

An Exploration on the Use of Gilbert's Behavior Engineering Model to Identify Barriers to
Technology Integration in a Public School

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ABSTRACT

Barriers to technology integration are not a new phenomenon for educators, however resolving the issues surrounding the barriers necessitates the use of appropriate methods to accurately identify them. The purpose of this study is to investigate (a) whether or not Gilbert's Behavioral Engineering Model is an appropriate instrument for identifying barriers to technology integration in an educational setting, particularly a public school and (b) can Gilbert's Behavioral Engineering model be used in a public school to identify barriers to technology integration. The research and design methods were conducted in two phases. In Phase I, a model usability study was conducted through an online Cause Analysis survey based on Chevalier's updated model. The survey was administered to 80 teachers and four administrators in a public school. In phase II, two expert reviewers validated the process used to implement the Behavior Engineering Model. The data from the Cause Analysis indicated that participants believed there was a lack of financial and non-financial incentives for integrating technology and that the management and reporting system did not adequately track the use of technology. The expert reviewers both agreed that Gilbert's model was implemented correctly identified barriers to technology integration and revealed a performance gap. They also agreed that Gilbert's model is appropriate to use in a public school setting.

Dedication

This dissertation is dedicated to my late parents and grandparents, Mr. and Mrs. Charles L. King, Sr. and Mr. and Mrs. James E. Waller. The life lessons you have taught me have been invaluable in this process. I am also proud to be your son and grandson.

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Chapter 1: INTRODUCTION

There is on-going dialogue regarding the myriad of problems that exist in public schools. Tom Kalil, the Deputy Director for the Science and Technology Policy Office at the White House, argues that despite the budget allocation for technology education, meaningful gains are a scarcity. As a nation, we continue to increase funding for each student in the public school system while outcomes remain inconsequential (Busteed, 2012).

Technology has long been touted as education's savior. It has taken up its own place as a tool meant to augment the quality and deliverability of education to students. However, a Gallup Poll administered by Phi Delta Kappa showed that the support of the public for technology, within the realm of education, is, at best, mixed (Martinez, 2011). And research shows that the attitude of teachers may be similar. A study conducted by the Eduventures Inc. (2009) found that merely 22% of teachers use technology regularly in classrooms. Even more astonishing than this number – which is quite low – is that 34 percent of the teachers that use technology use it infrequently. What is potentially one of the strongest tools to serve education is often ignored and is not being implemented in a manner where its true potential may be realized (Eduventures, 2009).

Perhaps this is a sign that teachers are not able or ready to complete the transition to using technology in classrooms. Knezek (2009), CEO of the International Society for Technology in Education, found support for this explanation as he talked to school administrators. In an educational publication, he reported that administrators regularly informed him that, although they did not have to urge the newly recruited teachers to check their emails any longer, there still remained no integration of technology with any more frequency than the trend at the time. Bingimlas (2009) discovered that teachers seemed to have a strong desire for the integration of technology in classrooms; however, they still faced scores of obstacles. The

main obstacles were determined to be an absence of confidence and a lack of access to resources. What this basically meant was that most teachers did not think they could implement different technology based tools into their classrooms, and those that did couldn't find the appropriate resources to get the job done. While research exposed a limited use of technology in education, it failed to offer any insight regarding ways to solve the problem (Barnes, 2010).

Balanaskat, Blamire, and Kefala (2006) claim that educators appear to recognize the value of technology as an instructional tool. Yet, teachers continue to encounter difficulties integrating technology in the learning process. Numerous studies have been conducted to identify the barriers that educators experience while integrating technology in schools. However it is important to note that the method used to identify the barriers can help or hinder the ability to discover appropriate solutions.

Although schools are allocating resources on the purchase of smart boards, wireless access and other technologies, teachers still fall short of implementing technology within the building (Dick, 2005). In an effort to address this need, professional organizations offer online sessions and regularly publish materials on topics pertinent to integrating technology into the classroom. Unfortunately, it is not sufficient to completely bridge the gap (McLeod & Richardson, 2011).

Comprehending the obstacles related to technology's integration in the learning and teaching environments is central to providing "guidance for ways to enhance technology integration" (Schoepp, 2012, p.2). In essence, by outlining the main problems, a clear solution can be identified. However, if the means used to identify barriers are in themselves inappropriate, the barriers identified and the measures applied to overcome them will not be sufficient.

To effectively address the barriers of technology integration, efforts must be made to identify the most appropriate method for discovering them. Determining the most appropriate method of identifying the barriers remains a challenge to the success of technology integration.

The need to find solutions to challenging problems is not unique to the public school setting. Businesses often use various methods to address and resolve difficulties related to employee performance. HPT (Human Performance Technology) is a method that involves analyzing the needs of an organization and then applying a variety of tools and processes to aid the organization in meeting the requirements and expectations in terms of quality in a cost-effective and timely manner. HPT is a systemic approach that seeks to achieve the improvement of productivity and enhancement of competence through the analysis of current and desired performances at the workplace. Furthermore, it implements interventions to narrow the gap between these two realities (Woodley, 2005).

Gilbert's (1978) Behavioral Engineering Model is one component of the HPT model that addresses performance in the workplace by focusing on the environmental aspects that influence productivity. Gilbert's model offers six factors that enhance individual, group and organizational performance. These factors, often dubbed "The Six Boxes", (see Figure 1.) also aid in the identification of the performance gap and formulate the system's framework (Performance Thinking Network, 2012).

Often, "approaches that had previously been proven effective in addressing one type of problem in a given context are effective in addressing an essentially different but in some aspects similar problem or context" (Ellis & Levy, 2008 p.30). Gilbert's (1978) BEM has been effectively applied in a corporate setting; however, its comprehensive focus, which includes an evaluation of both environmental and human factors, makes a viable option for use in public

education. For example, are teachers given enough time with technology? Are the school districts' expectations or policies vague regarding integrating technology in the curriculum?



Figure 1. Boxes® Model, copyright 2012, with permission of The Performance Thinking Network www.SixBoxes.com

Gilbert's Behavioral Engineering Model Overview

Thomas Gilbert (1978) outlined measures to determine the causes behind deficiencies in performance; “For any given accomplishment, deficiency in performance always has as its immediate cause a deficiency in behavior repertory (P), or in the environment that supports the repertory (E), or in both. But its immediate cause will be found in a deficiency of the management system (M).” (Gilbert, 1978, p.76).

Gilbert's BEM analysis of employee performance consists of three Leisurely Theorems:

1. Differentiate between behavior and accomplishment in order to define "worthy performance"

2. Identify methodology to determine the, "potential for improving performance (PIP)" (Chyung, 2002, p.2).
3. Describe six vital behavior components that can be influenced to achieve performance (Gilbert, 1978, p.83). (see Figure 1.)

According to Cox, Frank, and Philibert (2006), Gilbert’s HPT model illustrates that performance is a negation between both behavior and consequence (see Table 1). The goal of the performance process is to create worth. An accomplishment’s value should surpass the expense of the behavior to attain it (see Figure 2.). Inherent in Gilbert’s philosophy is performance, which can be measured with consistency and accuracy. Gilbert also held the position that competence must be measured along with performance in order to determine what provides worthiness to performance.

$$W = \frac{A}{B}$$

Worth = $\frac{\text{Accomplishment}}{\text{Behavior}}$

Figure 2. Gilbert’s Third Leisurely Theorem T.F. Gilbert, 1978, Human Competence: Engineering Worthy Performance with permission.

Table 1: Worthy Performance

Behavior	Accomplishment/Outcome	Worthy Performance
Learns efficient use of e-mailing	No response to email messages	No
	Appropriate response to e-mails	Yes
Increases sales calls numbers	Sales remain stagnant	No
	Sales increase	Yes

Source: T.F. Gilbert, 1978, p. 45 with permission

Gilbert's (1996) model is "one of the earliest and best-validated HPT models for improving performance in organizations. Gilbert identifies six general strategies for improving organizational performance" (p.10). Gilbert's divides the problems of performance into two levels: the environment and the person. The latter lists three supporting factors which are within the person; the former lists three supporting factors which are within the environment of work (see Figure 3). BEM also categorizes causes into three factor classifications that have influence on performance. They are information, instrumentation, and motivation (see Table 2).

	Information	Instrumentation	Motivation
Environmental Supports	Data	Instruments	Incentives
Person's Repertory Of behavior	Knowledge	Capacity	Motives

Adapted from *Human Competence: Engineering Worthy Performance*, by Thomas F. Gilbert (1978), p. 88, New York: McGraw-Hill, Inc.

Figure 3. Gilbert's Behavior Engineering Model T.F. Gilbert, 1978, p. 88 with permission.

Chevalier (2007) says that Gilbert's model showcases a way to, systemically and systematically, figure out the barriers on the path to organizational and individual performance. The BEM differentiates between an individual's repertory of behavior and environmental supports.

Table 2: *Gilbert's Behavior Classifications*

	S^D Information	R Instrumentation	S_r Motivation
E Environmental supports	<p>Data</p> <ol style="list-style-type: none"> 1. Frequent and relevant feedback regarding performance adequacy 2. Descriptions regarding performance expectations 3. Relevant and clear guides to aid performance 	<p>Instruments</p> <ol style="list-style-type: none"> 1. Materials and tools of work formulated to scientifically combine human factors 	<p>Incentives</p> <ol style="list-style-type: none"> 1. Sufficient incentives of finance that are made contingent with regards to performance 2. Non-monetary initiatives are made available 3. Opportunities to develop careers
P Person's repertory of behavior	<p>Knowledge</p> <ol style="list-style-type: none"> 1. Training that is scientifically designed and matches the needs performances that are exemplary 2. Placement 	<p>Capacity</p> <ol style="list-style-type: none"> 1. Flexible schedule of the performance to go with peak capacity 2. Prosthesis 3. Shaping physically 4. Adaptation 5. Options 	<p>Motives</p> <ol style="list-style-type: none"> 1. People's motive assessment with regards to work 2. People recruitment of people to go with the situation's realities.

Source: T.F. Gilbert, 1978, p. 88 with permission

The BEM by Gilbert rests on Skinner's three-term contingency (Skinner, 1969) that figured out the discriminative stimuli, feedback, and follow-up as parts of behavior-environment interactions. Day (1997) observed that Skinner was attempting to explain the way people work in various environments. He synthesized the thought that people, "learn to manipulate and control

their environment by their responses to it” (p. 23). Gilbert created the trio of columns in his model of six cells with the trio of terms found in Skinner’s work. He differentiated between environmental factors and individual factors that corresponded to Skinner’s three components. In an article in the *Performance Improvement Quarterly* entitled “Valuing the Gilbert Model – An Exploratory Study,” Cox, Frank, and Philibert (2006 p. 16), three performance technologists, reviewed Gilbert’s leisurely theorems and validated his framework through their research.

Updated Model

Chevalier (2007) found it necessary to update Gilbert’s (1978) model to make it more comprehensive and universal from individual to the organization. Chevalier (2002) suggests that the factors needed to be revisited, since environmental factors are considerably easy to enhance and have an influence on group and personal performances. It will be tough to estimate if the individual has the needed capacity, motives, skills and knowledge to perform the assignment given when the relevant environmental factors (incentives, information feedback, resources, etc.) are not present. Chevalier illustrates in figure 4 how some of the terms in Gilbert’s(1978) model were adapted to facilitate the way performance is normally discussed between practitioner and client.

Environmental and Individual Factors

In synchrony with the primary BEM model, the updated version (see Figure 4) distinguishes between individual and environmental influences that influence performance.

Environmental factors represent the first analysis point since they cause barriers to attaining outstanding performance. When environmental support is effective, individuals can easily perform as expected (Chevalier (2007). Rummier and Brache (1995) state,“ If you pit a good performer against a bad system, the system will win almost every time” (p. 25).

Environmental support is categorized into three factors that impact performance: information, incentives, and resources. Communicating clear expectations, providing the necessary guides to do the work, and giving timely, behaviorally specific feedback is included in

Environment	<p>Information</p> <ol style="list-style-type: none"> 1. Roles and performance expectations are clearly defined; employees are given relevant and frequent feedback about the adequacy of performance. 2. Clear and relevant guides are used to describe the work process. 3. The performance management system guides employee performance and development. 	<p>Resources</p> <ol style="list-style-type: none"> 1. Materials, tools and time needed to do the job are present. 2. Processes and procedures are clearly defined and enhance individual performance if followed. 3. Overall physical and psychological work environment contributes to improved performance; work conditions are safe, clean, organized, and conducive to performance. 	<p>Incentives</p> <ol style="list-style-type: none"> 1. Financial and non-financial incentives are present; measurement and reward systems reinforce positive performance. 2. Jobs are enriched to allow for fulfillment of employee needs. 3. Overall work environment is positive, where employees believe they have an opportunity to succeed; career development opportunities are present.
Individual	<p>Knowledge / Skills</p> <ol style="list-style-type: none"> 1. Employees have the necessary knowledge, experience and skills to do the desired behaviors 2. Employees with the necessary knowledge, experience and skills are properly placed to use and share what they know. 3. Employees are cross-trained to understand each other's roles. 	<p>Capacity</p> <ol style="list-style-type: none"> 1. Employees have the capacity to learn and do what is needed to perform successfully. 2. Employees are recruited and selected to match the realities of the work situation. 3. Employees are free of emotional limitations that would interfere with their performance. 	<p>Motives</p> <ol style="list-style-type: none"> 1. Motives of employees are aligned with the work and the work environment. 2. Employees desire to perform the required jobs. 3. Employees are recruited and selected to match the realities of the work situation.

Figure 4. (2002) Roger D. Chevalier, Updated Behavior Engineering Model with permission the environment support. Ensuring that the right tools, materials, processes, and times are accessible to fulfill tasks illustrates the resource part of the model. Incentives showcase suitable financial and non-financial supports that influence employee performance. This applies to the workplace, the worker, and the work.

As for individual factors, employees seem to bring their capacity, motives, knowledge and skills to the workplace. Motives should be in synchrony with the work environment to

inspire individuals to excel at their jobs. The capacity represents whether the worker has the ability to learn and apply the skills necessary to be successful in the workplace.

In figure 4 (p.9), Chevalier's (2002) model provides the necessary structures to assess the 6 factors of Gilbert's (1978) model, resources, information incentives, capacity, motives, and knowledge and skills that impact personal or group performances in a workplace.

