlation coefficient was used to determine the relationship between Normalized Gain and variables engagement level, percentage of assignments completed, positive mood, and negative mood for grade five, six, and seven students when completing differentiated homework on an iPad. The results of this analysis are shown in Table 4.27.

Table 4.27 illustrates, the correlation procedure using the Pearson product moment correlation coefficient yielded a positive correlation between Normalized Gain and positive mood ($r^2=.062$, $N=504$, $p=.000$). Normalized Gain shows no significant correlation with engagement level ($r^2=.000$, $N=504$, $p=.929$), percentage of assignments completed ($r^2=.000$, $N=504$, $p=.524$), and negative mood ($r^2=.000$, $N=504$, $p=.740$). This analysis indicates students who have a high Normalized Gain tend to exhibit a more positive mood when working on differentiated homework using an iPad.
Growth Index scores were used to calculate Normalized Gains. As such, the two variables show an extremely high correlation and similar results from their Pearson product moment correlation. This is represented in Table 4.28.

Table 4.27

<table>
<thead>
<tr>
<th></th>
<th>Normal. Gain</th>
<th>Engage. level</th>
<th>% Assign. Complete</th>
<th>Positive Mood</th>
<th>Negative Mood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normalized Gain</td>
<td>r 1</td>
<td>r² .902**</td>
<td>N 504</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engagement level</td>
<td>r -.004</td>
<td>r² .814</td>
<td>N 504</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage of Assign. Complete</td>
<td>r -.028</td>
<td>r² .000</td>
<td>N 504</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive Mood</td>
<td>r .249**</td>
<td>r² .062</td>
<td>N 504</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Mood</td>
<td>r .015</td>
<td>r² .000</td>
<td>N 504</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Growth Index scores were used to calculate Normalized Gains. As such, the two variables show an extremely high correlation and similar results from their Pearson product moment correlation. This is represented in Table 4.28.

Table 4.28

<table>
<thead>
<tr>
<th></th>
<th>Growth Index</th>
<th>Normalized Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normalized Gain</td>
<td>r .902**</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>r² .814</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N 504</td>
<td>504</td>
</tr>
</tbody>
</table>

Note: **. Correlation is significant at the 0.01 level (2-tailed).
Research Question Six

How did students’ engagement, moods, percentage of assignments completed on computerized differentiated homework, grade, gender, and special education status predict the level of growth index and normalized gain in reading literature?

A hierarchal multiple regression was conducted to measure the predictability of students’ growth index as the dependent variable for engagement, percentage of assignments completed on computerized differentiated homework, positive mood, negative mood, grade, gender and special education status. A second multiple regression was conducted to predict students normalized gain as a dependent variable for level of engagement, percentage of assignments completed on computerized differentiated homework, positive mood, negative mood, grade, gender and special education status.

The overall model for growth index was significant at the p=.05 level [Index F(7,496)=3.611, p,.001, adj. R² =.048]. An analysis of the engagement, percentage of assignments completed, positive mood, negative mood, grade, gender and special education status indicated that grade and positive mood were independent predictors of growth index. This is shown in Table 4.29.

Table 4.29

Model Summary for Growth Index

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>R Square Change</th>
<th>F</th>
<th>Change</th>
<th>df1</th>
<th>df2</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.220&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.048</td>
<td>.035</td>
<td>7.832</td>
<td>.048</td>
<td>3.611</td>
<td>7</td>
<td>496</td>
<td>.001</td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Mood Negative, Gender, Grade, Spec Ed, % HW completed, Engagement level, Mood Positive
Table 4.30

Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
</tr>
<tr>
<td>(Constant)</td>
<td>7.707</td>
<td>3.746</td>
</tr>
<tr>
<td>Grade</td>
<td>-1.037</td>
<td>.522</td>
</tr>
<tr>
<td>Gender</td>
<td>-.083</td>
<td>.716</td>
</tr>
<tr>
<td>Spec Ed</td>
<td>.688</td>
<td>.963</td>
</tr>
<tr>
<td>Engagement level</td>
<td>-.282</td>
<td>.680</td>
</tr>
<tr>
<td>% HW completed</td>
<td>-.003</td>
<td>1.401</td>
</tr>
<tr>
<td>Mood Positive</td>
<td>.039</td>
<td>.013</td>
</tr>
<tr>
<td>Mood Negative</td>
<td>.014</td>
<td>.031</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Growth Index

