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K-12 SYSTEM REFORMS ACROSS STUDIES: THE SIGNIFICANCE OF CHANGE, META-ANALYSIS, AND LOGISTICS REGRESSION

A Dissertation

Presented to

The College of Graduate and Professional Studies
Department of Educational Leadership
Indiana State University
Terre Haute, Indiana

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

by
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May 2013

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Keywords: K-12 education system, calendar, teaching methods, extracurricular activities participation, size effects, meta-analysis, logistic regression
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The main purpose of this research was to survey the literature about the U.S. education system and synthesize the important conclusions that could be identified as the main features of the education system in general as they relate to student achievement. The criteria were set and the meta-analysis procedures were carefully followed. This process identified a collection of studies that were categorized into three main groups which were named components to indicate the purpose of the research: (a) calendar, (b) teaching method, and (c) extracurricular activity participation. After calculating the effect size of each of these components, they were entered into a binary regression equation to examine the effect of each component on the overall significance which represented the importance of the factor on the education system. As LOGIT (binary regression) measured the odds ratio of such factor importance on the education system, the concern of joint probability changing all groups on the overall significance emerged. Although these components were found to be important on the education system, their joint effect, changing them together, was also important. However, it was found that these three groups had one thing in common, which was time exposure of students on learning within each factor. In other words, it seemed that the importance of these groups was expressed in the latent factor that was time exposure to learning for students. Therefore, increasing the time exposure of learning for students was the main requirement to envision a new alternative system which incorporates many of the existing system ingredients, such as buildings and staff. The research
concluded with a vision for a new suggested system based on the findings and the view that could be used as general guidelines for the future K-12 education system.
ACKNOWLEDGMENTS

“Who taught me one alphabet letter that I do not know, I become his slave.” This is a famous Arabic saying that put me in great debt to all of those people who supported me during this challenging phase of my life. Although it is very hard to remember each and every one, I will try to list the most memorable who gave the most support.

First, there is my husband and family who not only were there for me in difficult days, but also lived the frustration and hardship I went through to complete this ambition. Taking this roller coaster ride with me was an enjoyable journey that scared all of us at times and made us so happy at other times. Finally, we made it.

Second, my professional supporter who put so much trust in me beginning with Dr. Balch who in turn introduced me to Dr. Boyd, who was the godfather that I never imagined I would have. Dr. Barratt guided me through this maize by providing the light for my direction. Dr. Hampton helped me become familiarized with analytical methods where I had to sail far away to educate myself. Ms. Judy Barnes, the hidden soldier of the department and college who no one would or could survive dissertation or research without her touch on it. To all of you thank you, I feel so grateful for all of you.

Finally, thank you, Indiana State and Terre Haute, for being my safe, happy home for these many years. I never felt that I was a stranger, and I have had my greatest time in Terre Haute.
I do apologize if I unintentionally omitted anyone who I knew or helped me in any way during these past few years. Thanks to all of you.
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CHAPTER 1

INTRODUCTION

Education reforms are very important. These reforms can assist students in discovering their environment more easily and enable the students to get to know their own communities and other communities more clearly. Therefore, educators must identify the needs of different students and help them pursue their interests and challenge their thinking to help them excel after graduation from school and entrance into the professional world.

Education reform does not happen suddenly or through wishful thinking; it demands a great deal of effort. One of the core concepts of change is that of change readiness level, which is where educational design and the development process bring about change (e.g., e-learning). Change needs ready faculty with the required skills to bring about that change and help create a positive learning environment; a ready organization with the values, culture, system, and policies relevant to such change; and financial resources, leadership, and other resources to help carry out that change. Most education reforms focus on technology or training, while the development of the organization itself does not get much attention. This leaves the organization lagging behind in the chaos of the old system and procedures that leave it unable to implement these changes in an optimal way (Hord, 1992; Morse, 2004).

One important current reform in K-12 education is the development of education standards which has been a priority for policy makers for more than 20 years. This reform
started during the Clinton administration with the 1994 federal re-authorization of the Elementary and Secondary Education Act (ESEA) and continued during the second Bush administration with the No Child Left Behind Act (NCLB). As confirmed by recent studies, policymakers acknowledge the importance of standards as essential for state education policy (Massell, 2008).

Other education reforms pertain to school funding and budgets. The U.S. Department of Education increased appropriations from $125 billion in 2007 to $546 billion in 2009 for grants to improve schools (U.S. Government Accountability Office, 2011). This unprecedented funding increase should help the lowest-achieving schools implement fundamental changes. Lips, Watkins, and Fleming (2008) estimated an expected spending of $111,000 on each student entering first grade in 2004 and continuing for the duration of their primary and secondary education if they completed high school. This dollar figure was arrived at using an average of $9,266 per student for the 2004-2005 school year. On the other hand, the education system did not prevent the large percentage of failures and dropouts from the public school system. Many have found the cause of student failure to be the school funding and budget. Sable and Gaviola (2007) noted that the National Center for Education Statistics showed more than half a million students dropping out in Grades 9-12 in the 2004-2005 school year.

In addition to developments in classroom environments and advances in school administration, education methods have encouraged innovation and constructive reaction among students, teachers, and curriculum (Bennett, 2002). These developments have impacted school administration and curriculum. Technology in the educational operation has contributed largely to education development.
Another major component of the education process is teaching methods. The literature on teaching methods can be generally categorized into two categories: traditional teaching, and modern methods. Traditional teaching methods, in general, depend on the teacher using teaching materials by transforming, simplifying and displaying such materials to make the subject matter self-explanatory. On the other hand, modern methods focus on techniques used by the teacher to guide students in activities of learning. Students learn on their own and the teacher is a supervisor of learning activities, guiding students, and evaluating outcomes. Others have divided the teaching methods into more than two categories based on efforts. These divisions pertain to who is the main catalyst in the effort: the teacher, the student or a joint effort between the teacher and student.

Portable, wireless, connected laptops give an unprecedented opportunity to reform teaching practices (Chamberlain, 2004). Laptops, netbooks, and tablets provide the means for students to become active learners with their computers, not passive receivers of knowledge. With laptops, netbooks, and tablets students can research and explore areas of interest, construct meaning or knowledge, collaborate with others across the room or across the globe, as well as collaborate on significant projects that have value to the student beyond school coursework. Students’ work in school must prepare them for complex, real-life tasks that is demanded of them beyond the classroom and as adults. The portable laptop, netbook, or tablet can become the most important tool available to an active learner (Hamilton, 2005). Desktop computer labs in dedicated rooms are not as conducive to reforming teaching practice as are laptops, netbooks, and tablets. In fact, many labs are used solely to deliver instruction to students who are expected to learn from technology. Learning from technology is akin to the old sage on the stage notion of teaching. The technology is used solely to deliver or broadcast information to students.
While some direct instruction certainly has its place in an effective teaching environment, an exclusive diet of direct instruction will never give students higher-order thinking skills they desperately need.

Other education system reforms have pointed to the school calendar (Brekke, 1990; Cary, 2006). These reforms were based on U.S. students’ achievement in contrast with the other industrialized nations’ student achievement. This comparison has led state departments of education, local school districts, and other concerned educators to consider alternative calendars that extend the school day and/or school year to improve student achievement (Neal, 2008). This international comparison started with *A Nation at Risk*, a report published in 1984 (Nichols, 2005) which noted that the United States’ student achievement was lower than other countries in mathematics and science. One of the first considerations was to extend the school calendar to allow students to attend school year-round (Delp, 2008). Other considerations included extending the school day, class-allocated time, schedule of instruction, a longer block of instruction without interruption, the time of arrival for students and teachers, parallel block, intensive and modified blocks, and year-round schooling.

However, these alternatives that consider time variability formed a challenge to traditional organization of schools. It has been shown in empirical research that class size and student engagement have an effect on student learning, the traditional and classical self-contained classroom has been replaced by a commitment to manage and organize instruction as an organizational strategy due to the inefficiency of traditional organization in controlling class size and less time to engage in learning. This led educators to rethink and research the relationship between time and learning (Carroll, 2008).
A result of this rethinking was a proposal to consolidate schools to reduce costs and improve the quality of the education process. Literature supports the link between extracurricular activities and higher academic achievement in high schools (Cosden, Morrison, Gutierrez, & Brown, 2004; Mahoney, Cairns, & Farmer, 2003; Nettles, Mucherah, & Jones, 2000). However, research has shown that school consolidation provides mixed signals with regard to participation in extracurricular activities (Blake, 2003). Furthermore, according to Blake(2003) consolidated schools offered a wider range and greater number of extracurricular activities, while others found less participation in extracurricular activities among consolidated schools (Blake, 2003).

Therefore, the effects that the school calendar, teaching methods, and participation in extracurricular activities have on student learning and achievement makes them an essential part or main component of the education system. Any consideration of changing or modifying the education system should be built on these components to improve student achievement and the quality of learning. Using meta-analysis to collect effect sizes for these three components then examining their impact on the overall significance should help bring into focus the joint effect of changing all of these groups at the same time.

**Statement of the Problem**

In the United States, many school reforms and improvements began in the second half of the 20th century. DuFour & Eaker, (1998) indicated that reforms went back and forth in cycles like a pendulum without strong evidence of national progress presented in educational policy. Although research is lagging behind these reforms and experts only comment on them after the reforms are in place, this is about to change with the latest national reform and policy movement, which could break this ongoing cycle of research frustration.
This research on teaching methods, participation in extracurricular activities, and changing the school calendar are among the most important reform-related work currently being undertaken. Studies also examined how all of these components together affect students’ academic success; changing or modifying the education system requires the consideration of changing or modifying all of the main components at the same time. This reform needs to address and estimate the impact ahead of time at least as an indicative sign rather than detailed measurement of impact. In order to reach that stage and determine the impact, a search of the literature and selection of a common standard of measurement, such as size effect to be used in the analysis, is the beginning. Then these data can be used to examine the impact of change on the overall significance.

In addition, depending on educational reforms undertaken following the research on these components, a framework to a new school system will be suggested. This document is intended to be a resource guide for educational decision makers as they plan for a changing school system.

**Purpose of the Study**

The purpose of the study was to investigate the influence that changes in (a) school calendars, (b) teaching methods, and (c) participation in extracurricular activities have on students’ academic success, as well as how all of these components together affect academic success. Furthermore, the study serves as a research synthesis of K-12 school system reforms using research information from the past decade (1999 to 2011). In addition, relying on educational reforms undertaken following research of these components, a framework for a new school system will be suggested.
Research Questions and Statistical Model

1. As measured by student achievement, what is the effect size of changes to the school calendar?
2. As measured by student achievement, what is the effect size of changes in selected teaching methods?
3. As measured by student achievement, what is the effect size of changes to participation in extracurricular activities?
4. Does adopting these reforms jointly have any significance?

The statistical model for this study is: \( \text{LOGIT (Sig)} = \logit (\text{Sig}) = \beta_0 + \beta_1 \text{Cal} + \beta_2 \text{Teach} + \beta_3 \text{Extra} \), where Sig: Study significance, Cal: Calendar (Size effect), Teach: Teaching Method (Size effect), Extra: Extracurricular Activity Participation (Size Effect) leading to a hypothesis that \( H_0: \beta_1 = \beta_2 = \beta_3 = 0 \) and \( H_A: \text{Not all } \beta_i = 0 \).

Significance of the Study

There are many factors that point to the need for educational system reforms. These reforms might take many different forms, but their sole purpose is to improve learning, add flexibility to the educational system, optimize the use of available resources, adapt to current societal needs, enhance student skills and the bottom line improve the end product that is the student.

Although all children can succeed in school, many of them do not (Kaufman, 1992). Economically poor and minority students are at a disadvantage because of the current practice of sorting to high-quality programs (Kaufman, 1992). Setting up high expectations for all students and providing rich and demanding curriculum should replace the sorting paradigm with a talent development model (Borman, Hewes, Overman, & Brown, 2002).
K-12 public schools must become equitable, accessible, high-quality learning environments for diverse student populations in the U.S. An equitable, accessible, high-quality public education system is essential to ensure that all communities have access to full participation in our economic, political and social systems. Yet the long journey to end exclusion and the unequal education of students of color, immigrants, cultural and linguistic minorities, and low-income students continues. Disproportionately, these groups are provided less access to qualified teachers, to library and technological resources, to safe facilities, and high-quality materials (Darling-Hammond, 2010; Wu, 2010). The cultures of origins and languages of these minority and diverse students are marginal or invisible in their school curriculums. And they are tracked into pathways that prepare them for neither higher education nor for careers (Cummins, 1986). Despite large-scale school reform efforts at the state and federal levels, persistent achievement gaps are not being closed (Heafey, 2007). Furthermore, some educators have have been calling for strengthening and creating the public school system that embraces and serves all of the communities (Cohen, Fuhrman, & Mosher, 2007). The goal is high-quality, culturally and linguistically appropriate instruction, programs, and services.

Cohen et al. (2007) developed, piloted, and successfully demonstrated the high school Equity Centered School Reform model that has proven to build capacity of educators, strengthen programs, lessen achievement gaps and improve immigrant students’ progression through high school. Cohen et al. conducted groundbreaking research on the impact of school reforms on patterns of equity, on best practices in inclusive curriculum design and teaching strategies, on data-based approaches to improving public education, and on experiences of immigrant students in schools. Cohen et al. have provided technical assistance and professional development to thousands of educators, hundreds of schools, and dozens of school districts and county offices of
education. They continue to provide these services through contracts throughout the nation. They have worked with parent groups, community groups and advocates to build the movement to create equitable and visionary schools (Melograno, 2006).

**Collective Effect**

In order to reform the current education system, the whole construct has to be modified. The educational system comprises three main components – calendar (school time, day and year), teaching methods (techniques and systems of transferring knowledge) and participation in extracurricular activities – that impact students’ achievement and develop their non-academic skills. Each of these components was researched and analyzed individually. The literature is rich on the effects of each one, but considering them collectively was essential when considering modification of the educational system.

**Definition of Terms**

The following describes each of the educational components and what each one means in the scope of this study.

*Education system* excludes administration, economies, policies and other components that are contained within the current system, with exception of the components mentioned below. It is precisely concerned with K-12 education without any consideration to higher education. The main indirect objective is the provision of the suitable environment for students to learn and building the system around students’ needs and capabilities. Additionally, improving the education system and increasing its efficiency can be accomplished by improving these three components.

*Extracurricular* refers to those subjects or activities that are not required as core courses for the student to learn. Some school districts call them related art activities and some call them
electives. They are those subjects that are open to interested students to participate in, socialize, and learn a new skill or improve an existing one. Languages, sports and computer programming skills are some of the skills or activities considered here to be related arts.

_School calendar_ is covered under any aspect changing the current school time and calendar. Extending the school calendar, switching to a year-round calendar or any form of modifying the current calendar is considered. If summer break is changed to different dates that are tailored to each individual student and family instead of having one set vacation period for everyone, then class time and schedules would also be affected. Calendar and schedule pertaining to this research refers to any variable that relates to school time but focuses more on the overall academic school year than on individual classes.