The Study's Purpose

This developmental research study investigated whether Gilbert's (1978) behavioral engineering model as updated by Chevalier could be used to identify performance gaps and other barriers in technology integration within a public high school setting. As policymakers continue to look for solutions to the problem of integrating technology in public schools, it is necessary to use an appropriate model to categorize the barriers. Gilbert's BEM Model might provide an effective process for educational leaders, teachers, and instructional designers to identify the barriers and improve the integration of technology in the curriculum. The aim of this study is to explore and examine whether or not Gilbert's Behavioral Engineering Model is an appropriate instrument for identifying barriers to technological integration in an educational setting, particularly a public school. The research questions that guided this study are:

1. Can Gilbert's Behavioral Engineering model be used in a public school to identify barriers to technology integration?
2. Is Gilbert's Behavioral Engineering model appropriate for identifying barriers in public education?

Overview of Methodology

This study is developmental in nature and explored the usability of Gilbert's BEM model while seeking to validate its use in a public school setting by using it to investigate the problem

of technology integration in public schools. Data was collected in two phases. In phase one, data related to the integration of technology within an identified public high school was obtained using an online survey (Appendix D) developed according to Gilbert's Behavioral Engineering model. This instrument was disseminated to teachers and principals employed by a public high school located in an urban setting at the eastern base of the Blue Ridge Mountains. The second phase was an evaluation of the implementation model by two reviewers who are experts in HPT and technology integration.

Significance of the Study

Literature on the appropriateness of using human performance technology models to evaluate issues or problems in a public school setting is minimal at best. There are several guides or manuals designed to implement HPT models in the military and the corporate world (Binder, 2007). However, very little has been written that examines the effectiveness of HPT in K-12 environments. If the findings demonstrate that Gilbert's (1978) model identifies the barriers to technology integration, it could lead to the development of appropriate solutions, and this study could influence a shift in the way public schools identify and address their problems.

The Six Boxes in Gilbert's model provide a comprehensive picture of where resources and energy should be expended to prevent administrators and leaders from implementing strategies that are well intentioned but ineffective in correcting the presenting problem. This study seeks to demonstrate the benefits and challenges of using HPT models in a public school setting. And also adds to the current literature that exists regarding the specific problem of technology integration.

Organization of the Study

This study includes five chapters and eight appendices. Chapter One provides background information related to the specific issue of technology integration in public schools as well as the need to utilize appropriate models and methods when trying to address problems within a public school setting. Additionally, a general overview of the methodology and goals associated with the study are clearly defined.

Chapter Two examines the literature available on the relevant topics. The literature review contains information on the history of HPT and an overview of HPT Models with particular focus on Gilbert's model. Because the study will be using Gilbert's model to address technology integration, the literature review also includes existing research on the barriers that prevent teachers from integrating technology in the classroom.

Chapter Three outlines the methodology of the study by describing the type of study, population sample, and the data collection and analysis methodology. The study's findings are showcased in Chapter Four. Chapter Five which includes a synopsis of the findings and suggestions on how practitioners can utilize this research to inform their decision making and future practices. Recommendations for additional related research as well as the implications are included in Chapter Five.

Chapter 2: REVIEW OF LITERATURE

This chapter reviews the existing literature regarding the topic of Human Performance Technology including: (a) definition of HPT, (b) the history and evolution of Human Performance Technology (HPT) Models, (c) principles of Human Performance Technology (d) Thomas Gilberts Behavioral Engineering Model/HPT, and (e) a case for using HPT Models in public schools.

Human Performance Technology Defined

Human Performance Technology (HPT), in its broadest sense, utilizes a progression of procedures to assess an organization's needs and develops tools to assist its employees to increase their productivity. Woodley (2005) defines HPT as, "a systematic and systemic approach to improving productivity and competence by analyzing current and desired workplace performance and implementing interventions to close the gaps between these performance states" (p. 2). She further states that it is holistic and navigates systems examining the improvement of performance at the job, performer, process or the organizational level. HPT is an assessable means of problem solving or fulfilling the opportunities that are linked to performance and enhancement of human capital. The performance is driven by results and is focused on those achievements that are given value by performers on an individual basis and by the organization as a unit. It also stresses the need to analyze in order to determine the cause of the deficiencies in performance (2005). According to Moseley et al (2001), human performance technology "is the science and art of improving people, process, and performance" (p. 2). Pershing (2006) defines human performance technology as, "an application of moral principles used to improve efficiency in the workplace by implementing effective interventions that are all-inclusive and systemic" (p.6). The International Society for Performance Improvement (2010), explains it

as a mélange of three components: cause analysis, performance analysis and interventions that could be used to improve the output of a company.

Pershing (2006) states that, “Human performance technology is the study and ethical practice of improving productivity in organizations by designing and developing effective interventions that are results-oriented, comprehensive, and systemic.” (p. 6) However Pershing cautions against attempting to define the fields of HPT and HPI. First, definitions tend to change over time. A term used thirty years ago may not be relevant today. Second, it is difficult to reach consensus among those who contributed to the definition of HPT/HPI (Pershing, 2005).

Table 3 demonstrates the variability in definitions:

Table 3 *Definitions of Human Performance Technology*

<i>Author(s)</i>	<i>Definition</i>	<i>Key Terms</i>
Gilbert (1978, p. 18)	Human competence is a function of worthy performance (W), which is a function of the ratio of valuable accomplishments (A) to costly behavior (B).	<ul style="list-style-type: none"> • Accomplishment • Behavior • Competence
Ainsworth (1979, p. 5)	A cornerstone of performance technology is outcome signification—discovering valid, useful performance objectives and stating them in terms that are easily understood.	<ul style="list-style-type: none"> • Objective • Outcome signification
Stolovitch (1982, p. 16)	A field of endeavor that seeks to bring about changes to a system in such a way that the system is improved in terms of the achievements it values.	<ul style="list-style-type: none"> • Achievements • Change • System
Harless (In Geis, 1986, p. 1)	Human performance technology is the process of selection, analysis design, development, implementation, and evaluation of programs to most cost-effectively influence human behavior and accomplishment.	<ul style="list-style-type: none"> • Accomplishment • Behavior • Cost effective • Process
NSPI, via Coscarelli (1988, p. 8)	A set of methods and processes for solving problems—or realizing opportunities—related to the performance of people. It may be applied to individuals, small groups or large organizations.	<ul style="list-style-type: none"> • Processes • Realizing opportunities • Solving problems
Langdon (1991, p. 2)	Systematic application of identifying that a need exists to establish, maintain, extinguish, or improve performance in an individual or organization; defining the need; identifying, implementing, and networking appropriate interventions; and validating that the results are true improvements.	<ul style="list-style-type: none"> • Establish • Extinguish • Improve • Maintain • Systematic

Table 4 *Definitions of Human Performance Technology*

<i>Author(s)</i>	<i>Definition</i>	<i>Key Terms</i>
Stolovitch and Keeps (1992, p. 4; 1999, p. 5)	The application of what is known about human and organizational behavior to enhance accomplishments, economically and effectively, in ways that are valued within the work setting. Thus HPT is a field of endeavor that seeks to bring about changes to a system, in such a way that the system is improved in terms of the achievement it values.	<ul style="list-style-type: none"> • Accomplishments • Change to a system • Human and organizational behavior
Rothwell (1996, p. 29)	Human Performance Enhancement (HPE) is the field focused on systematically and holistically improving present and future work results achieved by people in organizational settings.	<ul style="list-style-type: none"> • Holistically • Present and future work • Systematically
O'Driscoll (1999, p. 97)	Systems thinking applied to human resource activities. (1) Systemic, (2) systematic, (3) grounded in scientifically derived theories and the best empirical evidence available, (4) open to all means, methods, and media, and (5) focused on achievement that human performers and the system value.	<ul style="list-style-type: none"> • Achievement • Derived theories • Grounded in science • Systems thinking • System value
Van Tiem, Moseley, and Dessinger (2004, p. 2)	The systematic process of linking business goals and strategies with the workforce responsible for achieving goals. Moreover, performance technology practitioners study and design processes that bring about increased performance in the workplace using a common methodology to understand, inspire, and improve. And finally, performance technology systematically analyzes performance problems and their underlying causes and describes exemplary performance.	<ul style="list-style-type: none"> • Achieving goals • Analyzes • Common methodology • Design processes • Study • Success indicators • Systematic process

Source: James Pershing (2006) Handbook of HPT with permission.

Stolovitch and Keeps (2007) noted that, “The term human performance technology sounds somewhat dry and mechanistic. Hence, human performance improvement (HPI) has begun to appear in professional publications as a more acceptable euphemism” (para. 3). HPI and HPT are used as one and the same terms throughout the human performance improvement and human performance technology processes.

It is evident that HPT or HPI methods are applied by organizations as a system or model aimed at increasing performance. Stolovitch and Keeps (1999) state that HPT is a field whose evolution is primarily a corollary of the reflection, experience and conceptualization of those practitioners that are endeavoring to enhance performance in workplaces. LaBonte (2001) expounds on this understanding by stating that HPI/HPT includes needs assessments, is a means of improving systems, includes engineering approaches that are scientific and designed to improve results, and is a part of a business’ efforts for reengineering.

The History and Evolution of Human Performance Technology (HPT) Models

B. F Skinner (1953) is credited as the behavioral science’s founder and the father of behaviorism. He coined the term, “operant behavior,” which is an organism’s response to consequences. Skinner (2001) states that, “behavior is best influenced by rewarding acts that most closely approach the desired behavior” (p. 6). Skinner’s principles are apparent in the workplace. Employees are rewarded for exceeding the expectations of their employers. For example, when an airline pilot exhibits behavior consistent towards achieving the requirement necessary for the successful completion of his/her training, the reward is a license to fly or a promotion.

Day (1997) says that “Many performance improvement pioneers got their start by attempting to improve training and were heavily influenced by Skinner” (p. 22). Human

performance improvement pioneers grounded their models in concepts of behaviorism and their foundation of knowledge originated from behavioral psychology (Dean & Ripley, 1997).

Several scholarly and professional pioneers laid the foundation for HPT in the United States in the '50s and 60s (Pershing, 2006). In 1960, Robert F. Mager published the first edition of his book titled "*Preparing Instructional Objectives*", that connected learning objectives with measurable performance benchmarks which changed the way trainers and educators viewed training and learning (Torch, 2009). According to Eckart (2004), HPT could also be perceived as, "An organism modifying its behavior in response to the comparison between its own behavioral output and its experience" (para 4).

Thomas Gilbert, a student of B.F. Skinner, was also among the early pioneers interested in ways to understand and subsequently alter human behavior. Stolovitch (2007) recognized Thomas F. Gilbert as performance technology's true innovator, due to his workplace performance related research conducted in the 60s and 70s. In his book, "*Human Competence: Engineering Worthy Performance*", Thomas Gilbert developed the "Behavior Engineering Model" in 1978. Gilbert applied his knowledge of the process to the technological improvement of people (Bailey, 2007).

Sanders and Ruggles (2000) observe that, "Contributors to the field of HPI/HPT such as Thomas Gilbert, Joe Harless, Geary Rummler, and Robert Mager (1997) are well established as the founders"(p. 27; see Table 4). The original characteristics and foundation of HPT were an offshoot of views by these early practitioners and theorists. During the 70s and 80s, Mager and Gilbert collaborated on systematic approaches to instructional design and human performance improvement (Pershing, 2006). Mager published a "Six-Pack" of guidebooks that became an accepted course on performance improvement and instructional design. However, Gilbert was

known as the source of the original theory on engineering human performance that incorporated innovative ideas for developing people.

Chevalier (2007) provides a theoretical framework of human performance technology. He stated, “HPT uses a wide range of interventions that are drawn from many other disciplines including, behavioral psychology, instructional systems design, organizational development and human resources management” (p. 1). Chevalier’s point of view stresses the use of a systemic approach, which unambiguously illuminates relationships between multiple causes and prioritized interventions. This became the foundation that HPT is built upon and promotes the idea that performance is indubitably enhanced when an appropriate system is maintained with the desired effect.

Collectively, contributions to the HPT field synthesized knowledge and theories that are utilized to add to and/or enhance the productivity and performance of the organization.

Table 5 An Overview of Contributors with their Accomplishments

Contributor	Focus of Work	Accomplishment to HPI/HPT
Thomas F. Gilbert	Behavioral Engineering	Identified six variables—three work environment and three individual—that are required to improve performance (Gilbert 1996)
Joe Harless	Front-End Analysis/Instructional Systems Design	Performance interventions require front-end analysis of the performers system. Data builds four types of interventions—: environment, selection, motivation, and knowledge (Harless, 1994)
Robert Mager	Instructional Objectives	Learning objectives are written as statements of measurable, expected performance, with conditions specified in order to improve performance (Mager and Pipe, 1997)
Geary Rummler	Three Levels of Performance Improvement	Established need for analyzing/aligning three levels of performance—process, organization, and job readiness—to create and sustain exemplary performance (Rummler and Brache, 1995)

Source: James Pershing (2006) Handbook of HPT with permission.

The HPI/HPT models lay the fundamental requisite framework for the creation of contextualized techniques for improvement of human performance. Wash (2009) emphasized that it is commonly believed that firms are constituted of complicated processes hinged on productivity, people and a lot of profit. Endorsing the practices of HPT/HPI might be an appropriate alternative approach to those that address issues of performance. “While his (Gilbert) accomplishment-based approach to performance improvement is not always fully understood or practiced by those in the field of human performance technology (HPT), it towers over his other strategic and tactical contributions to our field. Many of his other contributions were useful models or templates for performance analysis or design, tools that served subsidiary roles in relation to his overall accomplishment-based approach” (Chevalier, 2007 p.8). Dormant (1999) noted that, “Human Performance Technology (HPT) professionals implement wide varieties of interventions. Almost constantly, they try to get others to accept new and better ways of working” (p. 237).

Evolution of Models

According to Wile (2010), as human performance technology evolved over the years, models were created by other participants. These models represent a progression of development in the field. Each model builds on the preceding one. There are more than five accepted HPT models. These practitioners are considered as prominent leaders in the field:

- Thomas F Gilbert
- Joe Hartless
- Dean Spitzer
- Robert F. Mager
- Allison Rossett

Gilbert Model. In 1978, Thomas Gilbert offered a performance matrix, which was one of the first HPT models. He suggested that the manager responsible for performance is, “using the behavior engineering model to analyze alternative ways to achieve accomplishments more efficiently by looking at: (1) environmental methods, (2) people programs, and (3) management actions” (p. 35).