The overall model for normalized gain was significant at the p=.05 level [Index F(7,496)=7.234, p=.000, adj. R² =.093]. An analysis of the engagement, percentage of assignments completed, positive mood, negative mood, grade, gender and special education status indicated that grade and positive mood were independent predictors of normalized gain. This is shown in Table 4.31

Table 4.31

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the R Square</th>
<th>Change Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>R</td>
</tr>
<tr>
<td>1</td>
<td>.304a</td>
<td>.093</td>
<td>.080</td>
<td>.1576301</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Mood Negative, Gender, Grade, Spec Ed, % HW completed, Engagement level, Mood Positive
Table 4.32

Coefficientsa

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
</tr>
<tr>
<td>(Constant)</td>
<td>.320</td>
<td>.075</td>
</tr>
<tr>
<td>Grade</td>
<td>-.030</td>
<td>.011</td>
</tr>
<tr>
<td>Gender</td>
<td>.006</td>
<td>.014</td>
</tr>
<tr>
<td>Spec Ed</td>
<td>-.009</td>
<td>.019</td>
</tr>
<tr>
<td>1 Engagement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>level</td>
<td>-.028</td>
<td>.014</td>
</tr>
<tr>
<td>% HW completed</td>
<td>-.037</td>
<td>.028</td>
</tr>
<tr>
<td>Mood Positive</td>
<td>.001</td>
<td>.000</td>
</tr>
<tr>
<td>Mood Negative</td>
<td>9.563E-005</td>
<td>.001</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Normalized Gain

Research Question Seven

How did students’ engagement, moods, percentage of assignments completed on computerized differentiated homework, grade, gender, and special education status predict the level of normalized gain in reading literature?

A discriminant analysis was not conducted because the findings in question six yielded little significance amongst the variables.
CHAPTER V
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction
The purpose of this study was to investigate how grade five, six, and seven students’ engagement, mood and number of assignments completed on computerized differentiated homework using an iPad in a one-to-one mobile device environment influenced their growth index and normalized gain on a reading literature benchmark assessment. Furthermore, this study investigated if gender or special education status influenced the growth index or normalized gain on the reading literature benchmark assessment score when using an iPad in a one-to-one mobile device environment on computerized differentiated homework. Two multiple regressions were conducted to measure which variables were independent predictors to growth index and normalized gain scores. The conclusions emanating from this study consist of dimensions of academic achievement on reading literature benchmark assessment in terms of engagement and mood with technology,

Summary
School districts across the nation are rapidly acquiring mobile devices, such as the iPad, to raise student achievement while altering the dynamics of educational paradigms (Treen & Leonardi, 2012). This study intended to explore the influence of student engagement, mood, and completed homework using an iPad on student reading growth.
The subjects in this study acquired mobile device technology (iPads) with the implementation of a district technology initiative. The literature on this technological implementation is in its infancy and more empirical studies are necessary (Treen et al., 2012) regarding the benefits and long-term achievements with students. This study sought to answer two primary questions related to mobile device implementation and student achievement:

1. What were student engagement, mood, and completion of differentiated homework levels using an iPad?

2. How did student’s engagement, mood, and homework completion on an iPad influence their reading growth scores on benchmark assessments?

In a longitudinal study conducted from September 2011 to July 2013, Clarke, Svanaes, Zimmermann, and Crowther, studied the impact of one-to-one tablets in secondary schools. The conclusion of Clarke et al. (2013) study refers to the “iPad factor” which acknowledged parents and students alike recognize mobile device technology is desirable and has “an effective way of involving parents in their children’s learning.” Hence, districts have been purchasing one-to-one mobile devices for this purpose despite “not all leadership or teachers are necessarily comfortable with digital media,” because they recognize “that education needs to keep abreast of the continuing digital revolution that is occurring through social media and handheld devices” (Clarke et al., 2013, p. 45). Consequently, some districts are purchasing iPads for their students exclusively to remain competitive with their neighboring districts. This fast pace inclusion of technology is challenging, “educators [to] engage students, deliver content, and manage the traditional
classroom” with innovative and pedagogical methodologies (O’Malley, Lewis, Donehower, & Stone, 2014, p. 90).