_Teaching methods_ refers to the different means and methods used to pass knowledge on to students. Information technology and media are among the most widely-used educational tools. Presentations, online learning, distance learning, tutorials, etc., are some forms of the teaching methods considered in this research. To keep focused on the main objective of adapting teaching methods to student capabilities and allowing time flexibility, these methods that relate to one or more objectives are considered. Thus, since technology increases flexibility in the classroom and helps save time, those objectives proving to be effective in the literature will be included in teaching methods variable.

**Limitation of the Study**

As mentioned, this research was limited to the U.S. K-12 education system and its current school stages of elementary, middle and high school. By no means do I claim the superiority of this research nor do I claim it is the best or optimum education system, but rather one attempt among many to bring attention to the concept of change in the education system. Since this
research relied heavily on the literature, surveys, and available studies, it is logical to assume the limitations of these studies. The collected studies were conducted between 1999 and 2011.
CHAPTER 2

LITERATURE REVIEW

Change is not widely welcomed in almost every field, including education, but change is most needed in education because of its role of providing a very important service to the needs of an evolving society. Adhering to only one style or system leads to stagnation and failure (Coulson, 1996; McKenzie, 1998). Change in education systems means a change in either the system as a whole or in some of its components. Major changes could affect the structure of the organization, its goals or its staff.

People are the most important and valuable asset of any system. They are the ones who can make it or break it. At the same time, they are the source of many headaches to the system if they do not understand, believe, or support the system or change to the system. Sometimes, people are afraid of change because of past bad experiences when change was forced on them without knowing what positive end such changes would bring. In those cases, people can be a major obstacle toward implementing change.

One of the main reasons people resist change is the lack of employee participation within an organization. When employees are involved in the planning and implementation of changes, it should increase their confidence and reduce their fear of the consequences of such changes, which in turn leads to less resistance, and more acceptance of change (Hord, 1992). Worrying about changes in the status quo, not understanding end results, or hesitation from past bad
experiences all lead to the hindering or rapid implementation of change without regard to fundamental and potential successes.

It is, therefore, essential to involve people within the organization at all stages and start dialogue with individuals who may resist this change and those who prefer to cling to the past and present, who represent constraints to any development effort. This is an essential requirement for any organization that seeks a lasting change for performance development and output improvement.

Children are always changing. Shank (1994) broke those changing factors into many smaller ones that stressed the need for the system in which children live and learn to change. Schools must change if they do not achieve their desired results, if the system fails to educate students to be good learners and to be able to solve problems they face, or if they did not get an adequate level of knowledge to cope with the requirements of the times (Shank, 1994).

Some authors of the published literature showed that many educators tried to develop the education system over time through honest research, careful readings, and organized scientific thinking. The result was the emergence of many educational theories, many teaching methods and means, in-depth exploration of the learning process, and increasing demand for learning, continuity and effectiveness.

Future planning and preparation based on forecasting is an effective way of cultivating many of these theories, ideas and visions into applicable concepts that help the development of education to accommodate hopes and expectations. The current era of rapid change and especially technological revolution has created a new vision of anticipating the future with the hope it will help nations prepare and expand their vision for their future educational needs. Said differently, education, future vision, and planning have to take technological revolution as a
variable that needs to be incorporated and adopted into the education operation. Since school plays a major role in the renaissance and advancement of nations, this spurs a researcher’s interest to make school a priority (Nasser, 2007).

**Future Trends to Change the School System**

Imagining and defining the future school is in its early stages. Several studies have been conducted to deepen understanding of the roles these schools should play in the future and the potential role of policy formulation to assist in shaping the future of school systems. These studies focused primarily on the attempt to project possible future scenarios to help individuals to recognize potential changes and prepare them to adapt to such changes (Fulmer & Sashlin, 1995). There is no one single solution or scenario, but rather many drawn from an infinite set of possible future situations in a limited number of polar stimulated types of strategic options that should be addressed along with the main dimension of change (OECD, 2001). In addition, the question of the possibility and desirability for each scenario has been dealt with, as it is important to policy thinking to consider what can be done to make it possible and desirable and to maximize the circumstances that make the future options more desirable and more likely, and vice versa (Stylianides & Pashiardis, 2007).

**The Spender Model**

Spender (1996) proposed a model for the future e-school. The impact of technology on society in general is evident through its impact on the press and education, which is reflected in society as a whole. The changes of the future school compared to the current traditional system are similar to the transition from printed text to electronic text. What Spender calls *the overlap with the network* is a form of the future e-school model. In this model, the teacher’s role as a source of knowledge is replaced by the network where students are exposed to the knowledge. It
is worth mentioning that online knowledge is pulled by the student instead of the knowledge source being pushed to the students. In other words, students are the controllers of knowledge transfer from online sources, not the teacher, and instead of being the target to which everything is sold, they have the option of what to buy, to a certain extent.

The quantity of online information is abundant compared to the teacher source; in addition, student interaction is increased from the local class environment to internationally, on the global village level. Education through the network will lead to a shift in perception of the teacher by the student and will change the teacher’s role from being the model of power and knowledge to being an advisor because of the expanded availability of knowledge. The teacher’s role changes from a source of knowledge transfer to users, to an advisor or guide to make sure that learning is in order. Spender (1996) added that a gap is found between what teachers teach and what is available as knowledge, much of which is available in reliable online resources. She stressed the importance of starting to prepare school administration and teachers for this new, challenging role. In addition, it would be a cause of concern for those working in the education field in general, which required preparing and equipping them as well for such change (Spender, 1996).

Extending the subject further, this technological era will change the concept of grading and measurement systems. The day of deleting tests is coming. Evaluating knowledge will be based on competition, not qualification. The new testing goal will be based on how long it takes to retrieve a small piece of information or solve a problem by using the computer. Therefore, the need for testing with the use of computers is just like asking a student to get the correct basic mathematical operating result while using a calculator. Time is not the only testing factor; searching for mistakes or errors the student faced during the solving process also plays a vital
role. This learning process can be mastered through practice and building self-knowledge (Spender, 1996).

Educators and technicians have both tried to portray the future school, but each from their own perspective. These educational reform efforts have concentrated on the investment in information and communication technology to bring about this transformation into a new educational model. This positive direction is not strange, because it is a repeated event with every new technology. The only changing aspect is the technology itself, while the educational concept still remains traditional. Technology occupies the forefront of education planning at the expense of the overall perspective of change (systematic change) that considers all the components of educational project (Alsaleh, 2003).

Some believe that the information and communication technology is the main factor in bringing about the desired transformation of the educational model. Alsaleh (2003) indicated that this belief is not accurate where there are many other factors that interact in varying degrees to shape the new model. These factors are as follows.

The Transformation in Information and Communication Technology

This technology brought about tremendous changes in the way people work and learn. The technology became more efficient, accessible, and produced new concepts such as knowledge society, virtual learning, knowledge economics, human capital, e-government, e-commerce, etc., in a relatively short period of time.

Transformation of New Skills Required by the Third Millennium

Some believe the use of technical skills is the core requirement of the third millennium. This is an imprecise belief, because technical skills are among a larger group of skills that others call survival skills for life, such as communication, computing, teamwork, independent study,
critical thinking, innovative thinking, decision making, and lifelong learning (Trilling & Hood, 1999).

**Transformation in Educational Thought**

The alternative form of education is not limited to an electronic school; technology does not operate in a vacuum. The essential pillar in this new model is an educational ideology that stems from different perspectives of how individuals learn. In short, what is happening now is the transformation from information transfer to the learner model (transmission model) to information transformation model (transformative model). This means that a fundamental shift must occur simultaneously in the roles of teacher, student, and technology (Alsaleh, 2003).

**The Ability of the Current Traditional System to Respond to Challenges**

The traditional educational system is linear, which was suitable for the industrial era. Students are learning the same thing at the same time, similar to the assembly line in a factory. Some criticize that the system has consumed all of its energy and has nothing more to offer, thus, it must be changed. The current system of knowledge is fragile, inactive (inert), naïve, fragmented, and separated from reality. This knowledge is the product of poor incentives and is difficult to transfer to new situations (Branson, 1997; Perkins, 1996).

**Educational Reform and the Concept of Change Readiness**

Education reform does not happen suddenly or with wishful thinking only; education reform demands huge requirements of commitments. One of the core concepts of change is change-readiness level which should result in change (e.g. e-learning) (Sterbinsky, Rossa & Redfield. 2006). Change needs faculty ready with the required skills to use it and positive thoughts about it. Change within an organization needs to address its values, culture, system and policies related to relative change, in addition to its financial resources, leadership, etc. Most
education reforms concentrate on technology or training, while the development of the organization itself does not get that much of attention (TSE, 2006). This leaves the organization lagging behind in the mess of the old system and procedures that make it unable to implement these changes in an optimum way.

**Alternative Education Model Feature**

Educators have different views of the alternative model, but many look at it as involving technology in the absence of an overall perspective of the contemporary educational thought that should direct technology; an objective instead of a tool. The alternative model is not just an e-school but a school that is smart, energetic, informed, active and thoughtful. Much of the literature characterized the alternative school feature as authentic learning, integrated curriculum, teacher facilitation, student exploration, educational technology, cooperative learning, interactive learning, flexible schedules, alternative evaluation and change-accepting leadership (Hord, 1992; Morse, 2004). Ely (1999) said that most of these change initiatives have failed during execution because of their need for effective leadership that moves people toward the objective and transforms goals and intentions to become a reality.

**Helpful School Leadership Toward Change**

Literature points out two characteristics of educational leaders: 1) leadership, and 2) what some call the intelligences.

**Leadership.** Hord (1992) emphasized the role of leadership and change as in the following itemization. First, one needs leadership with clear vision, which is the ability to develop a compelling vision to take people to a new place or level. It can be identified by four types. One is a complete picture of the school and its components and an understanding of the relationship among them; organizational vision. Two is a complete, clear picture about the
school at a specific period in the future; future vision. Three is a personal ambition of the leader with regard to the school, acting as a catalyst and driving force of actions to link organizational vision with future vision; personal vision. Four is a connection current vision with future vision in a unique way personal vision that is suitable to the school; strategic vision.

Second is cultural leadership that include knowledge of the school culture and traditions, formation of school culture to support collaborative practices and naturalizing or eliminating others who impede realization of the vision of educational reform. Third is educational leadership, including understanding curriculum, teaching methods, learning, use of information and evaluation to improve the education system for the school. Fourth is activating the performance evaluation process and comparing past and current applications to improve performance labeled as reflective leadership. Fifth is humanitarian leadership meaning supporting fellowship or collegial relationships, team building, establishing leadership density, identifying opportunities, building on strength, and appreciating human resources in the school. Sixth is when leaders and followers raise one another to higher morals and motivation, seek ideal and moral values such as justice and equality, and take initiative (proactive) rather than merely being reactive Transformational leadership. Seventh is technical leadership by employing technology to implement school administration tasks, modeling technology use and leading educational reform that depends on technology. Eighth is encouraging public relations to publicize the importance of education reform to the school community and local community as a whole called symbolic leadership (Hord, 1992).

**Intelligences.** Multiple intelligences for change facilitated by school leadership are based on the eight intelligences of Gardner’s (1983) multi-intelligences: contextual, strategic, academic, reflective, pedagogical, collegial, emotional, and spiritual.
Contextual intelligence is the ability of leadership to make the school look at itself through its relationship with its society and the world at large to which it belongs and make decisions consistent with the school’s local context and larger community. It works openly with multiple points of view with no loss of focus on the fundamental goals (Gardner, 1983).

Strategic intelligence concerns the establishment of plans in which the long-term priorities for improvement are under constant review in light of new information from a social context, the clarity of goals to be achieved, participation in vision and goals among members of the school community and responding to current requirements, making the future and predicting results (Gardner, 1983).

Academic intelligence is emphasis on added value and the effectiveness of teaching and learning; high expectations of achievement, encouraging research and surveys, high achievement and performance by students; and encouraging the learning of teachers, and interactivity and influence of school community members.

Reflective intelligence relates to the use of interpersonal skills of monitoring, reviewing and evaluating school effectiveness in general and the progress and achievement of students in particular that should be the center of attention (Gardner, 1983).

Pedagogical intelligence is to ensure the application of evaluation to learning and teaching and continuous development to avoid being stuck in tradition, assuring the interactive relationship among them and between them and thinking on the other hand when deciding on the best strategy to be used; in other words, the school should view itself as an educated organization (Gardner, 1983).

Collegial intelligence is based on the concept that the composite whole is bigger than the sum of its components. Then the level of accomplishment will exceed individuals’ singular
efforts when all members work together to improve other applications. Therefore the leader should encourage and stimulate school community members’ energy on collegial work to improve special class operations (Gardner, 1983).

Emotional intelligence is encouraging and supporting school community members to express their feelings and respecting these feelings. This intelligence is between personal intelligence of understanding others’ feelings and what motivates them, as well as personal intelligence, which includes self-awareness, self-control, motivation, empathy and social skills.

Spiritual intelligence is to show great interest in the development of all school community members and consideration of every one of them as important and with something to contribute (Gardner, 1983).

Ethical intelligence is more emphasis on student rights and the need to involve students in decisions that concern them, stressing ethical and moral principles, such as justice and equality, respect and high regard for school as an educational organization, and insisting on the clarity of values and goals of the school’s mission (Gardner, 1983).

Leadership in Schools

Facilitated school leadership plays a vital role in supporting the transformation of the education model. However, this is just one element of the intelligent school system. Therefore, education should be looked at as a network of issues and not just a set of issues. In other words, systems-thinking has to be employed when discussing inputs, operations or outputs of the educational projects. Alsaleh (2003) stressed that change management is the most critical aspects of change which is documented by the literature of school leadership and change.

Buchen (2003) said that if we were able to jump 25 years ahead to view the current landscape of education then we would see some of the features most likely essential for
education in 2025. Buchen (2003) indicated that education would be heavily decentralized and provide a large number of options for parents, teachers, and students. Physical learning spaces would be replaced by time-related learning where the students were no longer the young only, but rather all community members.

Increasingly, learners would become autonomous, almost totally free agents; nevertheless, they must earn their independence through mastery of their prescribed knowledge bases. Cost control and supplemental finance would steadily take hold as municipalities divert federal and state funds; education has at most 10 to 15 years of favored focus of funding and attention. Increasingly, teachers would be at the center of administration, instruction, and evaluation; in some programs, they might replace principals (Buchen, 2003).

Horizontal collaboration among teachers, students and parents, rather than vertical hierarchies, would characterize school governance. A common vision and purpose would be reached and implemented collectively. Parents would become indispensible to effective learning. Very busy parents might hire parent surrogates as substitutes. Initially, business practices would only benefit education; eventually, education innovation would provide models for business (Buchen, 2003). Increasingly, minorities will take over education of minorities, mostly through charter schools. They will accomplish more through chosen rather than de facto segregation, and in the process save a whole generation of urban kids. It should not pass notice that this vision of schools is quite contrary to current practice with increasing emphasis on time on task and infrequent high stakes tests.