In Gilbert’s model, the category of *environment* refers to all factors of performance that are not related to the performer or the actions a manager can take (1978). The organization of a work group, rules of work, and work space with the right temperature, lighting, and noise levels are all a part of the environment. *People programs* refers to the workers’ skills, the knowledge they have, and the attitude they bring to the job. *Management* refers to the actions a manager can take, including providing feedback, information, and incentives (1978). Gilbert’s model will be described in more detail in a later section.

Harless Model. In 1987, Joe Harless, as part of his front-end analysis workshop, Accomplishment Based Curriculum Development (ABCD), offered a performance model that asked participants to think of the ABCD process as belonging to the larger field of performance technology:

- ABCD (“training”),
- Personnel selection,
- Environmental engineering, and
- Motivation-incentives.

In the Harless model, a new factor is introduced: personnel selection. This speaks to the earlier point that sometimes a person is not suited for a job. Here, Harless acknowledges that selecting the right person for the job is an important factor in human performance (Wile, 2010).

Spitzer Model. In 1990, Dean Spitzer wrote, “It has been found that there are seven major factors that underline human performance” (p.15). These factors are:

- Capacity,
- Expectations,
- Skills and Knowledge,
- Incentives,
- Task and job design,
- Resources and Tools, and
- Feedback.

Spitzer (1990) elaborates on previous models and takes Harless’s concept of selection of personnel to be more about capacity. He added the idea of job design, which acknowledges that for performers to be successful, they need a job that is engineered to address what tasks need to be performed, when they need to be performed, and by whom. Spitzer thought feedback was also important. To be successful, workers need feedback on how their current performance is meeting standards. Finally, the Spitzer model considers *tools and resources*, which are only alluded to in earlier models.

Mager Model. In 1992, Robert Mager offered a checklist entitled, “Why People Don’t Do What They’re Expected to Do.” This checklist was a tool to help explain to managers the reasons their employees might not be performing as desired. It included the following explanations:

- They do not know understand how to perform the task;
- They do not comprehend desired expectations;
- They do not possess the required authority;

- They do not get the information on time regarding how well they are performing (i.e. lack of feedback);
- Their sources of information are designed poorly, are not accessible, or simply do not exist;
- They do not have job aids to cue correct performance;
- Their workstations provide obstacles to desired performance;
- The organizational structure makes performing difficult;
- They are punished or ignored for doing things right;
- They are rewarded for doing things wrong; and
- Nobody ever notices whether they perform correctly or not.

Mager (1992) adds some factors that were overlooked in previous models. Workers need authority to perform. An employee can have the skills and tools for a job, but must be empowered to make decisions and take actions.

Mager (1992) also emphasizes the importance of feedback. Managers need to recognize good performance, measure it against a standard, and communicate those findings to the employee, team or organization. Documentation and job aids are also important elements of Mager's model. Documentation refers to codifying important information and job aids are specific methodologies and tools within HPT.

Rossett Model. (1992), Allison Rossett proposed a model of “causes of performance problems” (p. 22) She includes the following items as types of causes:

- Dearth of knowledge or skill,
- Wrong incentives,
- Wrong environment, and

- Absence of motivation.

Rossett (1992) defines skills or knowledge and motivation as factors inherent in the performer, and incentives and environment as outside influences. She refines Gilbert's (1978) model by breaking the category of management into incentives and motivation.

Principles of Human Performance Technology

According to Woodley (2005), HPT has been described as being the systemic as well as systematic detection and removal of barriers to the firm's and the individual's performance.

Woodley (2005) offers several key principles or features that include:

1. Outcome focused.
2. Takes the view of systems.
3. Augments value.
4. Establishes partnerships.
5. Systematic in the opportunity or needs assessment.
6. Systematic in the workplace and work assessment for the identification of the cause that limits the performances.
7. Systematic in the specification or solution's design of the requirements.
8. Systematic in the solution and its elements' development.
9. Systematic in the solution's implementation.
10. Systematic in the process and results evaluation. (p.4)

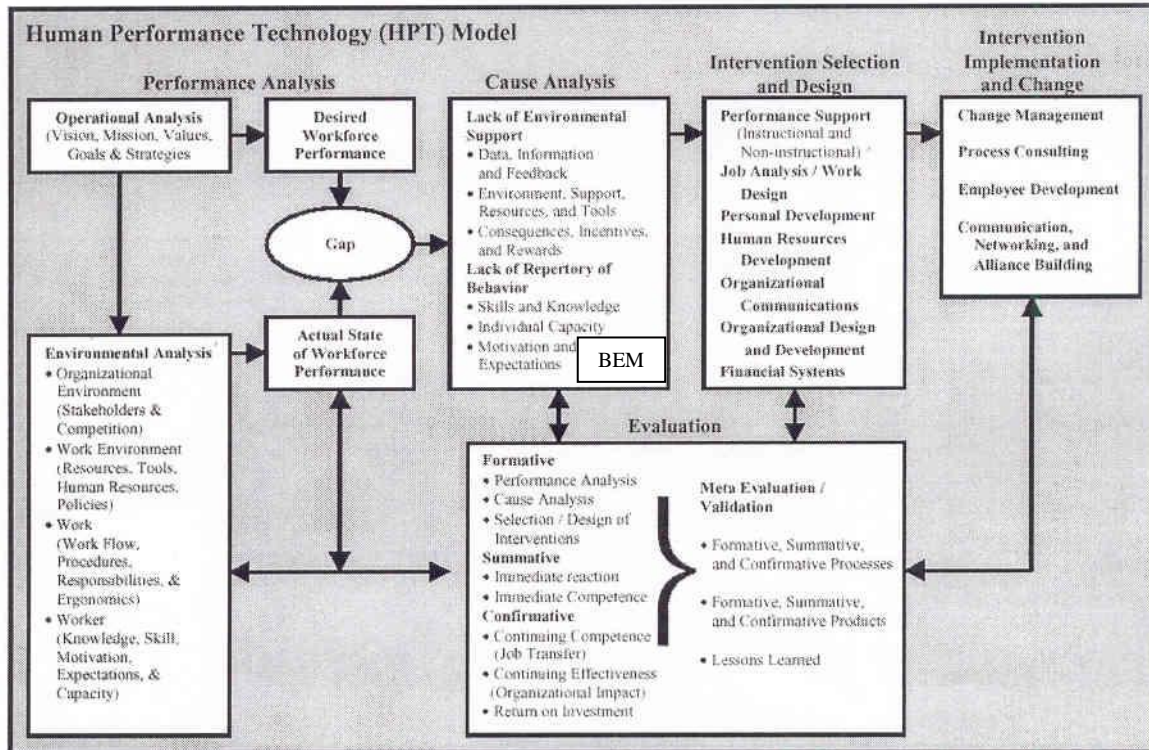


Figure 5. Copyright 2004. The International Society for Performance Improvement HPT model is from page 3 of Fundamentals of Performance Technology, Second Edition with permission.

Sanders (2002) states, “HPI is systematic because it consistently follows a process for articulating business goals, diagnosing problems, recommending and implementing solutions and evaluating interventions” (p. 45). Rosenberg (1999) observes that the HPT/HPI approach showcases that the, “systems approach is the foundation on which rests what is loosely termed the general process model of HPT” (p. 137). As illustrated in Figure 5, both HPT and HPI models use a systematic approach in order to enhance performance. The HPI model’s techniques and procedures are clearly connected to a design for improving human performance.

Stages in Human Performance Technology Models

Stage One of the performance technology model begins with the Performance Analysis which addresses the expectations and goals of the organization. As shown in Figure 6, the results of the analysis are an illustration of the gap between the existing and the desired. Boyd (2002)

says that, “the identification and definition of the performance gap is a critical step in helping an organization address human performance improvement” (p.43). Monitoring of the actual and desired performance is denoted as *gap analysis*, which is a process that involves diagnosing issues that are related to performance problems (Rossett, 1999).

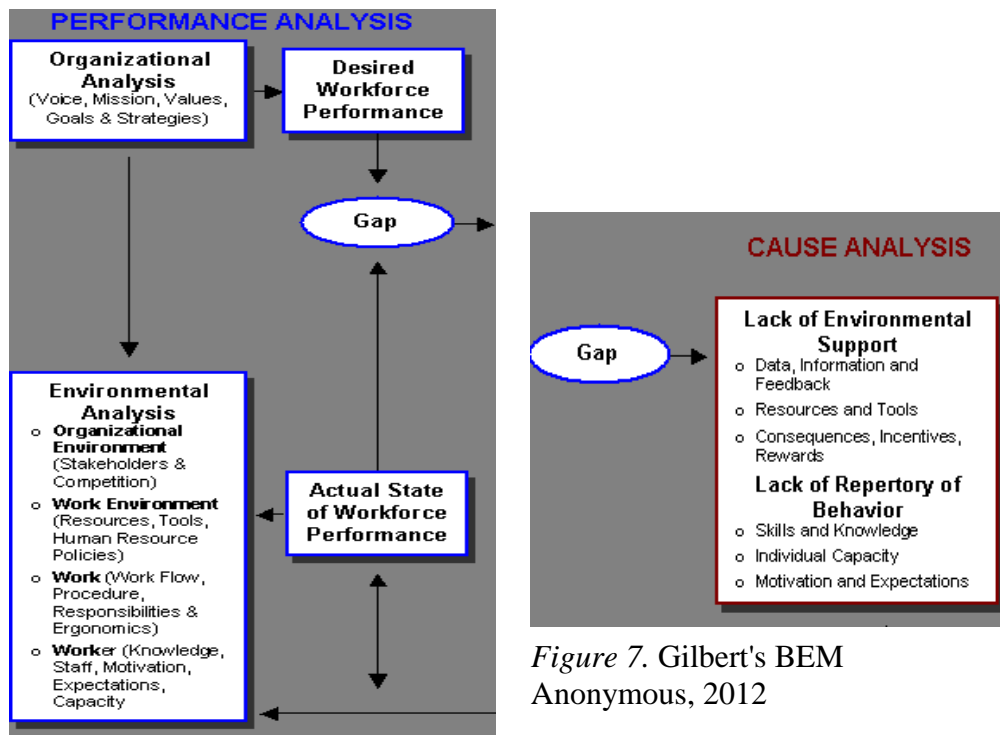


Figure 6. Performance Analysis
Anonymous, 2012

Figure 7. Gilbert's BEM
Anonymous, 2012

Stage Two, as represented in Figure 7, scrutinizes the organization and the individual to unearth what caused the gap in the first place. A thorough Cause Analysis helps identify the root cause of performance gap. The performance gap represents the disparity between what is and what should be. The gap and how it was caused has to be evaluated in a proper manner in order for progress to be made. Doggett (2005) says, “In order to solve a problem one must identify the cause of the problem and take steps to eliminate the cause. Locating and eradicating a problem’s

root causes is vitally important” (p.34) “Stated in its simplest terms, the question you want to answer in your cause analysis is: Why does the performance gap exist?” (Piskurich, 2002, p. 56).



Figure 9. Intervention Selection Anonymous, 20012

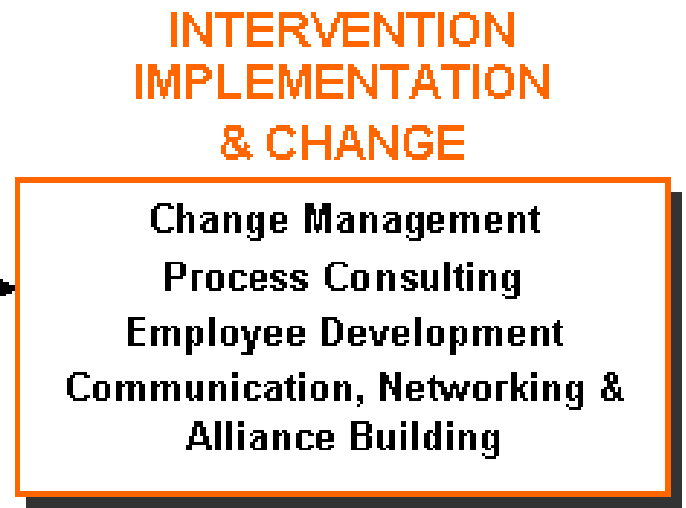


Figure 8. Intervention Implementation Anonymous, 2012

After determining why the gap exists, appropriate interventions must be developed and implemented (see Figures 8 and 9). *MSN Encarta Premium's* (2007) definition of intervention is, “the act of intervening, especially a deliberate entry into a situation or dispute in order to influence events or prevent undesirable consequences.” (sec. 1). The HTP model translates the environmental and individual factors into broad categories that can be used to create focused and specific interventions to narrow the performance gap. Depending upon the situation, it may be necessary or even advantageous to select more than one intervention. Van Tiem, Dessinger and Moseley (2001) stated, “The number of possible interventions is almost infinite, because any number of organizational, environmental, and people factors affect performance” (p. 3).

Interventions should be monitored at the beginning of implementation and throughout the process of improvement to assess their impact. Van Tiem et al (2001) say that, “implementing and changing requires the actual doing and putting into motion selected interventions...which sometimes requires implementation to be extensive and require major process changes.” (p. 20).

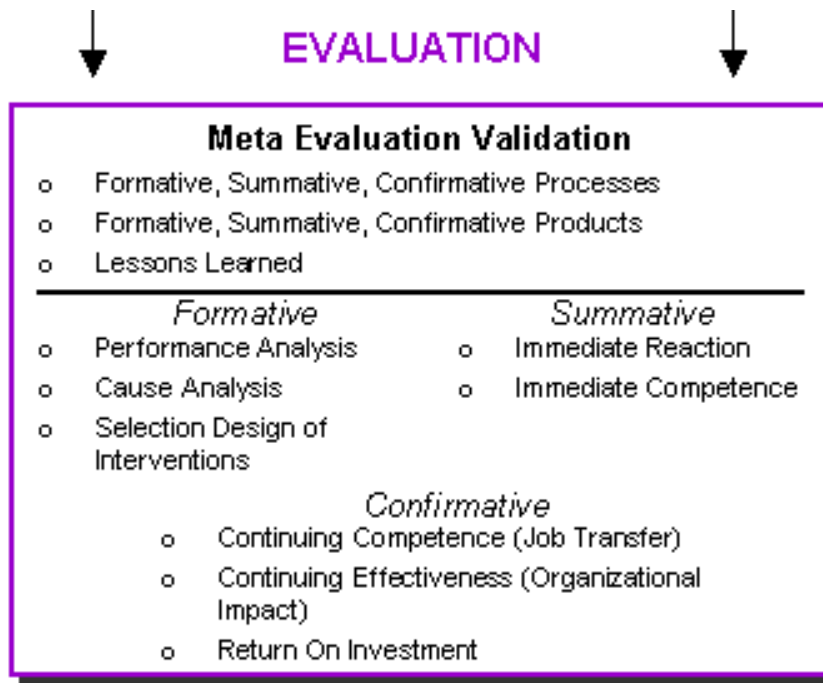


Figure 10. Formative and Summative Evaluation. Anonymous, 2012

Figure10 showcases the HPT model in which evaluation is both a summative and formative approach in a systematic process. Summative and formative evaluation is differentiated by Shrock and Geis (1999) by saying that they “differ in purpose and often in technique. Formative evaluation seeks data while the intervention is still under development and can be revised. Summative evaluation is conducted to determine whether the intervention is worthy of adoption or continuance” (p. 191).