The iPad and other such tablet devices are owned by more than one-third of all American households (34%) in 2013 according to research conducted by the Pew Research Institute; which is nearly double the rate it was only one year earlier (18%) in 2012. Additionally, the more educated and suburban, and higher income your household is, the percentage of tablet household ownership increases to over 50 percent (Zickuhr, 2013). As the students in our school system are growing up in households immersed in technology, “digital natives” learn and acquire information differently than “the people our educational system was designed to teach” (Prensky, 2001). With digital natives, the inclusion of emergent technology is essential for their success as twenty-first century learners competing in a global world.

Research supports that iPads are the necessary technological innovation to infiltrate academics and provide a more integrated teaching and learning environment so effectively, that other tablet devices will find it difficult to compete with (Raths, 2012). Additionally, studies refer to the iPad as the ubiquitous mobile learning device designed to promote learning, especially in literacy because the device “not only support[s] student learning, but students were also highly engaged” (Hutchinson et al., 2012). Hutchinson et al., conclude further research is necessary to examine how iPads can help meet these apparent curricular objectives. iPad technology hopes to further learning opportunities by allowing integration of curricular content through extending practice opportunities, ideally at home and through homework (Haydon, Hawkins, Denune, Kimener, McCoy, and Basham, 2012).
The participants in this study were grade five, six, and seven students from a middle school in a suburban northeast public school. The district provided all grade five, six, and seven middle school students with iPads. Each iPad was pre-loaded with applications specific to the student for differentiated homework. The applications were assigned based on pre-assessment data analysis gaps. The apps were intended to support the student in maximal growth opportunities in reading by engaging the student in their homework.

This study investigated the influence of engagement, moods, and percentage of assignments completed among grade five, six, and seven students using an iPad in a one-to-one mobile device by measuring and comparing their growth index and normalized gain in reading literature benchmark assessments. The grade five, six, and seven students recorded their engagement level and mood throughout the school year on their iPad while completing their homework. Analysis was conducted following their post benchmark reading literature assessment in the spring of the same school year.

The data yielded from this study was subjected to quantitative analyses. Frequency and descriptive statistics were calculated for all participants in the study. Independent samples $t$-test and one-way analysis of variance tests were performed to determine if the mean difference between grade, gender, and special education status existed for student’s growth index and normalized gain scores. Additionally, the student’s level of engagement, overall mood as either positive or negative, and their percentage of completed assignments using the iPad for homework were analyzed using a one-way analysis of variance. A post hoc Scheffe was performed to determine if any one variable pertaining to the results was significantly different. Lastly, a multiple regression was
conducted to see if any of the independent variables served as a good predictor of growth index and normalized gain in reading literature benchmark assessments when using an iPad during the course of a year for differentiated homework. The findings are summarized here.

Conclusions

Research Question One

What were the engagement, moods and percentage of assignments completed for grade five, six and seven students using an iPad for computerized differentiated homework?

The mean engagement level for all students using their iPad for differentiated homework was positive. Students in grade five reported being the most engaged as compared to their grade six and seven peers respectively. Grade seven students overall felt their engagement level was only slightly positive and show the greatest variance in being engaged. Prior research supports students consider the iPad to be a very desirable and engaging technological innovation which can support their learning, although if not clearly explained as it pertains to their learning will most likely serve as a distractor (Crichton et al., 2012; Rossing et al., 2012). Crichton et al. (2012) found many upper – secondary students report finding the appropriate app for curricular integration difficult and thus not engaging for classroom use. Rossing et al. (2012) found much more research is needed to understand how the iPad can become more engaging and thus academically beneficial for students. The results of this study confirm the recent findings of Crichton, et al., (2012) and Rossing et al. (2012) which suggest students in older grades who have been using iPads the longest are not as engaged with using it for academic purposes. A
possible reason could be the level of interactivity and “fun” of the actual app assigned for homework.

