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# Engagement's Mediation of the Relationship between Personalized Learning and Achievement

John-Patrick Grant Clark
*Western Kentucky University*, john-patrick.clark502@topper.wku.edu

# ENGAGEMENT'S MEDIATION OF THE RELATIONSHIP BETWEEN PERSONALIZED LEARNING AND ACHIEVEMENT

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Date Recommended 10/13/17

Jenni Redifer, Chair

Tony Norman, Committee Member

Gary Houchens, Committee Member

Dean, The Graduate School

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Date

## DEDICATION

This dissertation is dedicated to my wife, Meggan Clark, who said “Yes” to me, my dreams, and our future; even when she wanted to say “No”. I love you, Megg.

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Directed by: Jenni Lynne Redifer, Tony Norman, and Gary Houchens

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The present study investigates the effect of engagement as a mediating variable on the relationship between personalized learning and achievement. Personalized learning involves instruction and learning that is individualized to the student by means of several components. These components include goal-oriented mastery learning, flexible pacing, ongoing formative assessment feedback, and the incorporation of personalized information. The literature suggests that each of these components, both individually and as a whole, have a positive correlation with achievement. Engagement may mediate this relationship given that it involves the students' willingness to involve themselves in the learning process through the use of certain behavioral, emotional, and cognitive processes. Previous research indicates that these types of engagement have a mild to moderate effect on achievement as well. In addition, some behaviors pertaining to engagement overlap with components of personalized learning. However, previous research in the areas of either personalized learning or engagement only consider these variables at the individual or class level, leaving school wide plans for improving personalized learning and/or engagement lacking. As such, this study utilizes mediation analysis to determine the extent to which engagement mediates the nature of the personalized learning-achievement relationship for data at the school level. Results from a survey of (n = 111) schools participating in a program to improve both engagement and personalized learning indicate that personalized learning has no significant relationship

with either engagement or achievement when analyzed at the school level. However, engagement is significantly and positively correlated with achievement at the school level. Furthermore, engagement does not serve as a significant mediator of the relationship between personalized learning and achievement. Therefore, engagement, when considered as a meta-construct, merits attention from schools and teachers as a means to affect school wide achievement. This study also indicates that components of personalized learning and/engagement may vary in their effect on achievement and also merit further study.

# CHAPTER I: INTRODUCTION

## Introduction

Accountability models grounded in education legislation (ESSA, 2015; National Clearinghouse for Bilingual Education, 2001) encourage teachers to deliver as much content as possible to students, sometimes with little regard for the changing demographics and individualized needs of the students (Peters, 2009; Pykett, 2009). Some education advocates have voiced concerns that legislatures and schools are stifling natural curiosity and creativity through strict uniformity in curricula, instruction, and high stakes assessment leading to learners' disengagement with school (Au & Gourd, 2013; Polesel, Rice, & Dulfer, 2014; Robinson, 2006). The nature of legislative action and public concerns encourages teachers to reflect on the nature of individualized student learning and engagement in their classes to meet new federal mandates. However, the precise relationship between learning and engagement—and their relationship with achievement—is unclear to researchers and practitioners. Therefore, this study investigated the role engagement plays in the relationship between instruction and achievement.

Individualized (Sturgis & Patrick, 2010; Wolf, 2010) or personalized learning (Houchens et al., 2014; López & Sullivan, 1991; Moreira, Dias, Vaz, & Vas, 2013) came to the forefront of educational pedagogy as a means to deliver student-centered instruction and address changes in educational environments such as changing demographics and socioeconomic needs (Sturgis & Patrick, 2010; Wolf, 2010). Individualized models of learning promote student choice, mastery, and the productive use of instructional feedback (Bloom, 1968; Keller, 1968; Eyre, 2007). Personalized

learning requires the integration of student interests into instruction and researchers found that it positively correlates with student achievement (López & Sullivan, 1991; Ross & Anand, 1990; Walkington, 2013).