A Case for Human Performance Technology Models In The Schools

The acquisition of technology has become a significant expense for school districts across the nation. According to a report published by the Executive Office of the President, Council of Economic Advisers in 2011, \$625 billion dollars were spent in the United States for technology in schools. This price tag represents almost half of the U.S. Department of Education's annual budget of \$1.3 trillion dollars. Technology expenditures for K-12 education have nearly tripled in the last decade (Executive Office of the President, Council of Economic Advisers, 2011).

Riel and Becker (2008) compared the soaring costs of technology to purchasing an automobile with a price that has increased by 300%. Considering the cost of maintaining such a vehicle, wisdom and care should be used before placing the keys into the hands of another. The responsibility of not just introducing technology but also maintaining it in a proper manner is in itself far too great. Therefore, in today's atmosphere of increased accountability, the question remains, how can teachers ensure that technology is successfully, efficiently and effectively incorporated into the classroom?

In recent years, education has experienced an influx of new cutting-edge technologies such as virtual learning, transient technologies and the latest data systems. Mobile technologies like smart phones, laptops, tablets, PDAs and other handheld devices provide access to the Internet (Vail, 2005). Social networking has also emerged as a tool for engaging students in learning. It is now being used in such a prolific manner that there is very little in any person's life that isn't touched by social media. Although there are teachers that are implementing some form of social media related instruction, it isn't significant enough to count (McLeod, 2011).

“Every societal and economic sector that revolves around information is being radically transformed by digital technologies, online services, and social media. Very few areas of

American life remain untouched by these paradigmatic shifts. We know, simply from projecting current trends forward, that in the future our society will be even more digital, more mobile, and more multimedia than it is now. We're not going to retrench or go backward on any of these paths." (McLeod, 2011 p. 292). Additionally, there can be no separation or divorce of the school from technology any longer because of the changing nature of the students at hand. Johnson (2004) states that, "schools need to learn to use these technologies to enhance educational experiences, not ignore or ban them. The current generation of students is not willing to leave their virtual lives at the school door" (p.18).

Creighton (2003) observed that, "even the best of schools have barely tapped the potential of technology to radically impact teaching and learning" (p. 2). Some technology leaders believe that if technology is used appropriately in schools, it will create quality instruction in the classroom.

Barriers to Technology Integration

The studies conducted by Jacobsen (1998) and Beaudin (2002) discovered that a lack of time was a factor that impedes the integration of technology in the classroom. They also cited that teachers had limited access to computers labs for their classes due to scheduling conflicts as two of the main barriers. Zhao, Pugh, Sheldon, and Byers (2002) support their findings of inadequate access to technology. They found that most schools have computer labs, yet teachers still find it difficult to access because they have to contend with other teachers for time. While technology has been a priority for school systems; if teachers do not have sufficient access technology integration is pointless. Tsai and Sing (2012) stated "Schools that centralise their ICT facilities in computer laboratories may well learn that teachers are still not using them because of the clash in timetabling and tedious booking procedures" (p.1058).

Teachers that often feel overwhelmed by technology are not motivated to integrate technology. They hesitate to include technology in their lesson plans; particularly, if they lack the proper training (Hew & Brush, 2007). According to Yildirim and Yildirim (2009) teachers also fail to integrate technology in the classroom due to of a lack of interest because of their limited knowledge. The number of courses taught by teachers and time constraints are additional contributing factors as to why they are reluctant to use technology.

Hew and Brush (2007) conducted a study which cited the lack of time as a barrier that schools across the United States and in other countries are confronted with when attempting to integrate technology in the classroom. Integrating technology into a curriculum can be truly time-consuming, especially when it must be aligned with curriculum, standards and other goals. Educators must spend hours previewing websites, gaining familiarity with hardware and software, and acquainting themselves with various programs. Teachers who are willing to work longer hours to do this often pay a personal price in 'burn out' and an eventual exit from the school (Hew & Brush, 2006).

Although teachers are at the forefront of the process for integrating technology in the classrooms, the role of school leadership can not be underestimated. Gilbert (1978) said that the ultimate cause of low employee performance in the workplace is always a deficiency in the management system. For years, the title of Principal has been synonymous with Building Manager or Supervisor (Duncan, 2010). However, today the role of school administrators has drastically changed from the traditional job of a school manager to the job of an instructional leader. Today's principals are asked to be champions of innovation and change similar to Steve Jobs, Apple's late CEO. They are expected to manage million dollar budgets, build a sense of team among the stakeholders in the organization, and master the media (Duncan, 2010). The

evolution of the principal's position also requires understanding and directing the integration of technology (Duncan, 2010). "For public education to benefit from the rapidly evolving development of information and communication technology, leaders at every level – school, district and state – must not only supervise, but provide informed, creative and ultimately transformative leadership for systemic change" (Toward a New Golden Age, 2004, p. 15).

Knezek (2008), said that "Integrating technology throughout a school system is, in itself, significant systemic reform. We have a wealth of evidence attesting to the importance of leadership in implementing and sustaining systemic reform in schools. It is critical, therefore, that we attend seriously to leadership for technology in schools" (p. 4).

HPT in Schools

Human Performance Technology (HPT) is a rapidly emerging field combining multiple disciplines such as, design of instructional systems, development and change of organizations, psychology, communications, psychology, systems theory, and many other fields (Van Tiem, 2006). Business and military organizations have benefited from using Human Performance Technology Models to increase productivity. Foshay (1999) found that the HPT model is not exclusive to the private sector or government entities but rather public school systems are making use of the model as well.

Lin and Lu (2010) used an HPT model to identify barriers to technology integration. They explored the relationships among the cognitive motivators (which include self-efficacy and task values) of the teachers and their commitment to technology integration. The study investigated primary school teacher's integration of technology in instruction through the cognitive motivators approach as well as HPT. Their study was based in Taipei, one of the cities in Taiwan considered to be leading in integrating information technology education. They used

questionnaires delivered through the internet and airmail to collect data. The study found out that the use of technology in such a 'high-tech' school was relatively low. In addition, teachers' task-values and self-efficacy impact their efforts and commitment to integrating technology in their instruction. The age of teacher was also a factor in technology integration. In essence their aim was not to investigate the suitability of a HTP model in identifying barriers but identifying the barriers. They also did not have a particular HPT model. This study seeks to examine the appropriateness of a specific HTP model (Gilbert's Behavioral Engineering Model). Therefore, it will not only identify barriers, but it will also determine whether this model is appropriate in identifying barriers in the public school setting.

Hancock-Niemic et al (2004) described the use of a Human Performance Technology model in a suburban high school district to investigate the development of online high school courses. The teachers in this high school were to develop, design and teach the new online courses. The HPT model identified the factors that might prevent teachers from meeting the challenges of effectively designing and developing instructional content. Although they used HTP models. This study's primary aim was to identify the barriers of technology integration in curriculum development in high schools.

Moore (2004) synthesized findings from two studies that used HPT models in the schools. One of the studies, Orey and Hardy (2000) conducted a performance analysis of teacher tasks while the other, Moore and Orey (2001) investigated the process of performance technology implementation. The study developed teacher tools and used four teachers to investigate their usage, attitudes and performance. The barriers were identified through a case study.

The few studies cited above have illustrated that HTP models can and have been used to investigate barriers to technology integration in a public school setting. However, the appropriateness of the different models has not been investigated.

Although each of the HPT models listed above include some tangential references to human behavior; specifically as it relates to training, they fail to provide a comprehensive analysis of the relationship between human behavior and performance. The literature stresses the importance of the role leadership in public schools. In Gilbert's (1978) BEM, the principal within a school is the equivalent of a manager or management. While there are some things that are beyond the scope of the principal's responsibility or control, Gilbert's (1978) model places the environmental supports under the control of the school leadership. It provides the principal with the information to have a positive influence on the behavior and performance of the faculty within the school. Gilbert's (1978) model emphasizes the importance of valuable accomplishments that start on the job through behavior and in turn, ensures the provision of the proverbial *missing link* through a group or individual's behavior with regards to the organization's goals (Woodley, 2005).

Gilbert's Behavioral Engineering Model

Gilbert (1978) defined behavior as the direct actions of people or other animals. He believed that behavior could be measured. Gilbert's theorems outline the process of measuring behavior:

First Leisurely Theorem: Human competence is a function of worthy performance (W), which is measured by the ratio of valuable accomplishments (A) to costly behavior (B). That is, $W = A/B$ (Gilbert, 1978).

Second Leisurely Theorem: Typical competence is inversely proportional to the performance improvement potential (PIP). The PIP is the ratio of exemplary performance to typical performance. The ratio must be stated for an identifiable accomplishment -- there is no general quality of "competence" (Gilbert, 1978).

Third Leisurely Theorem: For any accomplishment, a deficiency in performance always has an immediate cause in a deficiency in the performer's behavior repertory (P), or a deficiency in the environment supporting the repertory (E), or both. The ultimate cause is always a deficiency in the management system (M). That is, $W = A/B = A/(P + E + M)$ (Adams, 2013).

Table 6 *Gilbert's Updated BEM*

	information	instrumentation	motivation
environmental supports	data	tools	incentive
personal repertory of behavior	knowledge	capacity	motive

Source: T.F. Gilbert, 1978, p. 45 with permission.

For example: Ray and Richard both own their car dealerships with different results from their efforts. Here a measurement of their current actual performance:

- Ray's monthly profits from car sales is \$2,000 but he invests \$1000 in it.
- Richard's monthly profits from car sales is \$6000 but he invests \$500 in it.
- Ray's $W = 2000/1000$ or $W=2$
- Richard's $W = 6000/500$ or $W=12$

Richard's profits are 12 times his investment and Ray's profit increases on 2 times his investment. In simple terms: First, determine the worth of typical performance. Second, determine the worth of exemplary performance. Third, calculate the PIP or “gap” between typical performance and exemplary performance.

Gilbert's BEM

Gilbert's (1978) Behavior Engineering Model offers six factors for improving individual and group performance (see Table 6). These six factors, also known as “The Six Boxes,” assist in isolating the performance gap between actual and optimal performance.

One of the factors that separates Thomas Gilbert's (1978) model from others is his realization that training is only one part of the performance equation. Gilbert pondered from the beginning whether training alone would be a suitable intervention to improve individual and organizational performance (Pershing, 2006).

When Thomas Gilbert published his *Behavior Engineering Model* (1978), it initiated an advancement of research-based methods among consultants and researchers. Their focus was expanded from the design of effective instruction to a broader and more comprehensive viewpoint including additional variables. This version of the model helped outline many elements associated with the subject at hand (see Table 6).

Table 7 Updated Behavior Engineering Model

TABLE 4 UPDATED BEHAVIOR ENGINEERING			
Environment	Information <ol style="list-style-type: none"> 1. Roles and performance expectations are clearly defined; employees are given relevant and frequent feedback about the adequacy of performance. 2. Clear and relevant guides are used to describe the work process. 3. The performance management system guides employee performance and development. 	Resources <ol style="list-style-type: none"> 1. Materials, tools, and time needed to do the job are present. 2. Processes and procedures are clearly defined and enhance individual performance if followed. 3. Overall physical and psychological work environment contributes to improved performance; work conditions are safe, clean, organized, and conducive to performance. 	Incentives <ol style="list-style-type: none"> 1. Financial and nonfinancial incentives are present; measurement and reward systems reinforce positive performance. 2. Jobs are enriched to allow for fulfillment of employee needs. 3. Overall work environment is positive, where employees believe they have an opportunity to succeed; career development opportunities are present.
Individual	Knowledge/skills <ol style="list-style-type: none"> 1. Employees have the necessary knowledge, experience, and skills to do the desired behaviors. 2. Employees with the necessary knowledge, experience, and skills are properly placed to use and share what they know. 3. Employees are cross-trained to understand each other's roles. 	Capacity <ol style="list-style-type: none"> 1. Employees have the capacity to learn and do what is needed to perform successfully. 2. Employees are recruited and selected to match the realities of the work situation. 3. Employees are free of emotional limitations that would interfere with their performance. 	Motives <ol style="list-style-type: none"> 1. Motives of employees are aligned with the work and the work environment. 2. Employees desire to perform the required jobs. 3. Employees are recruited and selected to match the realities of the work situation.

Source: Chevalier, R. (2008). The Evolution of a Performance Analysis Job Aid. Performance Improvement, 47(10) with permission.

Without question, Gilbert's emphasis on behavior output in lieu of behavior itself is regarded as being his most pivotal contribution (Binder, 2007). Gilbert believed that the most leverage for the improvement of performance lies in the environmental supports that are solely the management's responsibility. The management is also responsible for the recruitment, training, and termination of the personnel if need be.

Knowing that management is the ultimate cause for performance deficits, what is the intermediate problem? Does it lie within the environment? Or does it lie within the person's behavior repertory? As stated earlier, Gilbert's third Leisurely Theorem seeks to establish an orderly way of asking questions to identify the immediate problem. Gilbert's (1978) BEM looks for a way to identify which behaviors can be manipulated at a cost less than the received value of the accomplishment (see Table 7).

Table 6 highlights where feedback and guidance are powerful leverage points for the improvement of performance. If both guidance and feedback are not optimized then the

intervention in other realms would not result in the best possible performance. As a result, most of training programs fail.