Districts seeking one-to-one mobile device programs need to consider approaches to ensure students in the higher grades are more engaged as the use of iPads becomes ubiquitous in the school settings. Research compiled regarding early implementation of tablet devices with digital natives support increased engagement amongst higher education students (Chen, 2010; Jenkins, 2006, 2012; Prensky, 2005, 2010, 2012). Prensky (2004) suggests, we cannot and should not fight this learning wave of technology integration. Hence, it is recommended districts initiate mobile device programs in the primary grades and support methodologies to maintain high levels of engagement with students as early as possible.

The findings of this study revealed students using an iPad completed slightly more than three quarters of their assigned differentiated homework. The iPad applications assigned for homework varied for all students based on individual pre-assessment results. Hence, students were required to complete their homework with limited peer collaboration. The percentages of homework assignments completed were digitally recorded as students logged in and out of their eSpark account when completing homework. Data revealed grade six and seven students completed about 15-20 percent more homework assignments on their iPad than did grade five students. In disagreement of earlier findings by Prensky (2012), the findings of this study found grade five students statistically more engaged than older aged children who are more familiar with mobile device technology and subsequently more comfortable in completing their assignments.
Generally, the level of mood reported by all students in this study was overwhelmingly more positive than negative. Students reported significantly more positive moods than negative moods when initiating their homework. However, when students did report negative moods, the specific mood most often reported was bored (9.9 percent); all other negative moods (bullied, scared, lonely, mad, sad and frustrated) accounted for less than 9.9 percent. These findings suggest the participants in this study feel good and engaged when completing their homework on the iPad a majority of the time. Michael Fullan writes in his recently published book *Stratosphere*, “Still, there is no denying that good technology under the direction of a great pedagogue can do wonders” (2013, p. 59).

**Research Question Two**

What was the growth index and normalized gain in reading literature for grade five, six and seven students using an iPad for computerized differentiated homework?

Descriptive statistics were analyzed amongst all the grades for growth index and normalized gains. The students in this study had a mean growth index of nearly four points. This means they scored four more points on their post-benchmark assessment in the spring than expected, based on analysis expectations as compared to all other students nationally with similar pre-assessment results. Despite all students in the study averaging above expectations, grade five and six students outperformed their grade seven peers by more than double. An understanding of growth expectations needs to be fully identified to measure the level or extent to which higher grade students can continue to show progress above their expected level of growth using an iPad for differentiated assignments at home. Additionally, the rigor of the content becoming increasingly more
difficult with grade may serve as a cause for the reduction in overall growth amongst seventh graders. Similar results were found for normalized gain where all students in grades five through seven averaged a positive gain.

**Research Question Three**

How did students’ engagement, moods and percentage of assignments completed on computerized differentiated homework using an iPad relate to grade, gender and special education status?

As stated in the findings to question one, students in grade five reported the highest mean level of engagement as compared to grade six and seven students. These findings were significant based on the Scheffe *post hoc* test between grade five and seven students. These findings suggest students in secondary grades are less engaged than similar students in primary grades, specifically when completing differentiated homework on their iPad (McIntyre, 1983; Rossing et al., 2012). This is consistent with early literature which found seventh grade students were observed less engaged in their studies than grade three and five students in math class (McIntyre, 1983). Rossing et al. (2012) also concluded in their more recent research that post-secondary students report less actual engagement with the iPad despite reporting higher levels of perceived engagement and lower desired learning outcomes then expected. Hence, the cultivation of engagement amongst older students is essential with perspective to their learning.

The grade five students in this study indicated that their engagement level was very positive. Additionally, grade five students reported feeling in a positive mood despite completing the least amount of their homework assignments; indicating although they are happy and engaged in their use of the iPad, they need to be encouraged to use the
device for purposes of completing their homework and support their learning more. This finding is inconsistent with conclusions from a study conducted by Bindl et al. (2012), where work productivity remained high as long as positive moods were felt, regardless of the measured commitment to the organization.