Styliandes and Pashiardis (2007) conducted research to study the future education (pre-primary, primary, and secondary education) in Cyprus until the year 2020. They used three rounds of Delphi forecasting techniques for predictions about the future of schools and education
in Cyprus based on the views of the commission of Cypriot experts. They found that there is a growing influence of the free market; that schools need to be compatible with an information society, that school infrastructure and programming needs to be replanned, that procedures, evaluations, and staff development need more emphasis, and that school openness toward society needs to be increased.

Caldwell (2000) described three possible scenarios for the future of public schools over the next 20 years. First, people—mostly the middle class—would flee public schools and attend private schools searching for better education for their children. Those who could not afford private education would attend public schools for their children’s education and their jobs. Second, public schools would break into smaller entities in the form of home schooling or something similar where the structure and regulations for these lifelong learning institutions would change. Third, by contrast, the rapid evolution of these public schools would tend to relieve the government of its roles ranging from educator to financial resources coordinator. Although the role of government was very clear in this study, the main point was that the government was not the main source of funding, nor was it directly accountable for education. Expecting these Tomorrow Schools to be launched within the next 15 to 20 years based on their four-year study, the OECD (2001) identified six alternative scenarios. The six OCED scenarios are (a) status quo extrapolated, (b) re-schooling, (c) de-schooling, (d) learning organizations, (e) network society, and (f) resistance to policy. The study started in 1997 and was completed in 2001, involving experts from many countries. The study’s main objective was to increase policymakers’ understanding to prepare them for the Tomorrow School.

The authors categorized the possible scenarios into three classifications: ancient, next, and collapse groups. An ancient group is the continuation of the status quo of existing schools.
Put in a different way, “robust bureaucratic school systems, and expanding the market model” (OECD, 2001, p. 79). Next groups, or re-education schools, are reinforced schools with dynamic recognition and purpose. These are schools, social centers and infrastructure or focused learning organizations. Collapse groups or de-school educational centers are learner networks, community networks and migration of teachers. In their conclusion, OECD stressed that these scenarios should be used only as a starting point and should be understood or used as a final readymade for applications. They also recommend that these general guidelines be reformulated to fit different environments, societies, and countries (OECD, 2001).

**Current Trends to Change the K-12 School System**

School is one of the human resource institutions that has maintained strong recognition, survival, and stability. Changes have been limited to resources such as buildings, materials, living environment, and means of ensuring the comfort of students and teachers. In many cases, the use of technology was inflexible and stiff. Learners or receivers of information gather, teachers or information sources transmit the information, learners then try to repeat or replicate what they have heard or seen, and the learners are then evaluated based on their accuracy in reproducing what has been transmitted. Although the relationship between the institution and life has been questioned, it has never gone through a serious change. Even when changes have been adopted, they never touched the system itself.

**Teaching Methods**

Educators have been trying over the past two decades to revamp the educational services provided by schools. Haddad and Draxler (2002) declared that educators have succeeded in developing the education model to teach the many instead of the few, education with broad objectives instead of limited objectives, and from education of the elites to a national education
system. The education model had been affected by the industrial model and had in fact duplicated it. Students are run through assembly-line classes during the same work hours as businesses and tests are the equivalent of quality checks, all based on the inputs and outputs of a plant. This model, with all of its disadvantages, has contributed immensely to fulfilling the main learning needs, scientific progress and acquisition of skills, preservation of the social system, and conservation of cultures. It also played a major role in accomplishments in science, technology, social sciences and humanities. Many of these institutions have advanced research to search for truth and values in the face of common beliefs, past judgments, and ideologies (Haddad & Draxler, 2002).

With all of these successes, the next century contains a new set of challenges that the current education system cannot bear or absorb. New technological challenges have pressured schools and educational systems to provide classes, if not information and communication technologies, for all students. The pressure comes from many directions: salesmen, parents, business centers and technology advocates, to name a few. Decision makers are faced with two perspectives (Haddad & Draxler, 2002), one is the belief that providing schools with information and communication technologies would change the entire educational system, expecting that just a click to connect to the external network would change the student’s life as a whole. The second is the belief of technology as a computer and network while these are technology products and technology itself is the knowledge that produced these and many more.

In the past, education planners used to define the job by its required skills, then project a manpower need (Haddad & Draxler, 2002). Developing a program for such a purpose was considered the right way to go. However, now such changes outpace any educational program to be developed. Additionally, the role of the teacher will change to a competition initiator in the
class. Teachers will race against students to find the information first, which will make the student learn, re-learn, and keep learning. Emphasizing it more, the teacher’s role will change from instruction provider and information source to instruction provider and advanced information user. The teacher does not have all the required information readily available but should know how to get to it. Also, students will have ample time based on their abilities to understand the subject because time class boundaries will be removed (Haddad & Draxler, 2002). They can still search and acquire the needed information without being limited to the 50 minutes of class time.

Some authors and writers dug deeper on the subject of information technology use in education. Terry (2004) described the use of multimedia in the classroom and explained how to make it work. Gold (2004) explained from a broader view the importance of technology in general, expanding it to e-mail and gender use. Hyun (2004) studied the effect of peer learning when technology was available, and the result confirmed that children learn more from the use of technology with peers. Kearns (1993) took the subject even further by calling for the new model or change by increasing the use of technology, changing the nature of the relationship between the school and community to increase interaction and links between them, changing the role of the teacher from the conveyor of knowledge to the role of guide or personal trainer, and achieving integration in educational curriculum and education between the various subjects.

Reforming public schools to work on improving the quality of education requires significant changes. Wood (2002) adopted an approach to teaching and learning called Chapter Responding Model. Implementations of this model lead to more time for developing relationships, in-depth research and investigation, and reflection, based on Wood’s claim. For
this model to be implemented in classrooms, schools have to commit to three years, in addition to the following:

1. Allowing sufficient time for in-depth knowledge, investigation, and contemplation by narrowing the scope of the curriculum, and extending the time.

2. Starting the school year slowly, and encourage teachers to take the time to develop clear social and academic expectations to create an atmosphere of trust.

3. Allowing sufficient time for reflection and review throughout the year and providing more attention to special topics. The time following the holidays requires a review of the social and academic expectations to refresh students’ memories.

4. Modifying the schedule of the school day to lower productivity expectation in the afternoon. In the middle of the day, children need a break from rigorous academics.

5. Make the students learning environment a place of priority. The school environment should be peaceful, friendly, and active.

6. Change the schedule to allow more time for teachers, staff and administrators, and parents to interact with each other. (Wood, 2002, pp. 545-546)

Wood (2002) concluded by saying that by changing the structure and schedule of school, the overall climate can be improved, as can the well-being of adults and children who spend their days in schools. To make such climate different, exciting, and safe, a dedicated educational system is needed to give teachers more time to educate children and more time to learn.

Friedman (2006) indicated that the benefits of course websites have been established on the university level, but that there is a shortage of research based articles in the K-12 literature. He discussed in detail the encouragement and barriers, some of which are because of
infrastructure and parent awareness. On the teacher side, he found that some teachers did not use the websites that were included in the study on a regular basis.

Additional research is showing that learning via the Internet is at least legitimizing the movement, if not more effective than learning in normal classrooms. Adams and Defleur (2005) indicated that students said they felt they learned more and participated more in the online class than in the normal classroom settings based on a 2008 national survey.

**School Calendar**

School districts across the United States are faced with two challenges: student achievement and parental involvement in this effort. The major focus that has forced school districts to look at alternative ways to improve student performance is the need to master state standards as measured by state-mandated tests. This is why many school districts are investigating what the effect of adding additional days to school calendars has on student achievement.

**Summer Vacation**

More than 150 years ago, when a large segment of the United States was agricultural-based, the majority of families needed their children to stay home and help the family farm (Maine State Department of Education, 1994). Since then, the public school calendar was designed to accommodate this and still is. Today, only a very small percentage of society needs their children to be home in the summer to help with chores or field work, but the school calendar still follows the agricultural schedule (Palar, 1996).

Cooper, Nye, Charlton, Lindsay, & Greathouse (2003) investigated the summer holiday or break effect on learning and achievement from school districts’ point of view and found that a very small percentage preferred any change in the current summer break system. This was not
surprising because the investigation contained the opinions of those who had a major stake in the status quo. In other words, since only the affected side by calendar change equation was asked, it was natural to have a low positive response, but the picture should be looked at from a national perspective including all social entities (Brekke, 1990).

Traditional school calendar was not based on education needs but on agricultural calendar when children provided needed help on the farm in the summer, as one of the trustees noted during the discussion of the Federation of Teachers on crowded schools (Atkins, 1999). Parents in British Columbia were angry about the severe overcrowding in the area and were calling for an end to lazy summer days. An increase of 25-50% of cost, minus the cost of more building space, was anticipated if schools remained in operation during summer time. The Federation of Teachers raised the concern that cost was not the only factor to consider, but also educational gains. Ultimately, this overcrowding did not have an impact on the education system itself, but it influenced many aspects of life, whether social or political. Communication, transportation and family holidays were just a few of the indirect impacts within society (Winter, 2005). Communication between families and schools will change, communication between families and relatives will change, and communication businesses and services providers will change when a school calendar is changed.

Published research shows that the number of schools around San Diego operating during the summer rose from one school in 1968 to more than 2,681 public and private schools through 2000 in California (Atkins, 1999). Schools managed to ease congestion by breaking them into smaller, more manageable groups that follow a rotation schedule with short breaks. Again, this has an impact on society in all aspects, including the economic costs and benefits.
Palar (1996), Atkins (1999), and Boggs (2001) raise a legitimate concern with regard to summer break and the school year. Some of these expectations are:

- Assuming three sessions a year, remedial or supplemental instruction can be provided during the intersession weeks. Children who need help or who have problems can be helped early during this period instead of waiting all year for the summer break to get help. On the other hand, higher-achieving students can be given more challenges during the same period.

- Teachers would need less time for preparation and review of materials that were covered before the long summer break and that were then forgotten by students. Reports show that teachers’ and students’ burnouts are fewer, absenteeism is reduced, and behavioral problems are fewer when the length of breaks between school sessions is reduced.

- More time is spent with teachers interacting with students so that the students get more attention.

- Students are better-prepared for the next academic level.

- Younger children benefit more from continuing education because it helps them remember more of what they learned in the previous academic year.

Cooper et al. (2003) found that time out of school over the summer affected children’s test scores, especially in mathematics.

**Year-round School**

The traditional U.S. school calendar was originally based on the growing season. Children were taught at home and in community schools between the planting and harvest
seasons. As time progressed, society gradually evolved from an agricultural society to a manufacturing society (Davies & Kerry, 1999; Weber, 1926; White, 1999).

According to National Association of Year Round Education, there are two basic forms of year-round calendars; single track and multi-track. Single track calendars distribute the long summer vacation into smaller periods between sessions. School sessions and intersessions (vacations) are defined as either days of school or as days of vacation. As an example, 45-15 means this type of calendar follows 45 days of school session and then takes 15 days of vacation. There are few types of these single track calendars depending on the length of each session: 45-15, 60-20, 45-10, and 90-30. On the other hand, the multi-track is used to save costs for overcrowded schools where teacher and students are assigned certain schedules together to use school buildings and facilities. During their vacations other students and their teachers use the same buildings and facilities. The main idea is not to double the student number but maybe increase it by 30%. In other words, at any given time there is one-quarter of the students on vacation while the other three-quarters are in school. Some of the types of multi-track calendars follow 45-15, 60-20, and 90-30 days of school-vacation for 4-track type and 60-15 for the 5-track type (NAYRE, 2006).

The single-track and multi-track calendars allow for 30 days off for summer break rather than the traditional 10 to 13 weeks, the latter of which comes out to about 60 days. At the same time, those children on a year-round school calendar have 15-day periods off for fall break, winter break and spring break. On the traditional calendar, winter break is 10 days, spring break is five days and there is no fall break. Depictions of the traditional calendar and the year-round school balanced calendar are shown in Figures 1 and 2, respectively (NAYRE, 2006).
Figure 1 compares the distribution of days in school and days on break on the nine-month traditional calendar versus the distribution of school days on a balanced or modified calendar. Weekends are excluded from the charts, with both models detailing a typical year of 258 work days (Monday through Friday). Both figures represent a standard school year of 180 days.

**Figure 1.** Traditional calendar with no federal holidays

The traditional calendar features a long summer vacation of 12 weeks followed by a long period of in-session days, with the first break coming at Thanksgiving. The winter holidays are followed by 55 in-session days before a short spring break. Spring break is followed by 40 work days before the end of the school year.
Figure 2. Balanced calendar with no federal holidays

The balanced calendar reduces the long summer break and simply apportions those days throughout the school year, producing more frequent breaks and thus limiting long periods of in-session days as well as eliminating long vacations during which students lose connections with school related learning. Both calendars feature 180 days of instruction, with the modified calendar balancing the frequency of in-session days with days on break. The winter holiday and Thanksgiving break are the same on both calendars.

An extended school year and its effect on student achievement have sparked significant debate about academic time and student learning. The debate caught the attention of reform advocates, education researchers, policy makers and the school community and launched a discussion on systematic change within the public school system. The systematic change supported a higher academic standard that focused on the demands of underperforming students.

**Extracurricular Activity**

Feldman and Matjasko (2005) conducted a complex study and concluded that extracurricular activity led to higher achievement, a reduction in dropout rates, less substance
abuse, less sexual activity among girls, better psychological adjustment (increased self-esteem, less worry about the future, and reduction of feelings of social isolation) and a reduction in the rate of misbehavior.

As one of the extracurricular activities, sports has been shown to have a positive impact on students’ ability to read and better academic achievement in general (Intrator & Siegel, 2008). A study of academically talented students’ participation in extracurricular activities by Bucknavage and Worrell (2005) found that talented students tend to participate in extracurricular activities. However, gender effect was present, too, based on the type of activity. The extracurricular activities studied were dance, solo instruments, choral music, band, athletics, student government, science clubs, and clubs/ethnic cultural activities. In addition, the study concluded that there was an association between nonathletic activities and academic talent.

Another study by Powell, Peet, and Peet (2002) examined children’s participation in out-of-school activities and academic achievement. The sample consisted of first graders from low-income families and diverse ethnic groups. Powell et al. (2002) concluded that the relationship took a curvilinear shape based on gender, but there was an overall positive relationship between academic achievement and participation in out-of-school activities without regard to the number or frequency of extracurricular activities.

Summary

The future trends to change the school system focused primarily on the attempt to project possible future scenarios to help individuals to recognize potential changes and prepare them to adapt to such changes. One of these models is the Spender model that calls the overlap with the network is a form of the future e-school model. In this model, the teacher’s role as a source of knowledge is replaced by the network where students are exposed to the knowledge.
Transformation in technology and skills brought about tremendous changes in the way people work and learn. Technical skills are among a larger group of skills that others call survival skills for life, such as communication, computing, teamwork, independent study, critical thinking, innovative thinking, decision making, and lifelong learning (Trilling, Hood, 1999).