BEM's characteristics are:

1. Used as a tool to improve performances.
2. Used for the identification of the reasons behind both incompetence and competence
3. Used to figure out the areas in which the management's performance was unsatisfactory (Woodley, 2005).

Chevalier's Update BEM

In 2002, Chevalier updated Gilbert's (1978) Behavior Engineering Model (Figure 4 on p. 9) to provide a detailed explanation of each factor in the updated model. As in Gilbert's original model, the factors that influence performance are divided into two categories: individual behavior (people) and work environment (support). Chevalier (2002) states, "A cause analysis is done to determine what impact the work environment (incentives, information, and resources) and the people (individual capacity, motives and, skills) are having on performance." (para.1). It is important to note that correcting environmental factors is typically more cost effective and requires less effort than attempting to correct individual behaviors (ISPI, 2010).

Each of these six factors-incentives, information, resources, capacity, motives and skills-act as driving or restraining forces as it relates to the performance gap. According to Chevalier (2002), the driving forces are factors that work to narrow the gap between current performance level and the targeted performance level. The factors are cited and calculated on the basis of their strength on a scale that ranges between +1 and +4. Restraining forces represent factors that do not work to narrow the disparity between the current performance level and targeted performance level and are noted on a scale between -1 and -4 (see Table 8). The Cause Analysis

Worksheet (see Table 8) formulated by Kurt Lewin, provides a means of identifying and weighing the comparative strength of those factors that take part in the present performance level (Human Resources, 1947, pp. 5-41).

Table 8 *Cause Analysis Worksheet*

<u>Factors</u>	<u>Driving Forces</u>				<u>Restraining Forces</u>				
	+4	+3	+2	+1	0	-1	-2	-3	-4
<u>Information</u>									
clear expectations
relevant feedback
relevant guides
performance mgmt system
<u>Resources</u>									
materials/tools
time
clear processes/procedures
safe/organized environment
<u>Incentives</u>									
financial
other incentives
enriched jobs
positive work environment
<u>Motives</u>									
motives aligned with work
employees desire to perform
expectations are realistic
recruit/select the right people
<u>Capacity</u>									
capacity to learn
capacity to do what is needed
recruit/select right people
emotional limitations
<u>Knowledge/Skills</u>									
necessary knowledge
necessary skills
proper placement
cross trained

Chevalier (2007) provides the following guidelines for BEM usage:

- Identify opportunities for performance improvement.
- Know that management is responsible for the poor performances.
- Systematically monitor situations using the six factors of the BEM table.

- Maintain the components' sequence while searching for performance barrier causes.
- If a particular area is seen to possess a barrier en route to targeted performance, determine if a cost effective intervention exists to solve the obstacle of performance.
- Know that correction in a particular area would more often than not have cascading impacts on another zone.
- Know that problems of performance are quite frequently solved by the adjustment of the components of Environmental support. It is not really necessary or cost effective to alter the components of "Capacity" and "Motives".
- The knowledge components should be the final components analyzed within the sequence since the problem of performance can typically be resolved efficiently courtesy of addressing problems that are present in other component areas (see Table 6).

Chapter 3: METHODOLOGY

The focus of this study is to determine whether Gilbert's (1978) Behavioral Engineering Model is an appropriate method to identify barriers to technology integration in an educational setting, particularly a public school. This chapter details the research design and methodology for the study. The research questions that will guide this study are:

1. Can Gilbert's Behavioral Engineering model be used in a public school to identify barriers to technology integration?
2. Is Gilbert's Behavioral Engineering model appropriate for identifying barriers in public education?

Research Design

This study used developmental research methods. Seels and Richey (1994) defined developmental research as "the systematic study of designing, developing and evaluating instructional programs, processes and products that must meet the criteria of internal consistency and effectiveness". Richey and Klein (2007) linked developmental research to the field of instructional design and technology in their definition: "the systematic study of design, development and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and non-instructional products."

Richey, Klein, and Nelson (2004) refer to the two classifications of developmental research as Type 1 and Type 2. Type I research methods are geared to identify either general development principles or situation-specific recommendations. Conversely, Type 2 studies tend to emphasize the design, development, evaluation model or process (Seels & Richey, 1994). These studies may have a model construction phase, a model implementation phase, and a model validation phase (Richey & Klien, 2007)

This study used Type I research procedures because of its focus on model improvement and the conditions that facilitated its success. Ellis and Levy (2008) stated that “approaches that had previously been proven effective in addressing one type of problem in a given context are effective in addressing an essentially different but in some aspects similar problem or context” (p. 30). Type 1 studies are not confined to product design and development only; it includes evaluation as well. In addition, Type 1 research can validate a particular design or development technique or tool.

Design and development research offers two benefits for this study. First, design and development research and the field of Instructional Technology both utilize a combination of theory and practice. These elements are evident in developmental research which focuses on the creation of knowledge based on empirical research. It requires a problem where the product-development phase is reviewed and outlined, and the final product is tested (Richey, 1994). Peffers et al. (2007) stated that the identification of a problem is the initial part of design and development research. Ellis and Levy (2008) makes a distinction between product development and the nature of developmental research. A product can be developed for use; yet, it may not be based in literature. In general, developmental research, entails: “addressing an acknowledged problem, building upon existing literature, and making an original contribution to the body of knowledge.”

A second feature of design and development research is its ability to examine developmental procedures or rate a product as a whole or its individual components (Richey, 1994). According to Ellis and Levy (2008), design and development research's ultimate goal is to create artifacts or interventions that can reinforce the relationship between theory and practice. These artifacts can include the development of a new tool, product, or process (Richey & Klein,

2007).

The artifacts of design research can also include some less obvious outcomes, such as development of:

- new theories explaining the underlying cause of the problem;
- new design and development models such as the Spiral Model of the systems development life cycle (SDLC);
- new methods and processes for implementing existing models or using existing tools; And
- previously untested application of tools, models, or methods to a problem in a new context (Hevner et al., 2004, p. 109).

This research study involved the validation of the use of a HPT model, specifically Gilbert's (1978) BEM model in a new context, a public school setting (Richey & Klein, 2007). Richey and Klein (2007) stated that one way of validating an ID model is by evaluating its usability by designers and developers. In order to answer the research questions, this study consisted of two phases; the usability documentation and expert review.

Phase One –Model Usability

In order to validate the usability of Gilbert's (1978) Behavior Engineering Model in a public school setting, a Cause Analysis (2013) online survey was administered to the faculty of a local high school. The survey was based on Gilbert's (1978) BEM as described below under the "instruments section." The survey was used to determine why a performance gap exists in technology integration in the school. This procedure is consistent with the internal model validation methods used by Ouinons, Ford, Sego, and Smith (1995) who used a survey as an instrument to validate their human performance model (as cited in Richey & Klein, 2007).

Gilbert's (1978) BEM was based on six factors. Three of these factors, (expectations, resources, and incentives) address the influence of environmental factors on employee

performance. For example, the technology standards from the state represent the expectation for each school division and its teachers. Their also represents the performance analysis aspect of Gilbert's BEM. The next three factors (motives, capacity, and knowledge and skills) address the influence of individual factors on employee performance (Bailey, 2007).

Gilbert's BEM was implemented in the form of an online survey. The survey included questions from each of the six factors to determine why a gap exists in the area of technology integration .

Instrument

The research design for this study included the use of an Internet survey to ascertain whether or not Gilbert's Behavioral Engineering Model is an appropriate instrument for identifying barriers to technological integration in an educational setting, particularly a public school.

Observational and survey methods are often used to gather data (Borg & Gall, 1989). McMillan (2008) maintains that web-based surveys are commonplace in descriptive studies. The Cause Analysis survey consists of Likert scale questions based on Chevalier's (2007) probe model (Appendix D), which is an extension of Gilbert's Behavior Engineering Model. Although Gilbert provided a set of questions that addressed expectations, resources, incentives, motives, capacity, and knowledge /skills in his model, according to Bailey (2007) "Paul Hersey and Chevalier updated these questions to support Chevalier's updated BEM Model" (p. 8). Chevalier's probe model was adapted for the school setting (see Table 8). For each of the six factors, participants were asked to rate them using a 4-point scale. Each response was assigned a point value. For question 1, Extremely Well =1, Very Well = 2, Rarely =3 and Not at all =4. For question 20, Always = 4, Sometimes = 3, Rarely = 2 and Not at all = 1. For questions 2

through 24, Always=1, Sometimes = 2, Rarely = 3 and Not at all=4. The scale allowed the researcher to average the scores for each respondent. It also allowed for statements that represent different aspects of the same attitude (Brace, 2004).

Tavakol and Dennick (2011) stated that validity and reliability are two basic elements in the evaluation of a measurement instrument. McMillan (2008) provides a contemporary definition of validity. Validity exists to the extent to which inferences are appropriate and meaningful. “It is a judgment of appropriateness of a measure for the specific inferences or decisions that result from the scores generated by the measure” (McMillan, 2008, p.144).

Before administering the Cause Analysis survey, a group of seven external reviewers met to determine the content validity of the survey. The questionnaire was piloted with one principal, two technology specialists, and four teachers. Dillman (1978) provided a series of questions that were asked about each item included in the survey. Each member of the group were asked to use the questions provided in Appendix D to assure content validity. Members of the group were provided copies of the instrument and asked:

1. Are the directions concise? If no, please explain.
2. Are the directions clear? If no, please explain.
3. Are the directions complete? If no, please explain.
4. Does the survey contain language that can be understood by the participants? Is the reading level appropriate?
5. Does the survey address specific and appropriate issues?
6. Are any statements obtrusive or offensive?
7. Are there any statements that you would exclude from the survey?
8. Are there other statements that you would add to the survey?

9. Should the participants understand the response choices?
10. How long, in minutes, did it take you to complete the survey?
11. Do you have other comments?

The external group of reviewers returned the questions and suggested that some of the survey questions be reworded for clarity. The researcher reviewed the pilot questionnaires to ascertain the validity of the Cause Analysis survey. The results were used to make final revisions before the Cause Analysis survey was administered to the participants in the study.

The Cronbach Alpha was used to determine the reliability of the Cause Analysis survey. Reliability is concerned with the ability of an instrument to measure consistently. "It is expressed as a number between 0 and 1. Internal consistency describes the extent to which all the items in a test measure the same concept or construct and hence it is connected to the inter-relatedness of the items within the test" (Tavakol & Dennick, 2011 p. 7). The Cronbach Alpha score was .94 with a mean score of 12.8 and a standard deviation of 6.7. In addition, the standard error of measurement was 1.5. According to Tavakol and Dennick (2011) the closer the Cronbach Alpha score is to 1 the greater the reliability of the test.

Procedures

Dillman (2000) describes the Tailored Designed Method for generating a high response rate from a web-based survey. This method includes sending an initial contact letter which provides the link to complete the survey, a thank you/reminder postcard, and data analysis. The survey was sent electronically to the teachers and administrators in a database at the high school. The local school district provided the database of email addresses.

A cover letter (Appendix B) was sent via email to the 80 teachers and four administrators through Survey Monkey informing the participants about the survey. The surveys were sent

electronically to the teachers and administrators in the database at the high school. The letter included the link and code to the website hosting the Cause Analysis survey and the directions necessary to complete it. A second cover letter was sent through the standard school email system to ensure delivery to participants who experience firewall issues.

After the initial letter was sent, a thank you/reminder card (Appendix C) was e-mailed for non-respondents and to recognize the participants who completed the survey. The return rate of the surveys were monitored by accessing the hosting website. The website provided real time results of surveys completed that were downloaded to an Excel spreadsheet and integrated into SPSS. Respondents' surveys were linked to their access code.

The teachers and principals were given 45 days to complete the survey. A thank you/reminder card (Appendix C) was e-mailed to the participants every two weeks until the time allotted was completed.

Setting

Since 2001, the State of Virginia has invested over approximately \$347,600,000 in technology for schools. The Commonwealth initially assumed that all schools functioned at the same level of technology integration. Upon a closer analysis of the schools, they discovered that schools varied in size, economic resources, and instructional philosophies; it became evident that all schools are not equal (Virginia Register, 1998).

In an effort to support technology in the schools, [22.1-16](#) of the Code of Virginia states: School divisions shall incorporate the technology standards into their local technology plans and develop strategies to implement the standards.

A. Instructional personnel shall be able to demonstrate effective use of a computer system and utilize computer software.

B. Instructional personnel shall be able to apply knowledge of terms associated with educational

computing and technology.

- C. Instructional personnel shall be able to apply computer productivity tools for professional use.
- D. Instructional personnel shall be able to use electronic technologies to access and exchange information.
- E. Instructional personnel shall be able to identify, locate, evaluate, and use appropriate instructional hardware and software to support Virginia's Standards of Learning and other instructional objectives.
- F. Instructional personnel shall be able to use educational technologies for data collection, information management, problem solving, decision making, communication, and presentation within the curriculum.
- G. Instructional personnel shall be able to plan and implement lessons and strategies that integrate technology to meet the diverse needs of learners in a variety of educational settings.
- H. Instructional personnel shall demonstrate knowledge of ethical and legal issues relating to the use of technology.

The subjects of this study are the faculty of a local high school in the Commonwealth of Virginia. The high school employs 80 teachers and four principals with an enrollment of 1,159 students.

Data Analysis

This quantitative part of the study used descriptive statistics to analyze the data. The mean, standard deviation, frequencies, and percentages were used to measure the opinions among principals and teachers regarding the integration of technology. After the data was analyzed the findings were summarized and used to recommend possible interventions that will effectively address issues revealed in the data.

Phase Two – Expert Review

The second phase was an evaluation of the implementation of the model by expert reviewers in HPT and technology integration to determine if the model is appropriate for use in public schools. According to Richey and Klein (2007) “many expert review studies collect data

directly from persons serving as subject-matter experts”. Fisher and Sylvia (2002) define an expert reviewer as “someone with extraordinary insight into the population and/or subject under study above and beyond what a member of the population under study or participant in the phenomenon being investigated might have.”

Two expert reviewers were selected for this study. Criteria for selection was that the reviewer must have a minimum of 10 years of related field experience that may include work on an administrative level, or possess a post graduate degree in a program that included extensive research and study in HTP models. The expert reviewers were provided with a description of Gilbert’s model, a description of how the model was implemented, the findings, and resulting recommendations. A questionnaire (Appendix F) consisting of 10 questions related to the use of Gilbert’s model in this study was sent to the expert reviewers. A cover letter (Appendix E) was sent via email to the expert reviewers through Survey Monkey informing them about the questionnaire. In addition, the letter included the link and code to the website hosting the questionnaire and the directions necessary to complete it.