Conversely, grade seven students, despite reporting the lowest levels of engagement, completed significantly more homework when assigned on the iPad than the highly engaged grade five students. This is modestly contradictory with Prensky (2012) who suggested digital natives are more engaged with their technology and hence more likely to complete more homework than students not engaged. Since all students in this study are considered digital natives, Prensky (2012) suggests they should all be engaged.

However, although the data reveals grade seven students completed the most amount of homework, and maintained positive moods, the growth index or normalized gain scores on their reading literature post assessment were not significantly different. As such, the student’s in this study reported an overwhelmingly positive feeling at the time of initiating their differentiated homework when using their iPad. Thus it behooves school district leaders to understand negative feelings serve as a significant hindrance to academic growth; and teachers who are able to encourage positive moods and diminish negative moods would see greater progress by their students on assessments.

Research Question Four

How did students’ growth index and normalized gain in reading literature compare by grade, gender and special education status?

A one-way analysis of variance was conducted for growth index and normalized gain to determine if grade five, six, and seven students differed significantly
in their scores on spring benchmark assessment expectations. The results of the ANOVA indicated there is a significant difference between grades five and seven and six and seven for growth index and normalized gain scores, but not between grade five and six.

An independent \( t \)-test was conducted to for growth index and normalized gain to determine if gender or special education status differed amongst the students. The results of the \( t \)-test indicated that no gender differences existed for growth index or normalized gain. Additionally, no difference was found amongst students classified as special education and those not classified. This indicates that end of the year benchmark assessments in reading literature do not differ for males and females or students classified as special education, when using an iPad for differentiated homework.

These results suggest special education students perform just as well as their peers who are not classified. However, the special education students report being more engaged than their non-special education peers. This suggests that special education students, who are more engaged in completing differentiated homework using the iPad, perform indistinguishable from non-classified special education students on growth scores with reading benchmark assessments. These findings support prior literature conclusions affirming differentiation is beneficial for tiered homework in a heterogeneously mixed class while meeting the needs of the individual academically (Tomlinson, 1995, 2012; Bianco, 2010).

**Research Question Five**

What was the relationship between engagement, moods, percentage of assignments completed on computerized differentiated homework, gender, special
education status and grade level with growth index and normalized gain on reading literature?

A correlation analysis was conducted to determine the amount of variance contributed by each variable to growth index and normalized gain. The correlation analysis indicated that four percent of the variance in growth index was accounted for by a positive mood within the student. The remaining variables, engagement, percentage of assignments completed and negative mood, showed almost no correlation.

The significant finding of positive mood with the use of technology fosters an increase in learning, confirms the previous work by Chen et al. (2010). This suggests educators should expend considerable effort to ensure their students are learning while in a positive mood. Simultaneously, effort by educators should be made to redirect negative moods in students knowing learning is inhibited because the energy required for learning is being stymied (Baumeister, 2001; Pekrun et al., 2007).

**Research Question Six**

How did students’ engagement, moods, percentage of assignments completed on computerized differentiated homework, grade, gender, and special education status predict the level of growth index and normalized gain in reading literature?

A multiple regression analysis was conducted to investigate if the variables engagement, mood, percentage of completed assignments, grade, gender, and special education status would serve as predictors for growth index and normalized gain in reading literature. The analysis indicated all the listed variables were predictors of growth index for 4.8 percent of the variance, however, grade and positive mood, were
independent predictors. Students who reported the most positive mood also showed the highest growth index. This supports the notion that students who feel good, do good.

These findings are supported by prior literature affirming students’ positive thoughts and feelings about their academia, which can produce substantial benefits to their future achievement (Baumeister et al., 2001; Pekrun et al., 2007; Bohn-Gettler & Rapp, 2011; Bindl et al., 2012; Yeager et al., 2013). These findings are supported by research that indicates students who experience negative moods resource significant energy to reduce those negative feelings (Baumeister et al., 2001). Baumeister et al. (2001) concluded that even if a student experienced many good moods, one significant negative mood could outweigh the positive. This essential construct espouses that all stakeholders for student’s achievement should encourage behaviors related to achieving positive moods while reducing those that foster negative moods.