Another point of reflection for teachers is the level to which a student engages with the content, classroom social environment, and design of the lesson (Connell & Wellborn, 1991; Fredericks, Blumenfield, & Paris, 2004). Engagement is the extent to which a student participates in the lesson for the express purpose of learning (Fredericks et al., 2004). Because several types of engagement exist, the term engagement subsumes several constructs in empirical literature (Dweck & Leggett, 1988; Fredericks et al., 2004; Shernoff, Csikzentmihalyi, Schneider, & Shernoff, 2003). These myriad definitions of engagement result in research that is either operationalized to exclude some distinct sub-types of engagement or juxtapose these sub-types (Archambault, Pagani, & Fitzpatrick, 2013; Lee & Anderson, 1993; Mih, Mih, & Fragos, 2015). Definitions of motivation assist in operationalizing engagement because they are both positively correlated with student achievement over the course of a student's education with potential within-student interactions (Wang & Eccles, 2013).

Some literature suggests that personalized learning shares similar qualities with engagement, such as attitude and motivation (Edwards, 1977; Fachnie & Schillace, 1973; Walkington, 2013; Walkington, Petrosino, & Sherman, 013). Similar to personalized learning, engagement has a positive, albeit small, correlation with student learning (Fredericks et al., 2004). The complex relationship among the engagement constructs has been investigated using motivational concepts such as self-regulation (Zimmerman, 2002), goal-orientation (Ames & Archer, 1988), and theory of flow (Csikszentmihalyi,

1996). These motivational theories also relate to the behaviors and perceptions of personalized learning in such a way that the behaviors that reflect motivation and engagement are components of personalized learning; for example, mastery-based learning utilizes goal-orientation (Cakir & Simsek, 2010; Gifford & Vicks, 1982; Pascarella, 1977). Because personalized learning and engagement share some qualities and each have shown correlations with achievement, the nature of their relationship with achievement merits investigation.

## Problem Defined

This study explores the relationship between personalized learning and engagement and the impact of this relationship on student achievement. As cited above, personalized learning components correlate with achievement and the various engagement constructs also correlate with student achievement. However, the role that engagement takes in the personalized learning and achievement relationship is unclear.

### The Development of Personalized Learning

Models of student learning are not new to teachers or students (Bloom, 1968; Carroll, 1963; Dewey, 1913; Keller, 1968), but they have influenced the pedagogy of individual and whole class instruction. Carroll's 1963 model of school learning addresses components of the instructional environment, such as time and quality of instruction, that attempted to explain variations in student achievement. These aspects include individual aptitude, comprehension of instruction, perseverance, time allowed for learning, and quality of instruction. According to Carroll, teachers should consider each of the components as part of their pedagogy especially when working at the individual level. The model of school learning considers these five components as facets of a single model

though evidence indicates that some components have a stronger impact on learning than others (Carroll & Spearitt, 1967).

The model of mastery learning (Bloom, 1968) takes Carroll's (1963) model a step further by integrating the concept of student's prior achievement as a covariate for student instructional pace and readiness grouping. Carroll's model suggests that teacher consider each of the components for whole-class instruction; however, mastery learning suggests that teachers consider instruction for groups of students. This step modifies the pacing of the class based on formative assessment data and adjusts instruction accordingly. Personalized systems of instruction (PSI) proposed by Keller (1968) place control of instruction in the hands of the students, thus moving towards student-driven learning versus Bloom's (1968) proposed teacher-directed learning based on formative assessment results. One of the primary advantages of PSI over Bloom's or Carroll's model is that pacing and instruction are determined at the individual level instead of the class level. The components of PSI include self-determined pace, style of instruction, requires complete mastery prior to progression, emphasis on writing, and the use of individually proctored assessments. Therefore, in addition to Bloom's mastery and Carroll's individual consideration, flexible pacing; student assessments under the direction and assistance of a proctor; and focus on writing, PSI extends the role of student in learning. Technology has enabled educators to integrate personalized information into instruction with a positive effect on student achievement (Anand & Ross, 1987; Ross & Anand, 1990; Wolf, 2010). This student-centered model promotes individualization of instruction and has shown a larger positive effect on overall student achievement than

traditional direct instruction (Hambleton, Foster, & Richardson, 1998; Kulik, Kulik, & Cohen, 1979).