They were given two weeks to analyze the information and complete the questionnaire. A thank you/reminder card (Appendix C) was e-mailed to the reviewers each week. A follow-up phone interview (Appendix G) was conducted to clarify questionnaire responses.

In the Interview, detailed notes were taken by the researcher during the phone interviews with the expert reviewers. Each expert reviewer was asked four predetermined questions to clarify the answers and comments they provided on the Expert Reviewer survey (see Table 18 on p. 59-61).

Chapter 4: RESULTS

The focus of this study was to determine whether Gilbert's (1978) Behavioral Engineering Model is an appropriate method to identify barriers to technological integration in an educational setting, particularly a public school. The purpose of this chapter is to provide the results of the study and to answer the research questions.

1. Can Gilbert's Behavioral Engineering model be used in a public school to identify barriers to technology integration?
2. Is Gilbert's Behavioral Engineering model appropriate for identifying barriers in public education?

Phase I Model Usability

In phase I, a Cause Analysis survey was administered to teachers and administrators in a public school setting.

Population and Sample

The population of this study included eighty teachers and four administrators. There were 80 teachers and 4 principals that participated in the study, 76 returned the Cause Analysis Survey indicating 90% of the sample population. The large return of surveys resulted in a 95% confidence level with a 3.9% margin of error or a 99% confidence level with a 5% margin of error. The high school employs 80 teachers and four principals with an enrollment of 1,159 students. The faculty has an average of 15 years of teaching experience; in addition to this, 45 percent of the faculty holds a masters or doctorate degree.

Results

The Cause Analysis Survey used a Likert scale to collect data to identify barriers to technology integration based on Gilbert's model. For each of the six factors, participants were asked to rate them using a 4-point scale. Each response was assigned a point value. For question 1, Extremely Well =1, Very Well = 2, Rarely =3 and Not at all =4. For question 20 numbers were reversed for data analysis, Always = 4, Sometimes = 3, Rarely = 2 and Not at all = 1. For questions 2 through 19 and 21 through 24, Always=1, Sometimes = 2, Rarely = 3 and Not at all=4. The scale allowed the researcher to average the scores for each respondent. It allowed for statements that represent different aspects of the same attitude (Brace, 2004).

The factors that influence the performance in Gilbert's (1978) Behavior Engineering Model are divided into two categories: environmental and individual. The two categories will be discussed separately below.

Environmental Factors

The environmental factors are information, resources and incentives. In the Cause Analysis Survey administered for this study, questions 1-4 and 20 are associated with factor 1-Information (see Table 9). Questions 5-8 are associated with factor 2-Resources (see Table 10). Questions 10-13 are associated with factor 3-Incentives (see Table 11)

Table 9 *Factor 1 Information*

Questions:
1. Have the school division/ state technology requirements for teachers been communicated to you?
2. Do you understand your role in using technology as an instructional tool?
3. Does the observation/ evaluation system assist your primary evaluator in describing expectations for the use of technology?
4. Do you receive relevant feedback about the use of technology in your classroom?
20. During your recruitment and subsequent hiring, were you informed that teachers are expected to integrate the use of technology into their instructional practices?

Table 10 *Factor 2 Resources*

Questions:
5. Do you have the materials, such as manuals, instructional aides, or other documents needed for technology use in the classroom?
6. Are the processes and procedures for the use of technology defined in such a way that it enhances your ability to teach?
7. Are you provided with access to the network, computers, and software necessary to implement technology in your classroom?
8. Do you receive sufficient time to become familiar with technologies used for administrative and instructional purposes?

Table 11 *Factor 3 Incentives*

Questions:
10. Are there sufficient financial incentives present to encourage the use of technology?
11. Are there sufficient non-financial incentives present to encourage the use of technology?
12. Do measurement and reporting systems track the use of technology?
13. Are there opportunities for career development related to technology?

The mean score was calculated for each factor. Based upon the number of responses, it was determined that a mean of 2.50 or greater indicated that more than 50% of respondents gave responses with point values of 3 or 4. These values represent less than favorable responses and are therefore indicative of a potential barrier to the integration of technology.

The mean score for responses to the questions for factor 1 Information is 2.24. The mean score for responses to the questions for factor 2 Resources is 1.95. The mean score for responses to the questions for factor 3 Incentive is 2.68. See Figure 11. Therefore, of the 3 environmental factors, the survey indicates that incentives may be a barrier to the integration of technology.

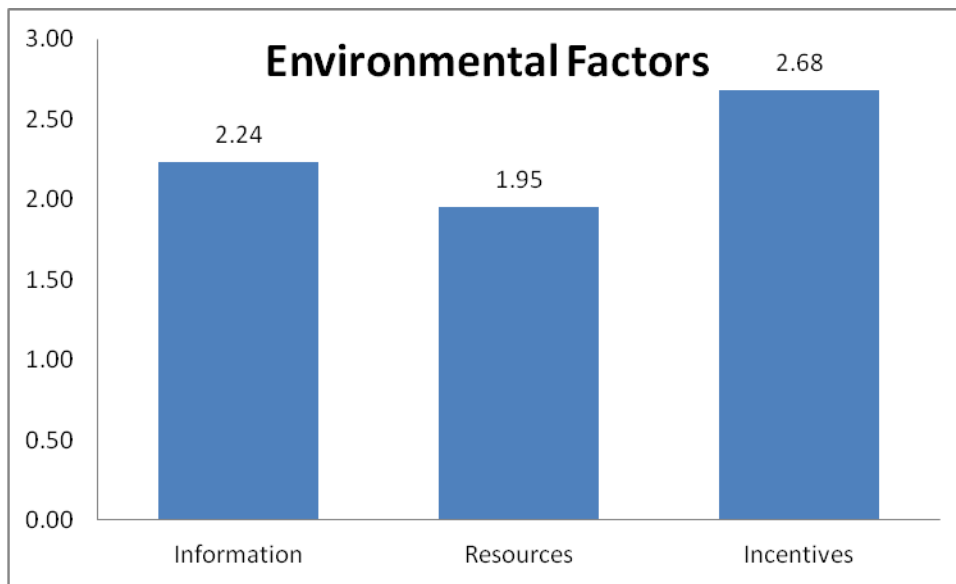


Figure 11. Environmental Factors

Individual Factors

The individual factors that influence the work environment in Gilbert's Behavior Engineering Model are knowledge, capacity and motives. In the Cause Analysis Survey administered for this study, questions 22-24 are associated with factor 4- Knowledge (see Table 12). Questions 17-19 and 21 are associated with factor 5-Capacity (See Table 13). Questions 14-16 and 9 are associated with factor 6- Motives. (see Table14).

Table 12 *Factor 4 Knowledge*

Questions:
22. Do you believe that your ability to effectively integrate technology in the instructional process will positively impact student achievement ?
23. Do you have the necessary knowledge to successfully integrate technology in the classroom?
24. Are you involved in a systematic training program to enhance your knowledge and skills of technology?

Table 13 *Factor 5 Capacity*

Questions:
17. Do you have a desire to integrate technology in your classroom?
18. Do you experience anxiety or stress related to the use of technology?
19. Do you think you can learn what is expected to successfully integrate technology in your classroom?
21. Do you have any physical disabilities or limitations that impede your ability to integrate technology in the classroom?

Table 14 *Factor 6 Motives*

Questions:
9. Is the work environment safe, clean, organized, and conducive for the use of technology?
14. Do you view your work environment as positive one to use technology?
15. Are there any rewards that reinforce the minimal use of technology?
16. Are there any negative consequences for frequent use of technology in the classroom?

The mean score was calculated for each factor. Based upon the number of responses, it was determined that a mean of 2.50 or greater indicated that more than 50% of respondents gave responses with point values of 3 or 4. These values represent less than favorable responses and are therefore indicative of a potential barrier to the integration of technology.

For factor 4, Knowledge, the mean score is 1.92. For factor 5, Capacity, the mean score is 1.71. For factor 6, Motives, the mean score is 1.76. (See Figure 12) Therefore, we can conclude that no individual factors are barriers to technology integration.

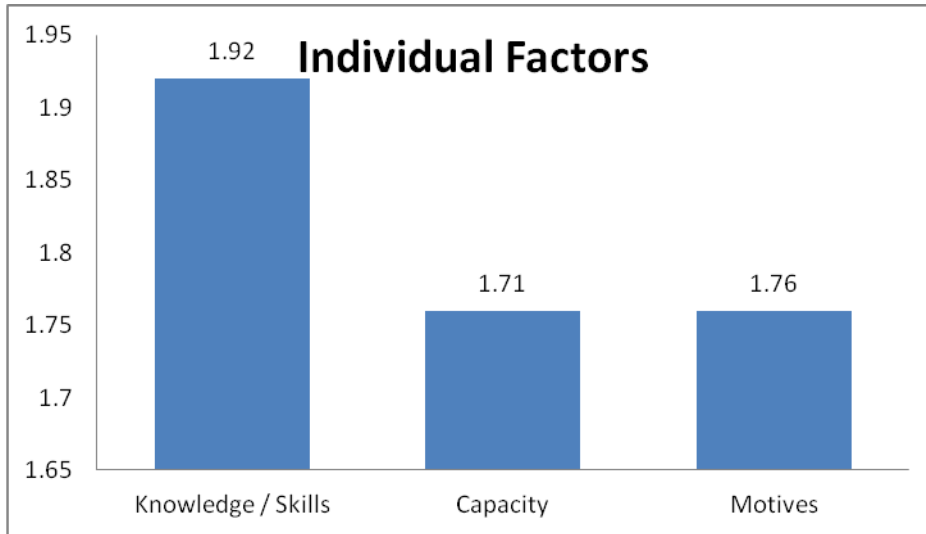


Figure 12. Individual Factors

Post Hoc Analysis

The survey indicated that incentives may be a barrier to technology integration. When looking closer at the responses (see Table 15), the survey found that three “incentives” may be barriers to the integration of technology. The data indicated that participants believed there was a lack of financial and non-financial incentives and that the management and reporting system did not adequately track the use of technology. The career development question had a mean score below 2.50 so it did not appear to be a barrier to technology integration. Although it is possible that the respondents may have interpreted the question to mean technology training rather than career advancement, we cannot determine this from the survey data.

Table 15 *Incentives Mean Scores*

Questions	Mean
Are there sufficient financial incentives present to encourage the use of technology?	3.28
Are there sufficient non-financial incentives present to encourage the use of technology?	2.84

Do measurement and reporting systems track the use of technology?	2.72
Are there opportunities for career development related to technology?	2.37

Recommendations

The purpose of administering the Cause Analysis survey, according to Gilbert's (1978) model, is to develop a set of recommendations based on the findings. Based upon the results of this study and the most significant barrier identified by the implementation of Gilbert's (1978) Behavior Engineering Model, the following recommendations seem appropriate:

1. School leadership should create financial incentives to motivate teachers to efficiently integrate technology in the school.
2. School leadership should create non-financial incentives to motivate teachers to efficiently integrate technology in the school.
3. School leadership should improve the measurement reporting system to track the time teachers use to create technology integrated instruction.

Phase II Expert Review

Phase II asked expert reviewers to validate the use of Gilbert's (1978) Behavior Engineering Model in a public school setting. Both reviewers agreed to evaluate the process used to implement the model. The experts were provided with an abridged version of the review of literature, a copy of the online Cause Analysis survey, the results of the survey, and the researcher's recommendations to guide the evaluation process.

The review process contained two steps. First, the reviewers completed an online Expert Reviewer survey. Next, a follow-up phone interview was used to clarify or expand upon the expert reviewers' responses. This section includes an analysis of the data as well as the experts' recommendations for improving the implementation of the model.

Participants

The individuals selected to serve as expert reviewers for this study were chosen based upon their years of experience in working with technology. Both reviewers are highly regarded in their respective fields and bring with them a wealth of knowledge and unique perspectives to the evaluation of the implementation of Gilbert's Model.

Expert 1 is an Associate Professor for the School of Education at Piedmont College. He holds a PhD in Instructional Technology from Virginia Tech. Expert 1 served as Director for the Center for Leadership and Professional Development for Radford University and has held several human resource and training positions in corporate settings. He is a proponent of using distance learning as an avenue for teaching leadership and uses animated simulations to reinforce learning.

Expert 2 is the Director of Information Technology for Lynchburg City Schools. He has over twenty years of experience in the field of information technology. Expert 2 supervises the administrative and instructional technology for the school district. He reports directly to the assistant superintendent. Expert 2 has an executive team that includes two network administrators, a coordinator of data processing, three technology technicians, a clerk and eight instructional technology data analysis resource teachers (IT DART).

Results of Online Survey

The Expert Reviewer Survey contained 10 "Yes – No" questions and allowed space to provide additional comments. The experts provided identical responses to questions 1-7 and 10 (see Table 16). Each thought that Gilbert's BEM identified barriers in technology and that the information contained in the model was useful. Neither expert could identify any additional benefits from the use of Gilbert's model or see how it would be appropriate to close the performance gap. The experts did not agree on questions 8 and 9. Expert 1 thought Gilbert's model was easy to use and that it did determine why the gap exists. Expert 2 did not think the model was easy to use or that it determined why the gap exists (see Table 17).

While both experts were able to provide valuable information regarding the use of Gilbert's model, the lack of prior experience with the model may have limited Expert 2's ability to provide more comprehensive responses. Additionally, the use of predetermined questions during the expert review process limited the scope of their responses.

Table 16 *Expert Reviewers Agree*

Questions:	Answer
1. Did the recommendations from Gilbert's Behavioral Engineering model seem appropriate to close the performance gaps?	No
2. Did Gilbert's BEM accurately identify barriers in technology integration?	Yes
3. Did Gilbert's BEM provide other benefits?	No
4. Were there any limitations found from using Gilbert's BEM?	Yes
5. Did you find the information from Gilbert's BEM useful?	Yes
6. Were there barriers to implementing Gilbert's BEM?	Yes
7. Did Gilbert's BEM complete its intended purpose?	Yes
10. Is Gilbert's BEM appropriate for identifying barriers in public education?	Yes

Table 17 *Expert Reviewers Disagree*

Questions:	
8. Is it difficult to use Gilbert model?	Yes/No
9. Did Gilbert's BEM determine why the gap exists?	Yes/No

Phone Interview

During a telephone interview, each expert reviewer was given an opportunity to offer feedback and recommendations for improving the implementation process of Gilbert’s Behavior Engineering Model.