Transformation in educational thought is the transformation from information transfer to the learner model (transmission model) to information transformation model (transformative model). The ability of the current system to respond to challenges is weak (Alsaleh, 2003). The current system of knowledge is fragile, inactive (inert), naïve, fragmented and separated from reality (Branson, 1997; Perkins, 1996).

To reform the current traditional system requires a change readiness. Change needs faculty ready with the required skills to use it and positive thoughts about it. Change within an organization needs to address its values, culture, system and policies related to relative change, in addition to its financial resources, leadership, etc.

Alternative education model should have certain features. Much of the literature characterized the alternative school feature as authentic learning, integrated curriculum, teacher facilitation, student exploration, educational technology, cooperative learning, interactive learning, flexible schedules, alternative evaluation and change-accepting leadership.

School leadership is a critical aspect of change. Changes have been limited to resources such as buildings, materials, living environment, and means of ensuring the comfort of students and teachers.

K-12 change trends had been concentrating around teaching methods and technology. Some authors and writers dug deeper on the subject of information technology use in education.
The school calendar is still based on agricultural-concept, were the majority of families needed their children to stay home and help the family farm in the old days. According to the National Association of Year-Round Education (NAYRE,2006), there are two basic forms of year-round calendars; single track and multi-track.

Extracurricular activity participation as a group has an impact on student learning and achievement. Feldman and Matjasko (2005) conducted a complex study and concluded that extracurricular activity led to higher achievement, a reduction in dropout rates, less substance abuse, less sexual activity among girls, better psychological adjustment (increased self-esteem, less worry about the future, and reduction of feelings of social isolation) and a reduction in the rate of misbehavior.

In short, the literature highlighted many components of the education system that can be grouped into three groups; teaching methods, calendar, and extracurricular activity participation. In order to consider changes to the current education system, these components impact have to be consulted while maintaining the vision of future school borderlines.
CHAPTER 3

METHODOLOGY

This chapter discusses the meta-analysis and binary regression used in this research as analytical tools. The first part introduces meta-analysis as a statistical tool; steps and procedures to follow to collect data; detailed statistical analysis; and a summary of the results. However, this method and procedure is applied separately three times to each education system component. In other words, the same standard procedures were followed to collect data for each component (teaching methods, school calendar, and participation in extracurricular activities). The second part covers the type of regression that was used in the last stage of the research to examine the joint probability of changing these three components simultaneously and their estimated impact on achievement significance— in other words, estimating the probability of the significance on student achievement as a result of the change of the three major components using the LOGIT regression.

Research analysis can be classified into three types: primary, secondary, and meta-analysis (Glass, 1976). Primary analysis deals with original raw data to answer a certain research question. For a different question the analysis can be classified as secondary. Meta-analysis, on the other hand, is the technique to analyze the original analysis by other research, hence, “analysis of analyses” (Glass, 1976, p. 3).
Meta-analysis contains the results of research that has already been conducted. It uses the resulting statistics such as mean, standard deviation, as well as test results to concentrate more on the treatment or alternative Effect sizes instead of the test significance. This technique focuses on previous studies’ features and outcomes by examining the influence on the effect size. Kulik and Kulik (1988), advocate for the use of meta-analysis as a statistical technique to combine and compare effect size. Meta-analysis is used to integrate the findings of statistical analysis of collections of analyses (Cooper & Hedges, 1994).

**Research Design**

This research design followed the main guidelines commonly found in the literature regarding meta-analysis (Hedges & Olkin, 1985), starting with defining the variables, establishing search criteria, searching the literature for related studies, coding relative data, calculating effect size and analyzing studies to test and integrate their findings. The research concluded with results, generalization, and conclusion.

**Defining Variables**

**Achievement**

Achievement was the dependent variable. It was the final score of the student in each subject with that given component. Since there were three components in this research (teaching methods, school calendar and extracurricular participation), achievement was the final score the student obtained in any given test related to that variable. Achievement score was used as the common dependent variable among all studies. Each independent variable required a relationship and some measured impact on the dependent variable to be considered in this research. Since the main objective of this research was to measure the effect size of each
variable on this dependent variable, achievement had to be measured twice, before and after, or on two different groups, one as the treated group and the other as the control group.

**Teaching**

This variable was defined in this research as one of the independent variables, and it meant any teaching method besides the classical or traditional teaching method. The classical or traditional teaching method was the one in which the teacher acquired the learning material from curriculum, developed a plan to code such knowledge in a way that her or his student would understand, used note-taking or a blackboard to explain the subject, transferred the minimum required knowledge to students and tested student comprehension and memorization of the transferred materials. Teaching methods as a variable in this research concentrated on all types of means for passing subject knowledge to students in a method other than note-taking and use of the blackboard—in other words, the use of technology, animation, video, etc., as the means by which to transfer the knowledge to students was considered by this variable. Ultimately, the concern was with the measured impact of this method on students’ achievement scores.

**Calendar**

This independent variable included the time spent in school or out of school with regard to the learning of material and of school operations. The normal school year encompasses about 180 days per year. In this research, the variable calendar covered all different school learning days beside the normal school year. Stated another way, any study related to extending, reducing, or changing the current traditional school year or calendar was contained within this variable as long as it measured the impact of these changes on student achievement and satisfied the meta-analysis criteria and guidelines.
Extracurricular

This referred to any activity the student participated in during school time or outside of school time as long as it was arranged by the school or related to schoolwork. There were many types of extracurricular activities, whether academic, non-academic, or sports-related. Academic curricular activities tend to concentrate on English or math subjects that are studied in school, but the extracurricular activities try to enhance student’s skills by providing extra participation and exposure to a given field. On the other hand, sports develop students’ physical skills, teach them teamwork, and provide them a means by which to socialize.

Meta-analysis Criteria

This research used meta-analysis to investigate the impact of teaching methods, school calendar, and extracurricular activity participation on student achievement. Thus, the data collection and analysis was conducted in different parts, one for the independent variable–Teaching–and the other for the independent variable–Calendar. In each part, the following criteria were met to be considered in the data collection and analysis.

1. The study had to measure the impact of, or relationship between, the independent variable on the dependent variable.

2. The study had to be a quantitative type that contained statistics such as means, standard deviations, t-statistics, f-statistics, ANOVA/ANCOVA, or that contained enough information to calculate the required statistics to measure the effect size or impact of such independent variables on the dependent variable (Achievement).

3. If the study did not contain the required statistics, it must include some number or index that allowed the calculation of the effect of the independent variable on the dependent variable.
4. The study had to be concerned with K-12 stages, not including pre-school or college stages unless there was a sound and reasonable belief that those stages could contribute to the objective of this study without any irrelevance to the objective.

5. The study had to have been conducted within the period 1999-2010.

6. The study could be published or unpublished (e.g., dissertations).

7. The study had to be accessible in its full text.

Literature Search

The literature search for the related studies was conducted in three parts, one for each independent variable. The first part included teaching methods, the second part demonstrated the procedure for collecting studies for the school calendar, and the third part was related to extracurricular activity participation. The source data included journals, dissertations, theses, and conference presentations. The reason for including unpublished studies was to avoid the file drawer problem, which is simply reaching an invalid conclusion based on only published significant studies. All sources had to be considered to produce a representative literature sample that is subjective and unbiased.

To collect the data, an Internet search for studies in the form of PDF files, Google Scholar files and Ebsco Host search engines as well as bibliographies from published research were used to collect as many studies as possible. Three databases containing the most studies in the literature were Educational Resources Information Center (ERIC), Psycinfo, and Dissertation Abstracts International (DAI).

Teaching Methods

Among the keyword searches for Achievement and K-12 were teaching methods, technology, computer, effective methods, enhanced methods, video, online and web-based
instructions. Some combinations of these keywords are used to help with relating achievement to learning methods. The literature search for teaching methods resulted in 9,886 hits. Articles were selected that contained contemporary best practices. Narrowing the list to only studies with abstracts and some general information to help in making the decision of inclusion led to 127 studies. Searching among the results of those that included a full text reduced the number to 21 studies as depicted in Table 1.

Table 1

Full Text Studies Considered for Inclusion in the Study for Teaching Methods

<table>
<thead>
<tr>
<th>No.</th>
<th>Author</th>
<th>Year</th>
<th>Rationale for Discarding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Haas, M. S.</td>
<td>2002</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Caliskan, I. S.</td>
<td>2004</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Chamberlain, M. E.</td>
<td>2004</td>
<td>No data or qualitative description</td>
</tr>
<tr>
<td>5</td>
<td>Kane, R.; Sandretto, S.; Heath, C.</td>
<td>2004</td>
<td>Study focus was college or university rather than K-12</td>
</tr>
<tr>
<td>6</td>
<td>Ma, X., &amp; McIntyre, L. J.</td>
<td>2005</td>
<td>Insufficient data</td>
</tr>
<tr>
<td>7</td>
<td>Rivkin, S., Hanushek, E., &amp; Kain, J.</td>
<td>2005</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Smith, T., &amp; Desimone, L.; Ueno, Koji</td>
<td>2005</td>
<td>No Achievement measure</td>
</tr>
<tr>
<td>9</td>
<td>Jackson, D. R.</td>
<td>2006</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>McMahon, G. P.</td>
<td>2007</td>
<td>Failed to get the complete copy</td>
</tr>
<tr>
<td>11</td>
<td>Woods, D. E.</td>
<td>2007</td>
<td>Insufficient data</td>
</tr>
<tr>
<td>14</td>
<td>Pang, K.</td>
<td>2009</td>
<td>Professional development, not K-12</td>
</tr>
<tr>
<td>15</td>
<td>Gazi, Bülent AKBABA</td>
<td>2009</td>
<td></td>
</tr>
</tbody>
</table>
Table 1 (continued)

<table>
<thead>
<tr>
<th>No.</th>
<th>Author</th>
<th>Year</th>
<th>Rationale for Discarding</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Chiu-Lan Lin, N.</td>
<td>2009</td>
<td>Technical college students, not K-12</td>
</tr>
<tr>
<td>17</td>
<td>Kurt, O., &amp; Parsons, C.</td>
<td>2009</td>
<td>Insufficient data</td>
</tr>
<tr>
<td>18</td>
<td>Korkmaz, O., &amp; Karakuş, U.</td>
<td>2009</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Ford, D. N.</td>
<td>2009</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Kantavong, P., &amp; Sivabaedya, S.</td>
<td>2010</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Yusuf, M. O., &amp; Afolabi, A. O.</td>
<td>2010</td>
<td></td>
</tr>
</tbody>
</table>

After fully examining the studies for required data to generate effect size calculation, the list was shortened to 11 studies that were included in the analysis. There were 29 different effect sizes generated from these 11 studies. Although there are no minimum numbers of studies that need to be collected and included, it is the general rule of statistics to have 30 to approximate the normal distribution for inferences.

**School Calendar**

The same process or criteria was used for the second variable, Calendar, in regard to achievement, but with different keywords for the Calendar variable. The keywords for Calendar were alternative calendar, modified calendar, year-round school, year-round education, breaks and holidays, and extended program calendars.

This search led to an enormous number of hits, about 18,797, and when class time schedule was included as a search variable, it increased to 44,108 hits. The search results were screened for achievement measurement and were then reduced to 1,027 hits. However, when the abstracts and full text were required, the number dropped to a total of 87 studies. Exploring
these studies in-depth led to a short list of 12 studies. Refining the list by searching for detailed statistics eliminated two more of these studies to finalize the list to 10 studies. The final list for school calendar studies that was included in the analysis is depicted in Table 2. Calendar studies produced a total of 43 separate effect sizes that could be used in further analysis.

Table 2

*Final List for School Calendar Students Considered for Inclusion in the Analysis*

<table>
<thead>
<tr>
<th>No.</th>
<th>Author</th>
<th>Year</th>
<th>Rationale for Discarding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Adams, R. L.</td>
<td>2001</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Cadwallader, H. T.</td>
<td>2001</td>
<td>Insufficient data</td>
</tr>
<tr>
<td>3</td>
<td>Cole, H. W.</td>
<td>2001</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cooper, H., Valentine, J. C., Charlton, K., &amp; Melson, P. A.</td>
<td>2003</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Ramos, B. K.</td>
<td>2006</td>
<td>Not full text</td>
</tr>
<tr>
<td>6</td>
<td>Cary, J. M.</td>
<td>2006</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Trent, S. E.</td>
<td>2007</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>van der Graaf, V. K.</td>
<td>2009</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Solomon, M. L.</td>
<td>2008</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Bussard, B. A.</td>
<td>2009</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Meier, M. R.</td>
<td>2009</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Rule, J. Y.</td>
<td>2009</td>
<td></td>
</tr>
</tbody>
</table>

**Participation in extracurricular activities**

Searching for studies that measured or related achievement to participation in extracurricular activities included after-school activities, non-academic activities, sports, social
activities and out-of-class activities. A relatively large number of hits were found for these keywords, 18,986. The first step, screening, led to discarding many that were beyond the scope of this research. The remaining 721 studies were reduced to a manageable list of 34 by considering only those with abstracts and full texts. Examining the studies for data sufficiency narrowed the list to 11 studies, of which one was eliminated at a later stage because of insufficient data to compute the effect size. Investigating these 11 studies resulted in 19 effect sizes. Table 3 shows the final 11 studies, including the one that was discarded.

Table 3

*Studies That Measured or Related Achievement to Participation in Extracurricular Activities*

<table>
<thead>
<tr>
<th>No.</th>
<th>Author</th>
<th>Year</th>
<th>Rational for Discarding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Powell, D. R.; Peet, S. H.; Peet, C. E.</td>
<td>2002</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Marsh, H. W.; Kleitman, S.</td>
<td>2002</td>
<td>Not sufficient data</td>
</tr>
<tr>
<td>3</td>
<td>Broh, B. A.</td>
<td>2002</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Guest, A., &amp; Schneider, B.</td>
<td>2003</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Lewis, C. P.</td>
<td>2004</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Darling, N.</td>
<td>2005</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Bucknavage, L. B., &amp; Worrell, F. C.</td>
<td>2005</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Hawkins, T. N.</td>
<td>2005</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Roberts, G. A.</td>
<td>2006</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Nears, K.</td>
<td>2007</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Presnell, J.</td>
<td>2009</td>
<td></td>
</tr>
</tbody>
</table>
Summarizing the Results

The studies data and results to be used in calculating the effect size were then coded. Studies that met the criteria were summarized in a list of effect size that was grouped together under the three components considered. A coding sheet was designed to extract all the necessary information from the studies, it may be seen in Appendix A. This coding sheet was used by the researcher and another assistant to extract the data to avoid bias as much as possible and to ensure the reliability of computation. This was the reason for discarding more studies even after inclusion based on the consensus agreement between the two coders.

Calculating the Effect size

Based on the collected studies’ information provided, the effect size was calculated from the study data if it was not provided directly. If it was not calculated or if it was estimated for a variety of different variables while including any of the independent variables mentioned above, namely, Calendar, Teaching Methods, and Participation in Extracurricular Activities, it was recalculated for these variables. The previous procedure was utilized to collect the effect size based on the information provided in each study. In general, the effect size was referred to as ES thereafter and follows Cohen’s $d$. Cohen’s $d$ was defined as the difference between two means in standard deviation units to measure the effect size.