Students who show high negative mood during a mathematics achievement test were associated with low achievement and abstract reasoning while students with positive mood (enjoyment) achieved significantly higher and had the most abstract reasoning (Pekrun et al., 2007). The findings of Pekrun et al.’s study are consistent with the findings in this study. Students who achieved the greatest growth and normalized gain scores were those who reported feeling the most positive mood. Despite no relationship between negative feelings and low growth index scores, positive mood is correlated with higher growth scores. This suggests educational leaders should promote positive mood feelings amongst their students to support higher growth index scores.
Recommendations

As of this writing, a Google search yielded over one billion hits for both search terms "iPad" and "education," while Google scholar yielded 44,900 hits for the same search. An EBSCO Host ERIC database search of only peer reviewed articles yielded 45 search results during the same time period. This indicates despite an immersion of iPad implementation in education, considerably more research is necessary prior to establishing conclusive success or failure conclusions. However, the results of this study, strongly suggest that when students are required to complete differentiated homework on the iPad, their expected growth on benchmark assessments significantly exceeds expectations.

In this study, a focus on the use of technology meant that students were given an opportunity to complete individualized homework content geared specifically for their areas of weakness based on a pre-assessment. Pushing out or downloading a myriad of content specific applications to individual students was minimally challenging on the iPad. Additionally, through the use of a third-party vendor, eSpark, tracking student’s assignment completion and understanding could be achieved.

School districts are implementing mobile technology initiatives at a rapid pace. Prior to implementation of one-to-one initiatives for their 21st century learners, it is essential districts develop plans to facilitate, maintain, and differentiate their delivery of applications, and consider how best to maximize the potential technology innovation to ensure the targeted audience can maximize learning and achievement. Several implications were identified and emerged from this study.
This study attempted to ascertain the variables that influence how grade five, six, and seven students’ engagement, mood and number of assignments completed on computerized differentiated homework using an iPad in a one-to-one mobile device environment influenced their growth index and normalized gain on a reading literature benchmark assessment. Furthermore, this study attempted to measure if gender or special education status influenced the growth index or normalized gain on the reading literature benchmark assessment score when using an iPad in a one-to-one mobile device environment on computerized differentiated homework.

The following recommendations are made based upon the findings and conclusions of this study.

- Districts must monitor the level of engagement throughout the implementation and use of technology to ensure the students feel the device and applications are suitable for their level. Not assessing the level of engagement may cause students to become disenfranchised and reduce the impact of the technology to support differentiation and achievement.

- Districts need to train staff to recognize the strong correlation between positive feelings and academic achievement. Students, who feel negative, will expend substantial energy in an attempt to diminish negative feelings at the expense of their own productivity limiting opportunities for academic success.

- Special education students are abundantly capable of accomplishing growth on benchmark assessments equal to that of their peers, when given appropriate differentiated homework on an iPad. School leaders must
make certain that the technology and applications are differentiated to support an amalgamation of learning styles and aptitudes. Recognizing schools, who report not meeting annual yearly progress (AYP) often as a result of their special education population, should achieve more successful performance if special education students are challenged appropriately with their differentiated homework.

- District technology initiatives should be established in the earlier grades initially. Younger students are more engaged with innovation and demonstrate more growth in acquiring assessment skills faster than their older peers.

Recommendations for Future Research

This study examined the influence of how grade, gender, special education status, level of engagement, mood and number of assignments completed on computerized differentiated homework using an iPad in a one-to-one mobile device environment influenced student’s growth index and normalized gain on a reading literature benchmark assessment. Caution must be exercised if one wishes to generalize these findings to one-to-one mobile device initiative districts throughout the country. Consideration for a districts ability to rollout similar initiatives is marked by a host of factors that may suggest various results in a similar study. Factors include, access to Wi-Fi, budgetary constraints, socioeconomic status of population, professional development of teaching staff, comfort level of technology usage by students, and ability for students to maintain ownership of mobile device throughout the school year. Subsequent research should be
conducted to determine whether the results identified in this study are applicable to other regions or school districts.