Table 18 *Expert Reviewer Telephone Interview*

Questions
1. Did the results from the Cause Analysis survey provide sufficient data to move the next phase? Why or Why not?
2. Was Gilbert’s Behavioral Engineering Model implemented correctly? Why or Why not?
3. Were the results from the Cause Analysis survey sufficient to determine why the gap exists? Why or Why not?
4. Were the results from the Cause Analysis survey sufficient to determine if Gilbert’s Behavioral Engineering Model is appropriate for public education? Why or Why not?

Both expert reviewers were called via a cell phone. The phone conversation with expert 1 lasted fifty minutes. The conversation with Expert 2 lasted thirty-five minutes. Notes were taken during both conversations and analyzed for common themes.

In addition, the phone interview provided both experts an opportunity to clarify question 1 in table 18. Expert 1, said “Yes, Gilbert’s did identify a performance gap”. Expert 2, said, “I do not know enough about the model”

Question 1: Both experts also noted that the Cause Analysis survey provided sufficient data to move to the next phase in the model.

during Cause Analysis phase of the Gilbert’s BEM.

Expert 1: Yes, there is enough data move to the next phase of the Human Performance Technology Model. The study has great potential. Consider collecting more teacher data to expand the process.

Expert 2: Yes, “surveys are good to a point. They can determine what the barriers are so that solutions can be found”.

Question 2: Both experts agreed that Gilbert's BME model was implemented correctly.

Expert 1: Yes, it was implemented correctly. Consider collecting more data from teachers to expand the process.

Expert 2: Yes, “I was very impressed with the model”.

Question 3: Both experts agreed that results from the Cause Analysis survey were sufficient to determine why the gap exists.

Expert 1: Yes, collect more data from teachers to expand the process.

Expert 2: Yes, it provided a good overview of what the main issues are.

Question 4: Both experts agreed that Gilbert’s BEM is appropriate to use in a public school.

Expert 1: Yes, it has been my experience that the model can be difficult to use if it is not expressed in K-12 language for teachers. Consider collecting more data from teachers to expand the process.

Expert 2: Yes, as I stated earlier, I am very interested in incorporating this model as we move forward with the one on one initiative.

Interview Summaries

According to Expert 1, the study produced enough data to move to the next phase of the Human Performance Technology Model. "I think you are on to something", he said. He believed the study has great potential and that the researcher should consider collecting more teacher data

to expand the process. "It has been my experience when using HPT model in the corporate world that the language of model can be confusing". Clients have a hard time understanding terms like, "instruments". It is extremely important that K-12 language in the school is used in the school environment. As questions are developed, give them to a focus group as many times as necessary to ensure the language is consistent for teachers in the school setting.

Expert 2 stated that the analysis resulted in enough information to move to the next phase. He noted, " I am very impressed with the model. It does identify barriers and provide enough data to develop instruments to resolve the problem". He thought this model gathered some very useful data in terms of identifying and defining the problem. "I am very interested in incorporating this model as we move forward with the One to One Initiative". However, he also commented that it will be important to modify the terminology to fit the targeted audience.

Themes

An analysis of the notes revealed common themes within the responses of both reviewers.

Challenges: Based on prior experience, the experts stated that one of the greatest challenges in using the model is making sure the language used is consistent with the environment. One expert reviewer stated, "The input from focus groups is way of refining your questions until they are consistent with the K-12 language used in a school setting".

Data: Both experts agreed that there was enough data collected to move to the next phase of the Human Performance Technology Model. The experts stated that in the future the researcher should consider collecting more for data from the teachers to expand the model. Experts 1 said, "I think you are on to something, this line of research has great potential".

Implementation of the model: The experts stated that Gilbert's BEM was implemented correctly. Expert 2, said "It provided a good overview of what the main issues are regarding

technology integration relative to teacher performance". Expert 1 supports the position of Expert 2. "It definitely identified a barrier to technology integration. It was implemented correctly".

Model appropriate for public schools: The experts agreed that Gilbert's model is appropriate to use in a public education setting. It identified a barrier in the integration of technology.

Additional Comments: The experts stated that the study is on to something and it has great potential. Expert 2: stated, "As I stated earlier, I am very interested in incorporating this model as we move forward with the One to One initiative".

Summary

Chapter IV presents the results of this study of Gilbert's Human Performance Technology Model that included teachers and administrators in a 9-12 high school. Teacher's and principal's perspectives regarding the integration of technology were examined based on twenty-four survey questions that were used to identify possible barriers to integrating technology. These questions were based on the six factors of Gilbert's Behavioral Engineering Model: information, resources, incentives, knowledge and skills, capacity, and motives. The questions were disseminated via an online survey posted on Survey Monkey and responses were confidential. The data was then downloaded into an Excel Spreadsheet to create a statistical analysis.

According to Gilbert (1978), for any given achievement, the performance gap can be found in the individual/ behavior repertory, or in the environment supports, or in both. But its direct cause can be found in a deficiency of the organizations system. Tables 5-6 and 8-10 indicated that over 50% of teachers and administers in this study had positive responses to two factors of environmental support and three factors of the individual. Responses to the questions related to information, resources, knowledge, capacity, and motives resulted in a mean scores of less than 2.5 indicating that at least 50% of the respondents believe these areas are adequately addressed within

the school. A mean score of 2.68 for questions related to incentives indicates that 50% or more of the respondents did not have a favorable response for this environmental support factor within Gilbert's model. Therefore, the results showed a lack of financial incentives, non-financial incentives and a tracking reporting system were the barriers to technology integration.

The expert reviewers said that Gilbert's model provides a tool to increase the administration's, principal's and teacher's understanding of the problems detected in the environment, as well as how aspects of individuals' behavior may influence their performance in the classroom or organization. The aim of this study was to determine if Gilbert's model was appropriate for identifying barriers to technology integration in a school setting. The feedback obtained from the follow-up phone interviews with the expert reviewers provided suggestions on ways to incorporate changes into the process of implementing Gilbert's model.

The expert reviewers validated the implementation process of Gilbert's BEM. They offered the following recommendations for improvement:

1. The model would be strengthened by collecting additional data from the teachers to expand the process.
2. Based on prior experience with Human Performance Technology models in a corporate setting, it is imperative that the language used in the model is consistent with setting in which it is implemented. If the participants are confused by the language in the model, the validity of the data could be an issue.
3. The creation of focus groups would be an excellent method to refined questions in order to ensure that they are appropriate for the environment.(In this study a group of teachers and administrators was created to review the survey questions and provide input for revising them for clarity and appropriateness prior to using the survey with others.)

It should be noted that human performance technology, “Gilbert’s model,” like design and developmental research, can be an ongoing process of implementation and evaluation. In order to accurately identify the barriers that are negatively impacting performance and develop the appropriate interventions, practitioners must be willing to fully implement the methods outlined in the HPT model. This process may require several revisions until the goal is achieved.

Chapter 5: DISCUSSION

The focus of this study was to determine whether Gilbert's Behavioral Engineering Model is an appropriate method to identify barriers to technological integration in an educational setting, particularly a public school. The design and developmental research method became the framework to investigate the use of Gilbert's BEM. Gilbert's six factors, which are referred to as "six boxes," are divided into two categories; environmental and individual. The environmental factors are information, resources, and incentives. The individual factors are knowledge, capacity, and motivation. "The model is a comprehensive categorization of these influences, based on over 60 years of basic behavior science, simplified into six easy-to-remember boxes. Chapter five summarizes this developmental research study and details how Gilbert's BME may benefit public school systems in identifying and addressing barriers to technology integration and the instructional design process.

Need and Finding

As technology continues to shape our global world, educational leaders are confronted with the daunting task of preparing students to navigate successfully in a technologically driven society (Reich, 2011). Technology has been a catalyst for advancing our society. It has revolutionized our industries as well as the medical field. Yet, school districts are seeing marginal gains at best related to technology's impact on learning. The learning gap between students in U.S. K-12 schools and those in other nations continues to widen (Jones & Chatterji, 2012). Balanaskat, Blamire, and Kefala (2006) stated that educators appear to recognize the value of technology as an instructional tool, yet teachers continue to encounter difficulties integrating technology in the learning process.

The use of instruments designed to identify gaps or issues that may have a negative impact on learning and developing solutions to address the deficiencies can be an effective method of improving technology integration in the classroom. Gilbert's (1978) Behavioral Engineering Model addresses performance in the workplace by focusing on the environmental aspects that influence productivity. Woodley (2005) stated that "HPT is a measurable way of solving problems or realizing opportunities related to work performance and human capital improvement. Human performance is results-driven and focuses on achievements that are valued by individual performers and the organization as a whole, but this approach also emphasizes the need for analysis to determine root causes and assess or evaluate" (p. 17).

Instructional design is an integral part of human performance technology, but it represents only one tool. When education or training is required to resolve a performance issue, instructional design and human performance technology follow a systemic and systematic process (ISPI, 2012). Both human performance technology and instructional design models are linked to learning and organizational performance. HPT and ID models employ some of the same principles. Developmental research methods offer a possible avenue to examine how instructional design principles can be used to create tasks or interventions to solve problems. (Richey & Klein, 2009). By implementing Gilbert's Behavior Engineering Model in a public high school to identify barriers to technology integration, this study incorporated human performance technology strategies to assess needs to move to the next level and develop interventions.

Developmental research leads to knowledge creation in the field of instructional design and provides for the validation of the process (Richey & Klein, 2009). The Cause Analysis is the first step in Gilbert's model. It consists of a series of questions aimed at discovering the actual

cause of a problem. A “Cause Analysis helps identify what, why, and how something happened. The main goal is to solve this problem so it doesn’t happen again” (Woodley, 2005 p. 15).

In this developmental research study, an online Cause Analysis Survey was administered to teachers and principals in a public school. The Cause Analysis indicated that participants believed there was a lack of financial and non-financial incentives for integrating technology and that the management and reporting system did not adequately track the use of technology.

Expert reviewers were asked to validate the implementation process of Gilbert’s (1978) model and offer recommendations. In order to validate the implementation process of Gilbert’s (1978) model, the expert reviewers were provided with an abridged literature review, a copy of the Cause Analysis survey, an analysis of the data, and the researcher’s recommendations. Both expert reviewers determined that the model was implemented correctly and there was sufficient data to move to the next step in the Human Performance Technology Model.

Both experts agreed that Gilbert’s model had great potential. The experts recommended obtaining additional data from the teachers and principals and expanding the process by refining the questions with the use of a focus group. Based upon prior experience with Human Performance Technology Models, the experts suggested that the model be communicated in K-12 language.

Contribution of Study

This study validated the appropriateness of Gilbert’s BEM model to identify barriers to technology use in an educational environment. The knowledge gained from this study has both theoretical and practical implications.

Theoretical Implications

Although the basic applications of Gilbert's BEM are primarily used for military and business organizations, the study demonstrated that it can be modified and effectively used within a public school setting. The Cause Analysis phase of Gilbert's model revealed that a possible performance gap existed. This phase is a critical part of the overall framework of the HPT model. Like a gap analysis, the Cause Analysis can aid in the development of the appropriate interventions to address problems found in the organization.

It was evident through the expert review process that Gilbert's BEM model is viable tool to detect technological barriers in schools. Gilbert's (1978) BEM was modified in order to accomplish this. The first modification of the model required the language to be expanded within each factor. Chevalier's Probe model (Appendix D), was used to revise the Cause Analysis survey. The questionnaire was piloted with one principal, two technology specialists, and four teachers. This group of seven external reviewers met to determine the internal consistency of the survey. They were given a set questions to evaluate the survey questionnaire. Based on feedback from the external reviewers, revisions were made to the Cause Analysis survey before administering it to the participants in the study. This step is consistent with the feedback provided by the expert reviewers in terms of keeping the language appropriate for the K-12 environment.

Practical Implications

The goal of developmental research is to bridge the gap that exists between theory and practice. As stated earlier, HPT and instructional design share many of the same principles and can enhance one another. Instructional designers use methods that are based on theoretical supports to solve real problems (Richey, et al., 2011). This developmental study implemented

Gilbert's model, based in theory, to address the "real" problem of identifying barriers to technology in public education.

Gilbert (1978) stated, "For any given accomplishment, a deficiency in performance always has as its immediate cause a deficiency in a behavior repertory (P), or in the environment that supports the repertory (E), or in both. But its immediate cause will be found in a deficiency of the management system (M)" (p.76). Gilbert believed that management or leadership was the ultimate cause for poor performance. This means the problem could rest in the environmental supports: Information, Resources, and Incentives.

As noted, Gilbert's (1978) BME places the environmental supports under the ability of management or leadership to influence positive behavior thus improving productivity. These findings were consistent with those of Kopcha (2012) conducted a two year case study that cited leadership as a barrier to technology integration.

Previous research also found that the following items listed were barriers to technology integration: time Beaudin (2002), leadership Kopcha, (2012), and resources (Tsai & Sing, 2012). Tsai and Sing (2012) stated that the way resources are organized within the school can be a factor in teachers not integrating technology

This study found that addition instruction and resources are not always the answer. Binder (2009) supports Gilbert's position "when training was introduced into environments in which other behavioral influences were lacking or in conflict, it was seldom cost-effective. [It became clear that] for performance to accelerate and maintain, it was necessary to manage a broader range of variables and conditions" (p. 7). This study demonstrated that one of benefits of implementing Gilbert's (1978) Behavior Engineering Model was its accuracy in identifying problems and solutions.

Conclusion

This study contributes to the body of literature by validating the effectiveness of HPT models, specifically Gilbert's, to identify barriers in education. Often, "approaches that had previously been proven effective in addressing one type of problem in a given context are effective in addressing an essentially different but in some aspects similar problem or context" (Ellis & Levy, 2008 p. 30). Gilbert's (1978) BEM was effectively applied in an education setting.

This study contributes to the literature that has illustrated that HTP models can be used to investigate barriers to technology integration in a public school setting. For example, Moore (2004) documented the results from two studies in which a HPT model was used in a school environment. One was a performance analysis of teacher tasks and the other explored the process of technology integration and implementation. The barriers were identified through a case study. This study used different HPT models to determine the barriers to technology implementation. As previously stated, this study took the extra step and used expert reviewers to validate the appropriateness of Gilbert's (1978) BME. The comprehensive focus of Gilbert's model, which included an evaluation of both environmental and human factors, makes it a viable option for use in public education.