The literature was very rich in the statistical methods used to calculate the effect size depending on the available information. Some studies included the analysis of variance (ANOVA) between two groups that used an experimental group compared with a control group. Other studies in the literature used correlation investigation between the two variables. In addition, regression was used widely in many fields. When the study provided the primary
required information such as samples, means and standard deviations, the direct method was used to calculate the effect size, as per Cohen’s $d$ as follows:

$$ES = \frac{\bar{X}_1 - \bar{X}_2}{S_{Control}} \text{ when } n_1 = n_2 \quad \text{(1)}$$

Where:

$\bar{X}_1$: Experimental group mean

$\bar{X}_2$: Control group mean

$S_{Control}$: Control group standard deviation

This was used when the experimental and control groups were equal, while assuming variance homogeneity.

If the samples were unequal, $n_1 \neq n_2$, then the pooled standard deviation was used by applying the above equation while replacing the standard deviation of control group with the pooled standard deviation, which was computed as follows:

$$S_{Pooled} = \sqrt{\frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{(n_1+n_2-2)}} \quad \text{(2)}$$

Where:

$S_1$: Experimental group standard deviation

$S_2$: Control group standard deviation

$n_1$: Experimental group sample size

$n_2$: Control group sample size

When $t$-statistic was given and there were equal sample sizes, then effect size equaled:

$$ES = \frac{2t}{\sqrt{N}} \quad \text{-------------------------- (3)}$$

Where:

$t$: $t$ - statistics given from the study
When t-statistics were given for unequal sample sizes, then the effect size equaled:

\[ ES = t \frac{n_1 + n_2}{\sqrt{n_1 n_2}} \]  \hspace{1cm} (4)

Also, \( t = \sqrt{F} \) and \( ES = t \sqrt{(1/n)} \)

When the analysis of variance (ANOVA) was provided with \( f \)-statistics, 

\[ ES = 2 \frac{F}{N} n_1 = n_2 \]  \hspace{1cm} (5)

Where:

\( F: F - statistics \)

\( N: Total \ sample \ size \)

When the two samples were not equal and ANOVA \( f \)-stat was given, then:

\[ ES = \sqrt{\frac{F(n_1 + n_2)}{n_1 n_2}} \hspace{1cm} n_1 \neq n_2 \]  \hspace{1cm} (6)

Where:

\( F: F - statistics \)

\( n_1: Experimental \ group \ sample \ size \)

\( n_2: Control \ group \ sample \ size \)

When proportion difference was used and provided, effect size equaled:

\[ ES = P_1 - P_2 \]  \hspace{1cm} (7)

Where:

\( P_1: Experimental \ group \ proportion \)
\( P_2: Control \) \( group \) \( proportion \)

When Pearson correlation was used and correlation coefficient was provided,

\[ ES = r \]  

\( r: Correlation \) \( Coefficient \)

When the correlation coefficient and the sample size were provided,

\[ ES = \sqrt{\frac{n-2}{n}} \times \frac{2r}{\sqrt{(1-r^2)}} \]  

When multi-regression coefficient \( R^2 \) was provided with \( N \),

\[ ES = \frac{(n-2)R^2}{(1-R^2)} \times 2 \frac{1}{\sqrt{\frac{N}{2}}} \]

Multiple \( R^2 = r \times b \) where \( r \) was Pearson correlation and \( b \) was beta weight.

When hierarchal regression was used and \( N, R^2, \) and number of models were provided, then

\[ ES = \sqrt{\frac{(N - (# of models) \times R^2)}{(1 - R^2)}} \times \frac{1}{\sqrt{\frac{N}{# of models}}} \times # of models \]

When Chi-square was provided,

\[ ES = \sqrt{\frac{\chi^2}{N}} \]  

\( \chi^2: Chi – square \) \( with \) \( one \) \( degree \) \( of \) \( freedom \)

\( N: Total \) \( sample \) \( size \)

When group correlation coefficients were used and \( t \)-statistics were provided, then

\[ ES = \frac{t}{\sqrt{t^2 + df}} \]  

\( t: t – statistics \)

\( df: degrees \) \( of \) \( freedom \) \( for \) \( used \) \( groups \)
Some studies did not directly provide the means and standard deviations to compute the effect size. Other statistical methods were used to estimate the standard deviation (Lipsy & Wilson, 2001) and effect size for each study individually.

When independent samples \( t \)-statistics, experimental and control groups’ means and unequal sample sizes were given, then the pooled variance was calculated as follows:

\[
S_{\text{pooled}} = \frac{1}{t} \times \frac{x_1 - x_2}{\sqrt{\frac{n_1 + n_2}{n_1 n_2}}}
\]  \hspace{1cm} (11)

Where

\( x_1 \): Experimental group mean

\( x_2 \): Control group mean

\( t \): Independent samples’ \( t \) – statistics

\( n_1 \): Experimental group size

\( n_2 \): Control group size

When \( F \)-statistics were provided from ANOVA, the pooled variance was calculated:

\[
S_{\text{pooled}} = \frac{M_{S_b}}{F_{\text{oneway}}}
\]  \hspace{1cm} (12)

Where

\[
M_{S_b} = \frac{\sum n_i (\bar{x}_i^2 - \frac{(\sum n_i \bar{x}_i)^2}{\sum n_i})}{k-1}
\]  \hspace{1cm} (13)

\( \bar{x}_i \): Every group mean

\( n_i \): Total size of both groups

\( k \): Number of groups used

When two-way ANOVA was used, pooled variance was calculated as:

\[
S_{\text{pooled}} = \frac{SS_R + SS_{AR} + SS_W}{df_R + df_{AR} + df_w}
\]  \hspace{1cm} (14)
When Proportion Difference was used between the experimental and control groups, the variance equaled:

\[ S = \sqrt{p(1-p)} \left( \frac{1}{n_{G1}} + \frac{1}{n_{G2}} \right) \]  \hspace{1cm} (15)

\( P \): is the weighted average of \( P_{G1} \) & \( P_{G2} \) and can be calculated as

\[ P = \frac{n_{G1}P_{G1}+n_{G2}P_{G2}}{(n_{G1}+n_{G2})} \]  \hspace{1cm} (16)

\( n_{G1} \): Experimental group size number

\( n_{G2} \): Control group size number

\( P_{G1} \): Experimental group Proportion

\( P_{G2} \): Control group Proportion

In addition, since effect size would be computed for each study separately, bias was expected. Hedges and Olkin (1985) suggested a simple adjustment to the computed effect size from means and standard deviations to correct for the bias, as follows:

\[ ES = \left( 1 - \frac{3}{4N-9} \right) ES_{computed} \]  \hspace{1cm} (17)

\( N \): Total sample size

\( ES_{computed} \): Computed effect size

Studies that used correlation coefficients could also be biased. To correct for this bias, Rosenthal (1984) suggested the following:

\[ ES = 0.5 \log \frac{1+r}{1-r} \]  \hspace{1cm} (18)

\( r \): Correlation Coefficient between the experimental and control groups.
Cooper and Hedges (1994) indicated the existence of sample size bias that leads to incorrect effect size because of the exaggerated variance due to sample size. They suggested the following correct alternatives:

\[ ES = \frac{n_{G1} + n_{G2}}{n_{G1}n_{G2}} + \frac{(ES_{comp})^2}{2(n_{G1} + n_{G2})} \]  \hspace{1cm} (19)

\( n_{G1} \): Experimental group size

\( n_{G2} \): Control group size

\( ES_{comp} \): Computed effect size

When Pearson correlation coefficient was used, the effect size was corrected as:

\[ ES = \frac{ES_p}{\sqrt{n-3}} \]  \hspace{1cm} (20)

When the Proportion Differences was used, the correction was calculated as:

\[ ES = \sqrt{p(1-p) + \left(\frac{1}{n_{G1}} + \frac{1}{n_{G2}}\right)} \]  \hspace{1cm} (21)

\( n_{G1}, n_{G2}, \) and \( P \) are calculated as mentioned above

In order to compute the total average effect size, a weighted average summation had to be estimated as follows:

\[ \bar{ES} = \frac{\Sigma (w_i \times ES)}{\Sigma w_i} \]  \hspace{1cm} (22)

\( w_i \): Inverse variance weight

\[ w_i = \frac{1}{se^2} \] where \( se \) is for each study.

The test of homogeneity for the collected studies, \( Q \), was estimated as follows:

\[ Q = \Sigma w_i ES^2 - \frac{(\Sigma w_i ES)^2}{\Sigma w_i} \]  \hspace{1cm} (23)

This computed \( Q \) was then compared with the Chi-squared critical value at the degree of freedom equal to \( K \), which was the number of studies used.
LOGIT

The second half and the analysis focused on testing the three different groups’ effect; namely, the total effect that calendar, teaching methods and participation in extracurricular activities has on achievement. Although it was intended to measure the total joint effect on student achievement when each of these three main education system components were changed or modified simultaneously, their probabilistic impact satisfied the objective of this research.

It was expected that not all collected studies provided all the required information, especially achievement scores. However, there was another way to investigate the effect of changing the three independent variables on the education system by examining the significance of these effects. The collected studies indicated whether the estimated effect size for each study was significant or not significant. Using these significances as the dependent variable in the analysis revealed the overall impact of all of these independent variables which could be tested and verified.

Since the dependent variable was represented by significance or not (1, 0), then one of the best statistical techniques in this case was the binary regression. It appeared that the one reasonable member of this family of regressions was the Logistic Regression Model.

Logistic Regression Model deals with the probability of success or failure rather than the event itself. This can be better explained by an example: Assume a simple model that has one independent (x) and one dependent variable (y). Assume the value that (x) can take or that can be realized is \( \pi(x) \). Thus, the quantity \( \log \left( \frac{\pi(x)}{1-\pi(x)} \right) \) is called the LOGIT.

This relationship can be represented as follows:

\[
Logit[\pi(x)] = \log \left( \frac{\pi(x)}{1-\pi(x)} \right) = \alpha + \beta x
\]
Another model for the Logistic regression that has a direct relationship with the probability of success is an exponent function,

\[ \pi(x) = \frac{\exp(\alpha + \beta x)}{1 + \exp(\alpha + \beta x)} \]

These Logistic regressions are a special case of the general regression models that are called Generalized Linear Models. Therefore, it follows the same basic requirement of an existing relationship between the dependent and independent variables. These LOGIT models are used to examine a certain trait or characteristic based on given variables. However, these regression coefficients measured the Odds Ratio for all dependent variables used in the regression, which was very common in many fields of study.

As with other regression models, the first step was to investigate the independent variable correlations, which were simply viewed via scattered plot graphs. If the independent variables followed the multivariate normal distribution and its variance-covariance matrix was homogenous, then Discriminate Analysis could be a better alternative. When all the independent variables were binary (0, 1) values, Linear Logarithm models were better fit. Quantitative dependent variables should always apply normal linear regression.

LOGIT Analysis can take one of two forms: Multinomial Logistic Regression or Logistic Regression. Logistic Regression provides predicted values, errors, and reliability based on the individual data level. On the other hand, the multinomial logistic regression classifies the data internally to make homogenous variance layers and then predict values, errors and reliability based on these layers. Normally, there are three steps to analyze when using the LOGIT Model: 1) applying the raw model, 2) applying the adjusted model, and 3) then testing the hypothesis.

LOGIT coefficient interpretation is different than linear regression and troublesome because it deals with odds ratios rather than direct change in the dependent variable. For
example, if a coefficient is 0.2 for a certain independent variable, this means that one unit
increase in the independent variable increases the odds ratio by a multiple of 0.2. Also, the result
of LOGIT coefficients can represent the marginal effect of the independent variable on the
dependent variable. In addition, the intercept can be interpreted as the relative change in the
odds ratio of the dependent variable.

For the purpose of this study, the LOGIT regression was used to test the hypothesis as
follows:

\[
\log \left( \frac{\pi(x)}{1 - \pi(x)} \right) = \beta_0 + \beta_1 Calendar + \beta_2 teach + \beta_3 Extra
\]

\[H_0: \beta_1 = \beta_2 = \beta_3 = 0\]

\[H_A: \beta_i \neq 0\]

This hypothesis tested whether any one variable had any impact on the overall
significance of effect sizes. In other words, while each one of these variables had some effect,
the question was whether it contributed to the overall significance. The contribution of this
research was that it investigated and examined the contribution of the joint impact of the
simultaneous change of each of these groups. The literature was rich with different studies that
examined each variable individually and that variable’s impact on achievement. However,
examining the joint effect on the probability of significance for all simultaneously was a
relatively new approach based on the researcher’s view and knowledge. A high probability of
success of the significance and marginal effects of these three groups meant that changing the
current traditional system by changing or modifying the three groups should lead to a better and
more significant education system.
CHAPTER 4

RESULTS OF THE STUDY

Chapter 3 described the required data sources and the collection method. Theoretically it was found that the main three variables recurring in the literature were calendar, teaching methods, and extracurricular activities participation.

Through the literature search, and using meta-analysis technique to abstract the required or expected important information from previous studies, resulted in a list of information for each component or variable individually; namely, calendar, teaching methods, and extracurricular activities participation. Meta-analysis was used to extract the effect size for every variable and then additional information was also collected from previous studies, such as overall study finding of significance (Sig1), study year when the data was collected for that study (SYear), and publication/completing/findings/printing year (PYear). Other information, such as author and subject, was collected to help in differentiating between data and may be helpful in the interpretation stage if the need arise. These data were pooled together to prepare for the analysis and the original lists are presented in Appendix A.

Simple Statistics

Starting with the three components or variables, simple and descriptive statistics was the first step in the analysis to get an impression about the data and its distribution. After shedding some light on the collected data, a reorganization of the data was required to prepare the data for
running the regression to test the hypothesis. Based on the analysis and the regression results, a decision was reached to conclude the results of this research, followed by the discussion of these results and their implications compared with what was found in the literature. The organization of this chapter begins with the analysis of each variable: calendar, teaching, and extracurricular activity participation. The analysis described the data statistics and distribution with tables and graphs that reflects a clear picture about the data and variables. The second section briefly explains the data preparation, running logistic regression, and the outcomes of this test. This is followed by a final comment and remarks about the main results.

**Significance (Sig)**

$\text{Sig}$ is the dependent variable that was used in this research to proxy the main objective of the importance of changing all the independent effects on the dependent variable. In other words, the dependent variable was collected from the previous studies to indicate the effect of these independent variables on the student achievement whether in science, curriculum, or any learning content the student needed to learn at school. Although the name of the variable was $\text{Sig}$ in this study giving the impression that it only represented the significance of the study, it did proxy the achievement of the K-12 students.