This researcher suggests the following to future researchers seeking to conduct similar studies understanding an overwhelming number of school districts are implementing one-to-one mobile device initiatives with the iPad prior to any significant research or feasibility study.

- Consider measuring the engagement level and mood of the students before and after each assignment to compare if the engagement and mood are changed as a result of the completed assignment.

- Consider a quantitative survey for collection of engagement and mood rather than a binary system, thus creating more scalar collected data.

- Include a qualitative approach to further evaluate the student’s engagement level and mood associated with completing their assignments.

- Establish a protocol for teachers or vendor to evaluate the skills students are acquiring more frequently throughout the experience so if successful understanding and completion of skill is achieved, students can continue to foster their growth by moving onto new and more challenging applications.

- Replicate study with a control group assigned similar differentiated homework tasks on paper and no iPad usage.

- Replicate study with a district, which has implemented a Bring Your Own Device (BYOD) initiative.
• Analyze student, family, and social aspects qualitatively if mobile device one-to-one technology implementation is creating the achievement we desire from digital native to be successful as 21st century learners.
REFERENCES


APPENDIX A

Descriptive Statistics for Student Moods

Table A.1

Descriptive Statistics for Moods Recorded of All Grades and Grade Five, Six, and Seven Students using iPads on Differentiated Homework

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Range</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>504</td>
<td>0-67</td>
<td>5.61</td>
<td>8.54</td>
</tr>
<tr>
<td>Bored</td>
<td>504</td>
<td>0-8</td>
<td>0.39</td>
<td>0.96</td>
</tr>
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<td>504</td>
<td>0-104</td>
<td>5.26</td>
<td>10.97</td>
</tr>
<tr>
<td>Cool</td>
<td>504</td>
<td>0-105</td>
<td>4.61</td>
<td>8.97</td>
</tr>
<tr>
<td>Excited</td>
<td>504</td>
<td>0-172</td>
<td>23.90</td>
<td>25.69</td>
</tr>
<tr>
<td>Fine</td>
<td>504</td>
<td>0-135</td>
<td>11.39</td>
<td>17.62</td>
</tr>
<tr>
<td>Frustrated</td>
<td>504</td>
<td>0-135</td>
<td>11.39</td>
<td>17.62</td>
</tr>
<tr>
<td>Happy</td>
<td>504</td>
<td>0-13</td>
<td>0.56</td>
<td>1.34</td>
</tr>
<tr>
<td>Lonely</td>
<td>504</td>
<td>0-16</td>
<td>1.06</td>
<td>2.06</td>
</tr>
<tr>
<td>Mad</td>
<td>504</td>
<td>0-51</td>
<td>2.34</td>
<td>4.51</td>
</tr>
<tr>
<td>Proud</td>
<td>504</td>
<td>0-47</td>
<td>1.15</td>
<td>3.05</td>
</tr>
<tr>
<td>Sad</td>
<td>504</td>
<td>0-9</td>
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<td>1.10</td>
</tr>
<tr>
<td>Scared</td>
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<td>8.38</td>
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</tr>
<tr>
<td>Bored</td>
<td>148</td>
<td>0-78</td>
<td>6.47</td>
<td>11.15</td>
</tr>
<tr>
<td>Bullied</td>
<td>148</td>
<td>0-38</td>
<td>5.77</td>
<td>7.68</td>
</tr>
<tr>
<td>Cool</td>
<td>148</td>
<td>0-97</td>
<td>25.09</td>
<td>22.36</td>
</tr>
<tr>
<td>Excited</td>
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<td>0-102</td>
<td>12.22</td>
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</tr>
<tr>
<td>Fine</td>
<td>148</td>
<td>0-7</td>
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<td>1.16</td>
</tr>
<tr>
<td>Frustrated</td>
<td>148</td>
<td>0-14</td>
<td>0.91</td>
<td>1.90</td>
</tr>
<tr>
<td>Happy</td>
<td>148</td>
<td>0-143</td>
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</tr>
<tr>
<td>Lonely</td>
<td>148</td>
<td>0-17</td>
<td>0.83</td>
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</tr>
<tr>
<td>Mad</td>
<td>148</td>
<td>0-7</td>
<td>0.49</td>
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<tr>
<td>6</td>
<td>166</td>
<td>0-67</td>
<td>7.53</td>
<td>10.78</td>
</tr>
<tr>
<td>Bored</td>
<td>166</td>
<td>0-5</td>
<td>0.30</td>
<td>0.69</td>
</tr>
<tr>
<td>Bullied</td>
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<td>0-104</td>
<td>8.01</td>
<td>14.80</td>
</tr>
<tr>
<td>Cool</td>
<td>166</td>
<td>0-105</td>
<td>6.77</td>
<td>12.95</td>
</tr>
<tr>
<td>Excited</td>
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<td>0-172</td>
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<td>32.57</td>
</tr>
<tr>
<td>Fine</td>
<td>166</td>
<td>0-48</td>
<td>2.39</td>
<td>5.80</td>
</tr>
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</table>
The following are the results of this analysis; bored N=504, M=5.61, SD=8.54; bullied N=504, M=0.39, SD=0.96; cool N=504, M=5.26, SD=10.97; excited N=504, M=4.61, SD=8.97; fine N=504, M=23.90, SD=25.69; frustrated N=504, M=1.63, SD=4.09; happy N=504, M=11.39, SD=17.62; lonely N=504, M=0.56, SD=1.34; mad N=504, M=1.06, SD=2.06; proud N=504, M=2.34, SD=4.51; sad N=504, M=1.15, SD=3.05; scared N=504, M=0.55, SD=1.10. The mean data appears to reflect most students identified with more positive moods than negative moods. The moods students identified with on average the most in descending order are: fine, happy, bored, cool, excited, proud, frustrated, sad, mad, lonely, scared, and bullied. These results indicate students feel fine more often when initiating differentiated homework than any other mood and feel bullied the least of all moods when initiating differentiated homework.
Descriptives for percentage of all moods, Positive Moods, and Negative Moods were computed for frequency. The results are shown in Table 4.8. The results show of all (N=29460) moods analyzed when students were initiating differentiated homework, they appear to feel fine the greatest percentage of time; fine=40.89, happy=19.49, bored=9.89, cool=8.89, excited=7.89, proud=4.01, frustrated=2.79, sad=1.98, mad=1.85, lonely=0.95, scared=0.93 and bullied=0.67.