This study also offers contributions to other fields that utilize instructional design principles as a platform for assessing needs within an organization. Morrison (2010) stated that design projects begin with a needs assessment to determine what problems exist and to provide solutions to those problems. While the literature clearly shows that other HPT models exist, they have evolved over the years. For example, Joe Harless (1987) front-end analysis model places an emphasis on personnel selection. Harless acknowledges that selecting the right person for the job

is an important factor in human performance (Wile, 2010). This study contributes to the evolution of HPT models by demonstrating how they can be modified to address performance problems in public school settings.

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Appendix A: Gilbert's Updated Probe Model

Probe Model

While Gilbert offered a collection of questions to assist us with defining the state of data, instruments, incentives, knowledge, capacity, and motives, Paul Hersey and Chevalier updated these questions to support Chevalier's Updated BEM model. They added open-ended questions to generate conversation instead of defensive responses, allow you an even better way to implement this tool within your work environment.

Information

- Have clear performance expectations been communicated to employees?
- Do employees understand the various aspects of their roles and the priorities for doing them?
- Are there clear and relevant performance aids to guide the employees?
- Are employees given sufficient, timely behaviorally specific feedback regarding their performance?
- Does the performance management system assist the supervisor in describing expectations for both activities and results for the employee?

Resources

- Do employees have the materials needed to do their jobs?
- Do employees have the equipment to do their jobs?
- Do employees have the time they need to do their jobs?
- Are the processes and procedures defined in such a way as to enhance employee performance?
- Is the work environment safe, clean, organized, and conducive to excellent performance?

Incentives

- Are there sufficient financial incentives present to encourage excellent performance?
- Are there sufficient non-financial incentives present to encourage excellent performance?
- Do measurement and reporting systems track appropriate activities and results?
- Are jobs enriched to allow for fulfillment of higher level needs?
- Are there opportunities for career development?

Motives

- Are the motives of the employees aligned with the incentives in the environment?
- Do employees desire to do the job to the best of their abilities?
- Are employees recruited and selected to match the realities of the work environment?
- Are there any rewards that reinforce poor performance or negative consequences for good performance?
- Do employees view the work environment as positive?

Capacity

- Do the employees have the necessary strength to do the job?
- Do the employees have the necessary dexterity to do the job?
- Do the employees have the ability to learn what is expected for them to be successful on the job?

- Are employees free from any emotional limitations that impede performance?
- Are employees recruited, selected, and matched to the realities of the work situation?

Knowledge and Skills

- Do the employees have the necessary knowledge to be successful at their jobs?
- Do the employees have the needed skills to be successful at their jobs?
- Do the employees have the needed experience to be successful at their jobs?
- Do employees have a systematic training program to enhance their knowledge and skills?
- Do employees understand how their roles impact organizational performance?

Appendix B: Cover Letter for Survey

April 23, 2012

Dear Colleague:

My name is Charles King and I am an assistant principal for Lynchburg City Schools and a doctoral student at Virginia Polytechnic Institute State University. I am conducting a research study and would greatly appreciate your participation.

I am attempting to evaluate whether or not Gilbert's Behavioral Engineering Model is an appropriate instrument for identifying barriers to technological integration in an educational setting; particularly a public school. You can assist me by giving twenty minutes of your time to complete an anonymous survey. Please answer the questions honestly. There will be no attempt to identify anyone who participated or chose not to participate in the study.

Your participation in the study is completely voluntary and you may withdraw at any time. The research findings will be based on the anonymous survey data and any information that could potentially identify the respondent will be kept confidential. The dissertation that results from this study will be published in hard copy and be housed at Virginia Polytechnic Institute State University Library.

The survey is available on-line at <http://> and must be completed by **June 1, 2013**. If you have any questions about the study, please contact Charles King by cell phone at (540) 525-5319 or via e-mail at kingcl@lcsedu.net.

Thank you in advance for your consideration and participation.

Sincerely,

Charles L. King, Jr.

Appendix C: Thank You/Reminder Postcard

DATE

Last week a link to a website hosting an Internet based survey seeking your response about the integration of technology in the classroom was e-mailed to you.

If you have already completed survey, please accept my sincere thanks. If not, please do so by DATE. I sincerely appreciate your help. When people like you share your experiences and opinions, we are better able to understand and identify instructional issues as well as provide viable solutions.

If you did not receive a survey, please contact me at 540 -525-5319 or by email at Kingcl@lcsedu.net and I will send another email with the website containing the survey.

Appendix D: Cause Analysis Survey

Cause Analysis Survey

Cause Analysis Survey

The purpose of this survey is to evaluate and examine whether or not Gilbert's Behavioral Engineering Model is an appropriate instrument for identifying barriers to technological integration in an educational setting, particularly a public school.

Cause Analysis Survey

Causal Analysis Survey

Part 1. Please select the answer that best represents your position regarding environmental factors such as information, resources, and incentives that influence technology integration in the classroom:

1. Have the school division/ state technology requirements for teachers been communicated to you?

Extremely well

Very well

Slightly well

Not at all

Comment

2. Do you understand your role in using technology as an instructional tool?

Clearly

Somewhat

Slightly

Not at all

Comment

3. Does the observation/ evaluation system assist your primary evaluator in describing expectations for the use of technology?

Always

Sometimes

Rarely

Not at all

Comment

4. Do you receive relevant feedback about the use of technology in your classroom?

Always

Sometimes

Rarely

Not at all

Comment

Cause Analysis Survey

5. Do you have the materials, such as manuals, instructional aids, or other documents needed for technology use in the classroom?

Always

Sometimes

Rarely

Not at all

Comment

6. Are the processes and procedures for the use of technology defined in such a way that it enhances your ability to teach?

Always

Sometimes

Rarely

Not at all

Comment

7. Are you provided with access to the network, computers, and software necessary to implement technology in your classroom?

Always

Sometimes

Rarely

Not at all

Comment

8. Do you have sufficient time to learn about technologies and use for administrative and instructional purposes?

Always

Sometimes

Rarely

Not at all

Comment

9. Is the work environment safe, clean, organized, and conducive for the use of technology?

Always

Sometimes

Rarely

Not at all

Comment

Cause Analysis Survey

10. Are there sufficient financial incentives present to encourage the use of technology?

Always

Sometimes

Rarely

Not at all

Comment

11. Are there sufficient non-financial incentives present to encourage the use of technology?

Always

Sometimes

Rarely

Not at all

Comment

12. Do measurement and reporting systems track the use of technology?

Always

Sometimes

Rarely

Not at all

Comment

13. Are there opportunities for career development related to technology?

Always

Sometimes

Rarely

Not at all

Comment (if necessary)

Cause Analysis Survey

Causal Analysis Survey

Part II. Please select the answer that best represents your position regarding individual factors such as motives, capacity, knowledge and skills that influence technology integration in the classroom:

14. Do you view your work environment as a positive one to use technology?

Always

Sometimes

Rarely

Not at all

Comment

15. Are there any rewards that reinforce the minimal use of technology?

Always

Sometimes

Rarely

Not at all

Comment

16. Are there any negative consequences for frequent use of technology in the classroom?

Always

Sometimes

Rarely

Not at all

Comment

17. Do you have a desire to integrate technology in your classroom?

Always

Sometimes

Rarely

Not at all

Comment

18. Do you experience anxiety or stress related to the use of technology?

Always

Sometimes

Rarely

Not at all

Comment

Cause Analysis Survey

19. Do you think you can learn what is expected to successfully integrate technology in your classroom?

Always

Sometimes

Rarely

Not at all

Comment

20. During your recruitment and subsequent hiring, were you informed that teachers are expected to integrate technology into their instructional practices?

Always

Sometimes

Rarely

Not at all

Comment

21. Do you have any physical disabilities or limitations that impede your ability to integrate technology in the classroom?

Always

Sometimes

Rarely

Not at all

Comment

22. Do you believe that your ability to effectively integrate technology in the instructional process will positively impact student achievement ?

Always

Sometimes

Rarely

Not at all

Comment

23. Do you have the necessary knowledge to successfully integrate technology in the classroom?

Always

Sometimes

Rarely

Not at all

Comment

Cause Analysis Survey

24. Do you have access to a training program to enhance your knowledge and skills of technology?

Always

Sometime

Rarely

Not at all

Comment

Appendix E: Expert Review Cover Letter

July 21, 2013

Dear Expert Reviewer:

I greatly appreciate your participation as an expert reviewer for my doctoral dissertation. I am attempting to evaluate whether or not Gilbert's Behavioral Engineering Model is an appropriate instrument for identifying barriers to technological integration in an educational setting; particularly a public school. You can assist me by completing an online questionnaire consisting of only 10 questions. Included in this email are several attachments to aid you in the evaluation process.

Your participation in the study is voluntary and you may withdraw at any time. The research findings will be based on the anonymous survey data and any information that could potentially identify the respondent will be kept confidential. The dissertation that results from this study will be published in hard copy and be housed at Virginia Polytechnic Institute State University Library.

The questionnaire is available on-line at <http://www.surveymonkey.com/s/LLN9732> and must be completed by August 5, 2013. If you have any questions about the study, please contact Charles King on his cell phone at (540) 525-5319 or via e-mail at kingcl@lcsedu.net.

Thank you in advance for your consideration and participation.

Sincerely,

Charles L. King, Jr.

Appendix F: Expert Review Questionnaire

Expert Reviewer Questionnaire

Please answer the following questions regarding the effectiveness of Gilbert's Behavioral Engineering Model.

Expert Reviewer Questionnaire

1. Did the recommendations from Gilbert's Behavioral Engineering model seem appropriate to close the performance gaps?

Yes

No

Comment

2. Did Gilbert's BEM accurately identify barriers in technology integration?

Yes

No

Comment

3. Did Gilbert's BEM provide other benefits?

Yes

No

Comment

4. Were there any limitations found from using Gilbert's BEM?

Yes

No

Comments

Expert Reviewer Questionnaire

5. Did you find the information from Gilbert's BEM useful?

Yes

No

Comments

6. Were there barriers to implementing Gilbert's BEM?

Yes

No

Comment

7. Did Gilbert's BEM complete its intended purpose?

Yes

No

Comment

8. Is it difficult to use Gilbert model?

Yes

No

Comment

9. Did Gilbert's BEM determine why the gap exists?

Yes

No

Comment

Expert Reviewer Questionnaire

10. Is Gilbert's BEM appropriate for indentifying barriers in public education?

Yes

No

Comment

Appendix G: Telephone Interview Questions

Expert Review Phone Interview Questions

1. Did the results from the Cause Analysis survey provide sufficient data to move the next phase? Why or Why not?
2. Was Gilbert's Behavioral Engineering Model implemented correctly?
Why or Why not?
3. Were the results from the Cause Analysis survey sufficient enough to determine why the gap exists? Why or Why not?
4. Were the results from the Cause Analysis survey sufficient enough to determine if Gilbert's Behavioral Engineering Model is appropriate for public education?
Why or Why not?

Appendix H: Chevalier's Probe Model and the Modified Questions

Chevalier's Probe Model and the Modified Questions

Probe Model Questions	Modified Questions	Factors
Have clear performance expectations been communicated to employees?	Have the school division/ state technology requirements for teachers been communicated to you?	Information
Do employees understand the various aspects of their roles and the priorities for doing them?	Do you understand your role in using technology as an instructional tool?	Information
Does the performance management system assist the supervisor in describing expectations for both activities and results for the employee?	Does the observation/ evaluation system assist your primary evaluator in describing expectations for the use of technology?	Information
Are employees given sufficient, timely behaviorally specific feedback regarding their performance?	Do you receive relevant feedback about the use of technology in your classroom?	Information
Are there clear and relevant performance aids to guide the employees?	Do you have the materials, such as manuals, instructional aides, or other documents needed for technology use in the classroom?	Resources
Are the processes and procedures defined in such a way as to enhance employee performance?	Are the processes and procedures for the use of technology defined in such a way that it enhances your ability to teach?	Resources
Do employees have the equipment to do their jobs?	Are you provided with access to the network, computers, and software necessary to implement technology in your classroom?	Resources
Do employees have the time they need to do their jobs?	Do you receive sufficient time to become familiar with technologies used for administrative and instructional purposes?	Resources
Is the work environment safe, clean, organized, and conducive to excellent performance?	Is the work environment safe, clean, organized, and conducive for the use of technology?	Motives

Are there sufficient financial incentives present to encourage excellent performance?	Are there sufficient financial incentives present to encourage the use of technology?	Incentives
Are there sufficient non-financial incentives present to encourage excellent performance?	Are there sufficient non-financial incentives present to encourage the use of technology?	Incentives
Do measurement and reporting systems track appropriate activities and results?	Do measurement and reporting systems track the use of technology?	Incentives
Are there opportunities for career development?	Are there opportunities for career development related to technology?	Incentives
Do employees view the work environment as positive?	Do you view your work environment as positive one to use technology?	Motives
Are there any rewards that reinforce poor performance or negative consequences for good performance?	Are there any rewards that reinforce the minimal use of technology?	Motives
Are there any rewards that reinforce poor performance or negative consequences for good performance?	Are there any negative consequences for frequent use of technology in the classroom?	Motives
Do employees desire to do the job to the best of their abilities?	Do you have a desire to integrate technology in your classroom?	Capacity
Are employees free from any emotional limitations that impede performance?	Do you experience anxiety or stress related to the use of technology?	Capacity
Do the employees have the ability to learn what is expected for them to be successful on the job?	Do you think you can learn what is expected to successfully integrate technology in your classroom?	Capacity
Are employees recruited, selected, and matched to the realities of the work situation?	During your recruitment and subsequent hiring, were you informed that teachers are expected to integrate technology into their instructional practices?	Information
Do the employees have the necessary dexterity to do the job?	Do you have any physical disabilities or limitations that impede your ability to	Capacity

	integrate technology in the classroom?	
Do the employees have the needed skills to be successful at their jobs?	Do you believe that your ability to effectively integrate technology in the instructional process will positively impact student achievement ?	Knowledge
Do the employees have the necessary knowledge to be successful at their jobs?	Do you have the necessary knowledge to successfully integrate technology in the classroom?	Knowledge
Do employees have a systematic training program to enhance their knowledge and skills?	Are you involved in a systematic training program to enhance your knowledge and skills of technology?	Knowledge