This dependent variable is a binary variable taking one of the (1, 0) or yes and no values of having significance or not. The collected data contained 91 records, 51 of these records had a 0 value or no significance and 40 records had 1 or yes, indicating there was a significance found in the study. Figure 3 shows the dependent variable distribution between these two binary values 1 and 0.
Figure 3. Dependent variable values from collected data

Figure 3 depicts the data distribution of dependent variable values in the vertical axis over the spread of Effect size (ES), the horizontal Axis. The general impression about the data distribution tends to take values of 0 over the lower level of ES while tending to take a value of 1 over the larger ES values. There appears to be concentration of 0’s toward the lower end of ES and 1’s toward the larger end of ES values. The ES values between 0.3 and 0.4 appear to be a middle ground as an average of ES to balance the data.

ES as an independent variable spread between a low of 0.026 and a high of 0.600 having a mean of 0.3531, median of 0.3400, range of 0.5740, and a standard deviation of 0.1314. Figure 4 depicts the closeness of the distribution to the normal distribution but not exactly due to the skewness of -0.054 and kurtosis of -0.012 which is not that much different than 0.
Furthermore, the normality test resulted in $p$-value of 0.2 in Kolmogrov-Smirnov and $p$-value of 0.092 in Sharpio-Wilk test which proved to be not significant at 5% confidence level for both tests. In other words, the ES distribution was not different than the normal distribution or the hypothesis that this distribution was not different than the normal distribution and cannot be rejected.

**Calendar**

This variable, as explained in the previous chapters, contains the collection of the final results of the previous studies collected from the literature in regard to changes or modifications in the school calendar and the impact of these alterations on the significance of the study. Said
differently, the collected studies researched the relationship or impact of school calendar modification on student achievement. The studies’ final results of whether the study found positive, negative, or no impact of these changes on student achievement collected. In addition, the statistical significance of these studies was collected to identify the strength of the evidence to formulate and support the study decision. To take the subject further and the analysis deeper, the study year and publication year was collected to examine if time had any impact on the measured variable and the significance of the study.

There were 43 Calendar effect sizes collected from the previous studies in the literature using meta-analysis technique. The mean of Calendar effect size was 0.3333, median was 0.3280 and standard deviation was 0.1104. The effect size ranged from as small as 0.13 and as large as 0.49 spanning a range of 0.6. The distribution appeared to be different than normal with a skewness of -0.085 and kurtosis of -1.003. In addition, the normality test gave contradicting signals with the Kolmogorov-Smirnov $p$-value of 0.071, which was not significant at 5% level of confidence, and the Shapiro-Wilk $p$-value of 0.028, which was significant at 5% level of confidence.
As presented in Figure 5, it was clear that the distribution was different than the normal distribution with clear skewness to the right and fat tail kurtosis. However, the ES remained centered around the 0.3 value, and to be more precise it was 0.3333.

*Figure 5. Calendar effect size (ES) distribution compared to the normal distribution*
Figure 6. Dependent variable (Sig) distribution over the range of independent variable (ES)

Although Figure 6 depicts the dependent variable where the total data were 43 records that was not all shown, based on this figure containing 22 records registering 0 value and 21 records registering 1 value. The reason was because there were many duplicated records having the same value that were printed on top of each other and, therefore, not shown in the graph. This was found when the original records or data list were cross checked against the graph.

In general it appeared that the Sig taking a value of 1 concentrated between 0.3 and 0.6 while the Sig values taking a value of 0 spread over a larger span between 0.15 to 0.6 of ES. There was also a larger gap within the distribution of the Sig with values of 0, specially above 0.4 of ES.
The study date (SYear) ranged from 2001 to 2009 while the years 2003 to 2005 contributed more than half of the studies collected for the purpose of this variable, Calendar change or modification. The largest number of studies were conducted in 2003, approximately 21%, and the smallest number of studies were conducted in 2008, barely 1% of the collected studies. Figure 7 depicts the study-year distribution which skewed to the right as the effect size skewness.

![Histogram](image)

**Figure 7. Study year distribution**

The publication year (PYear) appeared to lag about five years after the study based on the largest percentage contribution. For example, study year 2003 was the largest percentage contributor of studies with a share of 21% while the largest contributor in regard to study publication was 2009 with a share of more than 53%. Figure 8 shows the general increasing trend in publication with an opposite skewness compared to the effect size and study year.
A necessary clarification is in order at this point. The publication description does not imply a journal or publication but rather the year that study was printed. In other words, some of these studies were collected from dissertations that were not officially published in peer reviewed journals or magazines and, thus, their submittal or printing year was used as the publication year. On the other hand, these magazines or reviewed journal papers official publication year were used as the publication year. Therefore, publication was not assumed that all of the studies were published journal studies which would contradict with the meta-analysis requirement and the file drawer problem.

**Teaching Methods**

As mentioned previously, teaching methods variable (Teach_ES) indicated the change in teaching method effect on the student achievement. These collected studies examined and tested
many different teaching methods on student achievement. Some had examined the alteration of transferring knowledge using different strategies and others adopted a completely automated and electronic media for transferring knowledge methods. However, the consideration in this research focused on the effect of change itself on the significance of the study. Rephrased, this research was trying to test the effect of changing the teaching method would have on the significance.

Figure 9. Teach-ES distribution over the ES

The collected sample contained 29 effect sizes with a mean of 0.4431, median 0.4431, and standard deviation of 0.1314. The Teach_ES ranged from as small as 0.08 to as large as 0.68. The distribution appeared to be not normal with a skewness of -0.535 and thick tail of 1.255. Also, the distribution normality tests both Kolmogorov-Smirnov and Sharpio-Wilk had a p-value of 0.2 and 0.247, respectively, as reflected in Figure 9. Figure 9 shows how the teaching
independent variable (Teach_ES) distribution looks as though it is different from the normal distribution.

\[\text{Figure 10. Teach-ES distribution over the ES}\]

Because the data had duplicated effect sizes, Figure 10 seemed not to contain all the 29 data records. In the meantime the Sig data that registered a value of 1 tended to spread between 0.3 and 0.7 only, while the Sig data that registered a value of 0 covered the whole span of the ES axis. Said differently, there seemed to be a larger spread of the values of 0 and smaller spread for the values of 1. On the other hand, in general there were only seven records of the data that took a value of 1, and 22 of the records took a value of 0.

The study year (SYear) covered a period from 2002 to 2010 while most of the studies were conducted during 2005-2006. The publishing or completing year (PYear) covered the same
period and had the same average as that of the study year. However, the years of 2003 and 2008 did not contain any study or publish years based on the collected data.

**Extracurricular**

Extracurricular activities participation (Extra_ES) was the third independent variable that represented the effect size from previous studies which measured the effect of participating in extracurricular activities on student achievement. Extra_ES had 19 record points, seven records took the value of 0 and 12 records took the value of 1. More precisely, there were seven studies that found no significance of the effect of participating in extracurricular activities on student achievement, yet 12 studies found some significance of the extracurricular activities participation on student achievement. Figure 11 shows the distribution of these 0-1 values over the effect size (ES).
The mean of these ES values was 0.2502, median was 0.2984, and standard deviation was 0.1110. It covered a range of 0.38, from a minimum of 0.02 to a maximum of 0.4. The distribution seemed to be not normal with a skewness of -0.874 and a kurtosis of 0.046. This also confirmed the normality tests of Kolmogorov-Smirnov with a p-value equal to 0.057 and Shapiro-Wilk with p-value equal to 0.061 which were both not significant at 5% level of confidence. Figure 12 depicts the histogram of the distribution of effect size in Extracurricular activity participation (Extra_ES) compared with the normal distribution. The study year (SYear) and publishing or completing year (PYear) shared the same statistics ranging between 2002 and
2009, the average year closer to 2005, and largest contribution years were 2002 and 2007 with about 26%.

![Histogram](image)

**Figure 12.** Extra-ES distribution

**Individual Logistics**

In this section, each component or individual variable was analyzed to examine the isolated effect of each variable and its sub variables on the overall significance (Sig1). The sub variables included the binary data of the study being published in professional and peer reviewed journals or not (i.e., 0-1). Study year when the study or research was conducted to investigate if time did have any effect on the overall significance. The same in regard to the publishing year was conducted to illuminate if time was of any effect on the overall significance.
The following model was the general guide for testing these groups or variables on the overall significance.

\[ \text{Sig1} = C + Pub + SYear + PYear \]

The above is the linear equivalent model for the logistics regression. Since the dependent variable Sig1 was a binary variable, Logistics regression was best to fit this model. Although the other two sub variables SYear and PYear were scaled to continuous variables, Logistics regression was the model that dealt with such a mix of variables. However, because the main interest here was to measure the probabilities of the change in each of those variables on tipping the value of the dependent variable toward one of the only possible values of 1 or 0, a reweighted iterative least squares process called the Maximum Likelihood method was used. In this case the final results took the following form:

\[ P_i = E \left( \frac{Y_i}{n_i} | X_i \right) \]

The above equation related the probability of each factor to the expectation of the dependent variable for each trial given or knowing the value of the explanatory variable at that time. This process was repeated many times over and over again to reach the best probability that could produce this given piece of information based on the possible chances which could produce such data point.

When these probabilities were computed, taking the natural log of odds is called the LOGIT.

\[ \text{LOGIT}(P_i) = \ln \left( \frac{P_i}{1 - P_i} \right) = \beta_0 + \beta_1 Pub + \beta_2 SYear + \beta_3 PYear \]

\( P_i \): indicates the probability of such event happening and the dependent variable taking the value choice.
1 − 𝑃_𝑖: The probability of the event not happening.

𝛽₀: The intercept or regression constant. The dependent variable value when all of the independent variables values become zero.

𝛽₁: The publishing variable coefficient that needs to be tested if it is equal to zero or not.

𝛽₂: The study year variable coefficient that needs to be tested if it is equal to zero or not.

𝛽₃: The publishing year variable coefficient that needs to be tested if it is equal to zero or not.

The main objective was to test the hypothesis to determine if these coefficients were equal to 0 or not. In other words, could the values that these coefficients can be some number beside zero that was due to sampling or chance alone and was not caused by these groups.

**Calendar Effect**

To examine the effect of these sub variables on calendar significance, the above model was used in the statistical software (SPSS) to produce the following results. To make certain that the analysis concerned only Calendar significance and its own sub variables, SPSS was instructed to choose those cases that had the value of 1 for calendar (Cal=1).

\[ H₀: 𝛽₁ = 𝛽₂ = 𝛽₃ = 0 \]

SPSS tested the hypothesis in two steps calling them block 0 and block1. Block 0 used only the constant term 𝛽₀ to test the model and then added the other variables as Block 1. Although all of the coefficients had some value other than zero, none of these values were sufficiently significant to reject the null hypothesis of the coefficient equal zero.
Table 4

Calendar Effect Variables in the Equation

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1(^a)</td>
<td>publ</td>
<td>-.798</td>
<td>1.091</td>
<td>.535</td>
<td>1</td>
<td>.450</td>
<td>.053</td>
<td>3.818</td>
</tr>
<tr>
<td></td>
<td>syear</td>
<td>.126</td>
<td>.167</td>
<td>.572</td>
<td>1</td>
<td>.449</td>
<td>.818</td>
<td>1.574</td>
</tr>
<tr>
<td></td>
<td>pyear</td>
<td>-.090</td>
<td>.167</td>
<td>.293</td>
<td>1</td>
<td>.589</td>
<td>.659</td>
<td>1.267</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>-72.299</td>
<td>409.592</td>
<td>.031</td>
<td>1</td>
<td>.860</td>
<td>.000</td>
<td></td>
</tr>
</tbody>
</table>

Note. \(^a\)Variable(s) entered on step 1 = publ, Syear, Pyear.

Reviewing Table 4 and the Sig column, it was concluded that none of these variable coefficients was significant (less than 0.05). Thus, based on these data one failed to reject the hypothesis that these coefficients equaled zero ($\beta_1 = \beta_2 = \beta_3 \neq 0$).

In addition, the constant test itself in Block 0 was not found to be significant. This could be interpreted that none of these variables contributed to the odds ratio of the calendar to be significant. The odds ratio for any given variable, if it is significant, can be interpreted as the contribution of each unit change in the independent variable that could increase the odds of the dependent variable to take a certain value; in this case 0. Since none of these $p$-values are significant, it could be concluded that there seemed to be no effect of pub, Syear, or Pyear on the significance of Calendar change.

Not finding any significant effect of these sub variables on the main dependent variable (Calendar) could be used as support or evidence that calendar change significance was not related to time or publication. As reasonably and logically expected that calendar change significance was not related to a given period of time or whether calendar change significance
would be effected by the study publication or not. Published or not published studies did not affect the calendar change significance. Furthermore, model fit indicated by the relatively small 2-log likelihood and other $R$-squared equivalent measures were not of any interest at this stage.

**Teaching Effect**

To test if the sub variables of teaching effect, such as publication, study year, and publication year on the teaching method change significance; the above model was used to test if each sub variable coefficient was equal to zero.

$$H_0: \beta_1 = \beta_2 = \beta_3 = 0$$

$\beta_1$ was the publication, $\beta_2$ was study year, and $\beta_3$ was publication year coefficients or effects. If any of these coefficients computed had a $p$-value less than or equal 0.05, it meant that the corresponding variable had an effect on the teaching method change significance. However, it was expected not to find any significant coefficient because the teaching methods change significance should not be related to the publication of the study or not, the study year, and publication year of the study. In short, neither time nor publication had any impact on the teaching methods change significance as reflected in Table 5.

**Table 5**

*Teaching Effect Variables in the Equation*

<table>
<thead>
<tr>
<th>Variables in the Equation</th>
<th>95% C.I. for EXP(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Step 1*</td>
<td></td>
</tr>
<tr>
<td>publ</td>
<td>-1.242</td>
</tr>
<tr>
<td>Syear</td>
<td>.011</td>
</tr>
<tr>
<td>Constant</td>
<td>-21.502</td>
</tr>
</tbody>
</table>

*Note. *Variable(s) entered on step 1 = pub1, Syear.*
As expected none of the sub variables had any significance except the constant which was not of any interest in this model and it had no interpretation. However, there was an interesting statistical event in Table 5. The software automatically dropped the publication year (Pyear) due to redundancy and probable co-linearity with study year (Syear). Since Syear was not significant and as a matter of fact none of them were, redundancy was not an issue for this variable. Other model summary statistics such as model fit (log likelihood, and equivalent R-squared) were not of interest at that time.

**Extracurricular Effect**

The same is applied to the dependent variable, extracurricular participation significance, and its sub variables, publication, study year, and publishing year.

\[ H_0: \beta_1 = \beta_2 = \beta_3 = 0 \]

SPSS was instructed to select only those cases that Extra = 1 and then the model was run. Table 6 summarizes those results.

Table 6

<table>
<thead>
<tr>
<th>Extracurricular Effect Variables in the Equation</th>
<th>95% C.I. for EXP(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Step 1a publ</td>
<td>-1.351</td>
</tr>
<tr>
<td>Syear</td>
<td>-.103</td>
</tr>
<tr>
<td>Constant</td>
<td>207.860</td>
</tr>
</tbody>
</table>

*Note. aVariables entered on step 1 = pub1, Syear.*

Again the same results were achieved as seen previously in the teaching effect; none of the sub variables was significant. In addition, the same redundancy problem appeared again and
the publication year was dropped from model. As expected, the rationality of not having any significant effect of these sub variables on the extracurricular participation significance was that it was not tied to time or publication. It was an important variable and independent by itself, if it had any impact later on the overall significance, it was assured that it was not due to these sub variables.