Table A.2

*Descriptive Statistics for Mood Identified by All Students when Completing Differentiated Homework on iPad*

<table>
<thead>
<tr>
<th>Mood</th>
<th>N</th>
<th>M</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine</td>
<td>12047</td>
<td>23.90</td>
<td>40.89</td>
</tr>
<tr>
<td>Happy</td>
<td>5742</td>
<td>11.39</td>
<td>19.49</td>
</tr>
<tr>
<td>Bored</td>
<td>2826</td>
<td>5.61</td>
<td>9.89</td>
</tr>
<tr>
<td>Cool</td>
<td>2649</td>
<td>5.26</td>
<td>8.89</td>
</tr>
<tr>
<td>Excited</td>
<td>2325</td>
<td>4.61</td>
<td>7.89</td>
</tr>
<tr>
<td>Proud</td>
<td>1181</td>
<td>2.34</td>
<td>4.01</td>
</tr>
<tr>
<td>Frustrated</td>
<td>821</td>
<td>1.63</td>
<td>2.79</td>
</tr>
<tr>
<td>Sad</td>
<td>582</td>
<td>1.15</td>
<td>1.98</td>
</tr>
<tr>
<td>Mad</td>
<td>534</td>
<td>1.06</td>
<td>1.85</td>
</tr>
<tr>
<td>Lonely</td>
<td>280</td>
<td>0.56</td>
<td>0.95</td>
</tr>
<tr>
<td>Scared</td>
<td>275</td>
<td>0.55</td>
<td>0.93</td>
</tr>
<tr>
<td>Bullied</td>
<td>198</td>
<td>0.39</td>
<td>0.67</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>29460</strong></td>
<td><strong>58.45</strong></td>
<td><strong>100.00</strong></td>
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