All Groups

In this section the LOGIT model was used to test the joint effect of the three main variables on the overall significance of change. The main three variables were Calendar effect size (Cal_ES), Teaching methods effect size (Teach_ES), and Extracurricular effect size (Extra_ES).

\[
\text{LOGIT}(P_i) = \ln\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \beta_1 \text{Cal}_ES + \beta_2 \text{Teach}_ES + \beta_3 \text{Extra}_ES
\]

\[H_0: \beta_1 = \beta_2 = \beta_3 = 0\]

In this section each main variable effect size was analyzed, then all variables together were run on the overall significance.

Calendar Effect size (Cal_ES)

Calendar effect size was run on the overall significance and the model was as follows:

\[
\text{LOGIT}(\text{Sig}1) = \beta_0 + \beta_1 \text{Cal}_ES
\]

Statistics gained from running the above model are presented in the following Table 7.
Table 7

Calendar Effect size Variables in the Equation

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1a</td>
<td>Cal_ES</td>
<td>6.058</td>
<td>3.094</td>
<td>3.835</td>
<td>1</td>
<td>.050</td>
<td>427.686</td>
<td>.995</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>-2.072</td>
<td>1.086</td>
<td>3.639</td>
<td>1</td>
<td>.056</td>
<td>.126</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* aVariable(s) entered on step 1 = Cal_ES

From the information gleaned from Table 7, it was clear that both the intercept and the calendar effect size were barely significant at the 95% level of significance. This indicated that each 1% change in calendar effect size contributed 427 times the odds to tip the probabilities toward being not significant (Sig1 = 0). This seemed to be unpractical and not logical in the interpretation of having more than four times the probability. Since this interpretation was based on the coefficient (B) where the interpretation was just the exponent of beta, this beta is considered very high for some reason. Although the constant term (beta zero) had a negative coefficient which reduced the impact of the calendar effect coefficient, the coefficient was still considered to be very high.

**Teaching Methods Effect size (Teach_ES)**

To examine the individual group teaching methods effect size (Teach_ES) on the overall significance, the following model was run:

$$ LOGIT(Sig1) = \beta_0 + \beta_1 Teach_ES $$

Regression results abstracted in Table 8 show that the Teach_Es coefficient (B1) was not significant with *p*-value of 0.160>0.05.
Table 8

*Individual Factor Teaching Methods Effect size Variables in the Equation*

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1a</td>
<td>Teach_Es</td>
<td>5.772</td>
<td>4.104</td>
<td>1.978</td>
<td>1</td>
<td>.160</td>
<td>321.106</td>
<td>.103 999248.710</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>-3.833</td>
<td>2.039</td>
<td>3.535</td>
<td>1</td>
<td>.060</td>
<td>.022</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* a*Variable(s) entered on step 1 = Teach_Es.*

The exponent of the coefficient (Exp B1) was very high in addition to a very large interval of confidence (0.103-999, 248). The constant term B0 was not of interest at this time and the main variable coefficient was not significant, thus it was concluded that teaching method effect size was not a good predictor of the overall significance.

This was also supported by the Chi-square (5.207) that had a p-value of 0.635 which indicated that B1 could not be rejected because of not being zero-based on the Hosmer and Lemeshow test. This non-significance could be due to the small sample available and not having enough variation to explain the dependent variable variation or in this case the odds ration of the dependent variable taking a value of 0 not significant.

**Extracurricular Effect size (Extra_ES)**

Investigating the Extracurricular activities participation effect size on the overall significance (Sig1), the same model used in the previous two main variables individually was used. This model constructed as follows:

\[ LOGIT(Sig1) = \beta_0 + \beta_1 Extra_ES \]
Testing the hypothesis that the main variable coefficient was equal to zero by using the binary logistics regression in SPSS, checking the significance of the computed coefficient, and the t-test equivalent using the Hosmer-Lemeshow test is presented in Table 9.

Table 9

*Extracurricular Activities Participation Effect size Variables in the Equation*

<table>
<thead>
<tr>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra_Es</td>
<td>2.879</td>
<td>4.399</td>
<td>.428</td>
<td>1</td>
<td>.513</td>
<td>17.802</td>
<td>.003</td>
</tr>
<tr>
<td>Constant</td>
<td>-.170</td>
<td>1.173</td>
<td>.021</td>
<td>1</td>
<td>.885</td>
<td>.843</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* aVariable(s) entered on Step 1 = Extra_Es.

In reviewing Table 9, it is evident that extracurricular activities participation could not be considered a good predictor of the overall significance. The p-values for the coefficient and constant were not significant, being more than 5% (0.05). The confidence interval was also very wide (0.003-988, 99). The model Chi-square (6.936) was small and the Hosmer and Lemeshow test resulted in 0.327 which was much more than the allowed 0.05 according to the level of confidence required for this research (95%).

The final conclusion about this model or specifically this main variable was that it cannot be a good predictor of the dependent variable taking a value of 0, or not significant. Again, one possible rationale for this was the small sample size used in this regression which did not have enough variation in the explanatory variable to predict the dependent variable variation.
Joint Factors

To test the joint effect of all the main groups together to determine if they could be good predictors of the overall significance was answered by testing the following model for overall significance.

$$\text{LOGIT}(\text{Sig1}) = \beta_0 + \beta_1 \text{Cal}_ES + \beta_2 \text{Teach}_ES + \beta_3 \text{Extra}_ES$$

The hypothesis that needed to be tested was

$$H_0: \beta_1 = \beta_2 = \beta_3 = 0$$

If the overall model became significant, then these main variables together could be used to test their joint effect on the overall significance. Table 10 demonstrates the results.

Table 10

<table>
<thead>
<tr>
<th>Joint Effect Factors Variables in the Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>Step 1a</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Note. aVariable(s) entered on step 1 = Cal_Es, Teach_Es, Extra_Es.

Upon review, both calendar effect size and extracurricular participation effect size were significant but not the teaching methods effect size. In the meantime the interpretation was somewhat harder which could be rephrased to make better sense. One way to reduce the coefficients and make simple interpretation was to standardize the variables. This was done by transforming the variables into their standardized counterpart by the following equation for each
When $X$ was the variable name, $\bar{X}$ was the variable mean, and $\sigma$ was the variable standard deviation based on the available data. After computing the new variables which were renamed accordingly; New_Cal, New_Teach, and New_Extra; the regression was rerun to achieve the results in Table 11.

Table 11

<table>
<thead>
<tr>
<th>Renamed Variables in the Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% C.I. for EXP(B)</td>
</tr>
<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Step 1*</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Note. *Variable(s) entered on step 1 = New_Cal, New_Teach, New_Extra.

It was noted that when Table 11 was compared with Table 10 the significance remained the same, while the coefficient value and most importantly the exponent of the coefficient, had better sensible meaning. The result for the standardized data indicated that each unit change in the independent variables, New_Cal and New_Extra increased the likelihood of the dependent variable being significant by 1.7 times and 2.4 times, respectively. For example, each unit change in calendar effect size changed the likelihood of the dependent variable of being significant by 1.7 times compared to no change in calendar effect size change. The same could be deduced for the extracurricular but not teaching methods.
To investigate the teaching methods effect on the dependent variable via the other two variables, interaction effects were added to the model. If none of the interaction effects were significant, it could be concluded that teaching method was not a predictive variable for the dependent variable or overall significance. Table 12 demonstrates that teaching methods did not add any significance to the model. The new model constructed as follows:

\[ \text{LOGIT}(\text{Sig}1) = \beta_0 + \beta_1 \text{New}_\text{Cal} + \beta_2 \text{New}_\text{Teach} + \beta_3 \text{New}_\text{Extra} + \beta_4 \text{Cal} * \text{Teach} + \beta_5 \text{Cal} * \text{Extra} + \beta_6 \text{Teach} * \text{Extra} + \beta_7 \text{Cal} * \text{Teach} * \text{Extra} \]

Table 12

Variables Not in the Equation

<table>
<thead>
<tr>
<th>Step 0</th>
<th>Variables</th>
<th>Score</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>New_EXTRA</td>
<td>3.945</td>
<td>1</td>
<td>.047</td>
</tr>
<tr>
<td></td>
<td>New_TEACH</td>
<td>4.164</td>
<td>1</td>
<td>.041</td>
</tr>
<tr>
<td></td>
<td>New_CAL</td>
<td>2.714</td>
<td>1</td>
<td>.099</td>
</tr>
<tr>
<td></td>
<td>New_EXTRA by New_TEACH</td>
<td>.039</td>
<td>1</td>
<td>.843</td>
</tr>
<tr>
<td></td>
<td>New_CAL by New_EXTRA</td>
<td>10.559</td>
<td>1</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>New_CAL by New_TEACH</td>
<td>.046</td>
<td>1</td>
<td>.830</td>
</tr>
<tr>
<td></td>
<td>New_CAL by New_EXTRA by New_TEACH</td>
<td>5.370</td>
<td>1</td>
<td>.020</td>
</tr>
</tbody>
</table>

Note. *Residual Chi-squares were not computed because of redundancies.

It was evident in Table 12 that any variable including the interaction term, which was interacted with teaching methods, decreased its significance. The three variables interaction’ together were a good example of this. When only the two significant variables, calendar and extra, interacted together the significance decreased from 0.001 to become 0.02.
Table 13 was the result of SPSS running the regression including the interaction terms, which the software dropped out variables due to no significance. Since this result confirmed the importance of only the calendar and extracurricular and not the teaching methods, a new model was constructed to include only those two significant and important variables to test if there was any increase in the model significance and accuracy by comparing different statistical indicators.

Table 13

*Variables in the Equation Minus Interaction Terms*

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>3.579</td>
<td>1</td>
<td>.059</td>
<td>14.730</td>
</tr>
</tbody>
</table>

Note. *Variable(s) entered on step 1 = New_Extra, New_Teach, New_Cal.*

The new model that included only calendar and extracurricular variables is as follows:

\[ \text{LOGIT(Sig1)} = \beta_0 + \beta_1 \text{New_cal} + \beta_2 \text{New_Extra} \]

Running this model resulted in improving the overall model significance from 0.007 to 0.003. Table 14 also reflects an increase in the variables significance by cutting them almost in half.
Table 14

*Calendar and Extracurricular Variables in the Equation*

<table>
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<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
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<td>.010</td>
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</tbody>
</table>

*Note. aVariable(s) entered on Step 1 = New_Extra, New_Cal.*

When the three-variable model was used, calendar had a significance of 0.01 and now it showed a significance of 0.005. The same held true for the extracurricular variable, it was 0.022 and now was 0.01. On the variable level, there seemed to be an improvement in the significance but there was also an increase in the coefficient to explain the dependent variable.

Table 15

*Clarification of Overall Accuracy With Teaching Methods and Without Teaching Methods*

<table>
<thead>
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<th></th>
<th>Without Teaching Methods</th>
<th>With Teaching Methods</th>
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</thead>
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<td></td>
<td>Predicted</td>
<td>Predicted</td>
</tr>
<tr>
<td></td>
<td>Sig 1</td>
<td>%</td>
</tr>
<tr>
<td>Observed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig 1</td>
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<td>51</td>
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<td></td>
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<td>40</td>
</tr>
<tr>
<td>Overall %</td>
<td></td>
<td>56.0</td>
</tr>
</tbody>
</table>

|                      | Predicted                | Predicted             |
|                      | Sig 1 | %    | Sig 1 | %    |
| Observed             |       |      |       |      |
| Step 1               |       |      |       |      |
| Sig 1                | 0     | 37   | 14    | 72.5 |
|                      | 1     | 18   | 22    | 55.0 |
| Overall %            |       | 64.8 |       | 65.9 |
Although the new model increased the overall model significance and the variables’ significance compared to the older three-variable model that included teaching methods, the model accuracy did not improve as reflected in Table 15. Table 15 clarified the model’s overall accuracy whereby both models—with or without teaching methods—had an overall accuracy of 56% when the constant only was used, but the model with teaching methods had a better accuracy when all variables were included (65.9%). One possible rationale for such accuracy improvement, while not having any effect on the overall model significance, was that teaching-methods variation made the model fit the data better but without explaining any of the dependent variable variation.

Summary

In general, it was concluded that only those variables, calendar and extracurricular activities participation, were the ones that contributed more to overall significance or importance. Teaching methods, on the other hand, did not contribute greatly in anticipating the overall significance or importance because it was the only one of these variables that did not add school time. It appeared that exposure time to instruction was more important than the type of instruction method used to pass information from the teacher to the student.

Another possible cause for teaching methods not being significance is sampling related. All of the data collected from the studies that was collected based on criteria did not reveal any time information. Thus time data we not included in the data that was used to estimate the teaching method effect size.
CHAPTER 5

RESULTS AND DISCUSSION

The main results identified in Chapter 4 are discussed relative to the literature review and available research. Chapter 5 examines each finding and whether agreement was been found in other studies or discrepancies, if any, and their potential interpretation, if possible. The main objective of this research was the overall U.S. K-12 education system. This system requires an overall system change, and the overall complete picture is discussed by interpreting the components change impact. Although the research design was complex, the overall picture and suggested system is described at the conclusion.

As a reminder, the main objective was the overall concept of the education system; the components definition, data collection, analysis and findings, and conclusion should be addressed as parts of the overall education system. In other words, since the research concern is the overall education system and literature has suggested that teaching methods, calendar modification, and extracurricular activity participation are relatively the main components of the current education system; each individual implication should be valued within the system as a whole. Although this research did not precisely discuss the administration and procedures, it goes without saying that components change; teaching methods, calendar, and extracurricular participation; requires administration change because they are considered as supportive components that makes the complete the system as a whole.
To remain focused on the overall picture of an education system is not simply to study a mix of variable definitions. The overall significance is an imaginary variable that was created to link all of these components into one reference point. This was established by separating all the referenced studies into two groups based on the findings. One group is those studies or research that concluded such component or factor change that led to significance. This group took the value of one. The other group that did not find significance for the component or factor change was categorized as a zero factor. Although some of these studies examined different variables, most measured the significance relative to the student achievement or test scores. Because the purpose of the education system as a whole is to measure students’ learning by their scores or grades, the whole system evaluation is based on its component significance.

Based on the above, the bigger picture of the whole system change or modification can be deduced from its components’ significance and their joint significance. Keeping this in mind, separate components, groups, or variables significance is meaningful individually but its totality can be very helpful in evaluating the whole system.

The following is a discussion of the findings of the components separately as they appeared in Chapter 4 and concludes with the final overall system evaluation or significance. This is followed by developing basic guidelines for new system proposal that is fair and can be used as a start for system change or modification.

**School Calendar**

The first step in the analysis in regard to the variable Calendar was the descriptive analysis. From this analysis, it was found that the effect size (ES) was not normally distributed; not significant all ES and significant only higher ES (average .33), Average Study year 2003, publish year 2007, average study time four years.
All Pub1, Syear and Pyear were not significant (failed to reject – it was not zero) except constant which did not have a meaning. Thus, Calendar change significance did not depend on the study year or publishing year, or if the study was published or not. This somehow contradicted the conventional wisdom that published studies are normally significant and non-published studies are not usually significant (Cooper et al., 2003).

Within this weak inferential framework, the average effect size for 39 school districts was quite small, $d = .06$, favoring modified calendars. Studies that used statistical or matching controls revealed an effect size of $d = .11$. The final outcome for this research was any modification for school calendar had a positive impact on student achievement. This was also well confirmed with NAYRE (2006).

An extended school year and its effect on student achievement has sparked significant debate about academic time and student learning. The debate caught the attention of reform advocates, education researchers, policy makers, and the school community, and launched a discussion on systematic change within the public school system. The systematic change supported a higher academic standard that focused on the demands of underperforming students. In addition, Neal (2008) noted, “Calendar reforms were based on American students’ achievement in contrast with the other industrialized nations’ student achievement” (p. 1). This comparison has led state departments of education, local school districts, and other concerned educators to consider alternative calendars that extend the school day and/or school year to improve student achievement. This international comparison started with A Nation at Risk, a report published in 1984 (Nichols, 2005), which noted that the United States’ student achievement was lower than other countries in mathematics and science. One of the first considerations was to extend the school calendar to allow students to attend school year-round
(Delp, 2008). Other considerations included extending the school day, class-allocated time, schedule of instruction, a longer block of instruction without interruption, the time of arrival for students and teachers, parallel block, intensive and modified blocks, and year-round schooling. However, these alternatives that consider time variability formed a challenge to the traditional organization of schools. It has been shown in empirical research that class size and student engagement have an effect on student learning, the traditional and classical self-contained classroom has been replaced by a commitment to manage and organize instruction as an organizational strategy due to the inefficiency of traditional organization in controlling class size and less time to engage in learning. This led educators to rethink and research the relationship between time and learning (Carroll, 2008).

The education system and its objective of teaching student knowledge and skills had been researched and analyzed from many directions. However, since 1999 much of the research targeted the school day as the main window to focus on the learning operation itself. Accountability rose during the 1990s as a tool to hold every party, administrators, students, and parents; responsible for controlling the operation of learning.

Within accountability, the standards movement broke the education operation into many smaller components. The main controlling issue was that it is relatively easier to observe and monitor was funded. Who spent the money and on what was the main concern. This also raised the subject of overcrowded school buildings and schedules.

The main objective of this research is understand the current educations system, analyze it, and recommend reform. Historical research could not be considered because of the possibility of discussing side issues that already been considered and solved. However, the main persistent
issues are of main concern because of their possibility to be caused by the overall system rather than a passing or periodical reason.

**Teaching Method**

**Technology**

None of the sub variables tested, namely, Study Date, Published or not, and Publishing Date were significant. Said differently, the collected studies information were not important to the change of the education system. The study size effect was not influenced by the study date, published or not, and publishing date. None of the studies reported significant results for these variables, which confirmed the finding that the importance of changing or modifying the teaching method in the education system, or the study significance in this case, has nothing to do with the publishing or not publishing and the study year date.

**Structure**

However, using technology, computer, online video and web-based instruction did not have a clear effect on student achievement. The technology is an important tool to help the student learn, but there is an important factor which is effective for student achievement—structure. According to Wood (2002) by changing the structure and schedule of school, the overall climate can be improved, as can the well-being of adults and children who spend their days in schools. To make such climate different, exciting, and safe, a dedicated educational system is needed to give teachers more time to educate children and more time to learn.

Friedman (2006) indicated that the benefits of course websites have been established on the university level, but there is a shortage in literature on course websites at the K-12 level. Friedman discussed in detail the encouragement and barriers, some of which are because of
infrastructure and parent awareness. On the side of the teacher, he found that some teachers did not use the websites that were included in the study on a regular basis.

**Extracurricular Activities Participation**

In the literature reviewed for extracurricular activities participation none of the coefficients were found to be significant. Reinforcing the concept that the year of the research study or publication of the article has nothing to do with significance found in the study and, therefore, importance to the education system is the main concern of this research. Since year of the study and publication of the article does not impact the significance of the study, it cannot be said that extracurricular activities participation does not affect student achievement. Literature supports the link between extracurricular activities and higher academic achievement in high schools (Cosden et al., 2004; Mahoney et al., 2003; Nettles et al., 2000). However, research has shown that school consolidation provides mixed signals with regard to participation in extracurricular activities (Blake, 2003). Furthermore, consolidated schools offer a wider range and greater number of extracurricular activities, while others found less participation in extracurricular activities among consolidated schools (Blake, 2003).

Bucknavage and Worrell (2005) found that talented students tend to participate in extracurricular activities. However, a gender effect was present, too, based on the type of activity. The extracurricular activities studied were dance, solo instruments, choral music, band, athletics, student government, science clubs, and clubs and/or ethnic cultural activities. In addition, the study concluded that there was an association between nonathletic activities and academic talent.

Another study by Powell et al. (2002) examined children’s participation in out-of-school activities and academic achievement. The sample consisted of first-grade students from low-
income families and diverse ethnic groups. Powell et al. concluded that the relationship took a curvilinear shape based on gender, but there was an overall positive relationship between academic achievement and participation in out-of-school activities without regard to the number or frequency of extracurricular activities.

**LOGIT of All Factors**

Running the LOGIT on all the independent factors together revealed the following conclusions:

- Calendar is barely significant at 5% but interpretation is not reasonable.
- Teaching method is not significant.
- Extracurricular participation is not significant.
- Joint effect reveals that Calendar is significant at about 2% and Extracurricular is significant at about 1% while teaching method is not significant.
- After standardizing the calendar, change of one unit increased the likelihood of significance by 1.7 times and the extra one unit change increased the likelihood of significance by 2.4 times.

When only the two significant groups were included in the LOGIT regression, the significance increased to a 0.005 and 0.008 from the two-digit significance for the other model that included all three groups or variables. The final outcome for this research is any modification for school calendar has a positive impact on student achievement. This study confirmed the importance of time in the educational process. Carroll (2008), Delp (2008), NAYRE (2006), and Neal (2008) proved in their research there is a relationship between time and learning.
Suggested School System Vision

Since it was demonstrated in past chapters that the current educational system is out of sync with many of the new changing demands and the student differences, the new school system should adapt to these shortages. In addition, given the current usage of information technology and its inefficient linkage with curriculum and different capabilities of students, the new system should streamline such available technology more efficiently and make it custom made to students' needs.

The new suggested system was described through the main factors discussed and analyzed above; namely Calendar, Teaching Methods, and participation in Extracurricular Activities. Although what is provided in the next section is a general and intended as guideline, a detailed plan would require much more effort and study to develop.

Calendar

As it has been discussed above that the current calendar outlived its purpose some time ago. The present and future needs of the education system are changing from needing students as farm manpower in the summer to much more heralding skills, talent, and quality. Therefore the new calendar should be based on an all-year-round schedule for students. Eventually this will get many stakeholders more involved in the education system, not only teachers and administration, but also parents and family members.

To give a better picture of the suggested calendar, imagine all-year-round school days which breaks are chosen by the student. The minimum requirement of attendance is the normal nine months with an open ceiling. Depending on the student decision, his or her capabilities, and family influence (holidays, travel, etc.), the student can rest for a maximum of three months in each fiscal calendar year. Otherwise he or she can continue studying and covering more study
units if he or she wish too. Each calendar month is divided into four weeks and each week covers a unit of the required curriculum. The calendar week is the normal week that starts on Monday and ends on Friday. Each day is divided into study hours just like the present system.

The difference between the existing calendar and the new suggested all-year-round calendar is the flexibility of the new calendar to student needs. One example is external influence (family, travel, etc.). Another is the internal flexibility where the student can finish the curriculum requirement and spend more time in school reading, exercising, socializing, or continuing with the next academic requirement.

Furthermore, if the student needs to accelerate his or her educational progress to complete more units, he or she can do more at home online unless they need further assistance that is only available in school the next day. This calendar flexibility is expected to allow capable students to accelerate their learning process and shorten their graduation time. For these students, they should be allowed to continue their education toward college. Even then, should they graduate from college at a young age and decide to work, special training programs should be designed to accommodate them to give them more real-life work experience. This should develop their skills further and start serving society earlier for longer periods.

Other less capable students should be provided the maximum allowable time to complete their requirements. The students who did not complete the requirements within the maximum given time are expected to be at least developing certain interests and skills. In addition, parents should be able to choose what and when their children can study and learn to make the system tailored to each student’s needs and capabilities.
Teaching Methods

Again, it was discussed in proceeding chapters that among the many different teaching methods, it was found that time exposure is of more importance than the method itself. Thus, instead of forcing a certain method of teaching on a student, an option of choosing the preferred method is given to the student. Since students naturally have different skills and capabilities, they should be provided with the option to choose the way they learn.

The minimum curriculum requirement designed by education administrators (e.g., Department of Education) should be provided electronically online. This online curriculum content should have all possible formats such as text, animation, presentation, video, and net links. The student starts the instructional hour by looking up the minimum requirement content and choosing the best learning method. This should be followed by short quiz that demonstrates the student understanding of the requirement. If the student finishes the minimum requirement he or she can proceed to the next unit or next subject without violating the guidelines. These guidelines should be established by education administrators to expedite the learning process but while assuring subject variety within each week and each student.

The teacher’s role should be switched to guidance on request and supervising instead of instructing. Students should ask for teacher assistance when they need to whether for curriculum requirement or socializing and relationship development. Otherwise, students should be mentally sailing in front of their computers learning and reacting with their intended subjects. Classrooms would be more like computer labs than present classrooms.

Extracurricular Activities

Students can cover curriculum based on their own pace and extra time can be spent on special interest in extracurricular activities to allow for better physical fitness and additional
social skills. However these activities can also be more of instructional/occupational sessions for certain skills under the label of special projects. They can be designed provide support and guidance for any project the student is interested in. These activities should be designed under the general umbrella of present trade skills required by society. Said differently, gifted students are expected, in general, to acquire more knowledge and thus tend to quench their hunger in completing more required units (Bucknavage & Worrell, 2005). These types of students, in general, tend to be interested in details and more complex projects. General trades tend to be of more interest to these students who do not continue their education while they develop special talented skills in precise field or subject.

Giving the student a chance to start early developing their interests early and getting them exposed to such activities should formulate a deep knowledge and practice of the skill. Opponents could argue that this could limit the student imagination and affect developments in knowledge that we see nowadays which came from theoretical learning. It can be rebutted by showing that people interested in theory were students who pursued their interest in theory and accomplishments in learning settings not in special hands-on daily trades. For example, a carpenter who develops his or her skills of trade in their daily job has less interest in theory and learning beyond college. On the other hand, students who accelerate in school-learning-setting and develop interest in math, for example, tend to be more interested in theoretical knowledge and its generation.

**Education Administration**

Integrating the above general guidelines requires a tremendous change in school administration concept. Although some of the existing manpower and productivity control should remain as it is now, much of the administrative processes and operations should be
changed to adopt these changes. One of the changes in education administration is accepting change itself and getting everyone involved. In spite of school buildings remaining the same, class room settings, operations, and financing would change to adapt to new all-year-round operations. Second, teacher education and training would need to be changed according to the new curriculum design. Third, productivity (i.e., teacher and students) evaluation would need to be changed also.

Change would be the “name of the game” that would affect all aspects of life including economy (e.g., vacations) to politics (e.g., regulation) to many other aspects of life. However, new-world demands and requirements necessitate change of the present system to a more flexible system that simulates social, technological, and economical requirements.

Furthermore, educational systems should strive to stimulate student capabilities to learn and teach them to be responsible and build their character. Since the individual characteristics and capabilities are different from one student to another the system should be flexible enough to allow those who failed certain remedial opportunities. This flexible system should consider not only K-12 graduates but also college graduates too. A futuristic education system should concentrate on professionalism in certain high demand majors or fields more than concentrating on passing the general academic courses.

**Recommendations**

- Meta-analysis is superior to narrative reports for systematic reviews of the literature and helps to indicate the future trends of education reform, as well as to evaluate and critique education phenomenon. Still, when the analysis is executed by arduous rules, the quantitative results must be cautiously inferred.
• Most education reforms focus on technology or training, while the development of the organization itself does not get much attention. This leaves the organization lagging behind in the chaos of the old system and procedures that leave it unable to implement these changes.

• More than 150 years ago, when a large segment of the nation was agricultural-based, the majority of families needed their children to stay home and help the family farm (Maine State Department of Education, 1994). Since then, the public school calendar was designed to accommodate this and it still does. Today, only a very small percentage of society needs their children to be home in the summer to help with chores or field work, but the school calendar still follows the agricultural schedule (Palar, 1996). It is important to allow parents to participate in the making of the students’ academic calendar; after all, parents have the largest impact on their children.

• Change is more important when all (i.e., calendar, teaching methods, and extracurricular activity participation) are all changed together.

• Change to the system to be more flexible to be concurrent with future job needs.

• Allow multi-way education instead of the current traditional one way.

• Open the education system and class room ceiling to adapt for the gifted and talented while maintaining the bottom line for slow learners.

• Adapt to the current technological revolution and phasing out the one-size-fits-all learning concept.

• Consider free learning style and time instead of limiting the learning to pre-set time and place.
• Free up vacation time for students and parents to allow for closer relationships.

**Future Research**

Since the finding of this research is that calendar and extracurricular activity participation appear to be more important than teaching methodology, further research is needed to investigate the following:

• Administrators and teachers acceptance to change should be investigated, and recommend involvement strategy;

• Administrators should consider and identify the minimum required knowledge in each learning subject to allow students to better use their time once they pass these requirements;

• Building and facilities maintenance and operations should be examined for readiness to accept students for longer hours including those out of their geographic location;

• Civic societies, trade unions, and specialized organization integration with the education system should be investigated;

• Social networks should be considered to be integrated with the education system to be used as a part of teaching methods;

• Economic impact on infrastructure, vacations, and transportation should be studied to estimate the economy overall impact when school day break the current boundaries of time and space; and

• Employer’s orientation and their hiring practices should be tested for change to accept younger graduates even as observers. Recommending a treatment plan is required.
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(EJ679900)


*Journal of Educational Change, 1*, 307-329.


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White, K. A. (1999). Quietly, the school calendar evolves. *Education Week, 19*(9), 1-3.


APPENDIX A: CODING SHEET

Component:  (1) Teaching Methods  (2) Calendar  (3) Extracurricular ____________

Author:  ____________________________________________________________

Year:  ____________________________________________________________

Publication:  (1) Published  (0) Not Published

Dependent or Measured Variable

Independent variable 1 _____________ Independent variable 2 ________________
Independent variable 3 _____________ Independent variable 4 ________________
Independent variable 5 _____________ Independent variable 6 ________________

Data Provided:

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Statistics:

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Findings:

(1) Significant  (0) Not significant

Effect size
## APPENDIX B: SAMPLE STUDIES

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