As the field progressed, a few quintessential, related components of individualized learning emerged from earlier models: mastery-based learning, rich and useable assessment feedback, and varied pacing based on student learning goals. Mastery-based learning focuses on students attaining competence in a unit prior to progression onto the next unit of study (Guskey & Gates, 1986). The use of mastery-based goals instead of performance-based goals leads to a successful learning experience for students that has a positive and enduring impact on motivation and subsequent achievement (Slavich & Zimbardo, 2012). As part of developing a mastery-based environment, frequent formative assessment is used in the role of an instruction-assessment feedback loop; in this loop, feedback from formative assessment influences instructional design that is re-evaluated with formative assessment (Marzano, Norford, Paynter, Pickering, & Gaddy, 2001; Natriello, 1987). Formative assessments are instructional assessments of learning and/or performance standards that serve primarily to inform instruction rather than to determine a student's level of total mastery and are typically ungraded (Roberts & Fairclough, 2012), but are also authentic assessments focused on the learning goals (Gulikers, Bastianes, & Kirschner, 2004). A final pivotal component of individualized learning is the pacing with which the student moves through the curriculum. Traditionally, the teacher determines the pace of instruction from assessment of an entire class, but in individualized learning, the pace for students varies based on the results of ongoing formative assessments (Bailey & James, 1987; Schnakenberg & Sullivan, 2000). When students are permitted the opportunity to learn at

a pace consistent with their mastery, they demonstrate greater perseverance during learning, and ultimately, greater achievement (Cakir & Simsek, 2010; Carroll & Spearitt, 1968; Eyre, 2007).

Eventually, the term personalized learning became differentiated from individualized learning in the respect that personalized learning integrates personal information while individualized instruction is merely tailored to the student's needs, pace, and goals (López & Sullivan, 1991, 1992). Integrating personal information—such as hobbies, appearance, names of friends and family—into instruction promotes a stronger connection to the material and subsequently increases achievement (Ormrod, 2004). Personalization can be as simple as including the student's name and favorite drink in a choice-based learning activity, positively impacting student achievement by increasing intrinsic motivation to learn (Cordova & Lepper, 1996).

Choice is another critical component of personalized instruction. When students immerse themselves into a virtual learning environment, similar to massive multiplayer online games like World of Warcraft® or Second Life®, their choices during learning afford them increases in learning benefits (Dalgarno & Lee, 2010). The ability to choose instructional paths or activities relates to the learner's sense of competency which in turn promotes learning and achievement. In a meta-analysis of studies on choice and intrinsic motivation, Patall, Cooper, and Robinson (2008) posit that students who can choose instructional activities and pace during instruction demonstrate greater motivation, autonomy, and sense of competence with the material. Thus, the role of personal choice is central to personalized learning.

Given that the defining feature of personalized learning is designing instruction for students as individuals, the nature of implementing personalized learning across a larger population of students, such as school-wide implementation, is still unclear in the literature. The models proposed (Bloom, 1968; Carroll, 1963; Cordova & Lepper, 1996; Keller, 1968; López & Sullivan, 1991; Walkington et al., 2013) represent the connection between personalized learning and achievement for students and classes. Furthermore, clinical investigations of personalized learning give only indirect evidence on the practical nature of implementing components of personalized learning (Miller et al., 1983). Therefore, investigation of the relationship between school-wide implementation of personalized learning and achievement is needed.

**Role of Engagement in Learning**

The term *engagement* is defined in many ways in educational and psychological literature (Connell & Wellborn, 1991; Fredericks et al., 2004), including the ways that students involve themselves in instruction such as behaviors and attitudes. Researchers define engagement in myriad ways in order to capture a thorough range of the participants' involvement during their learning experiences (Appleton, Christenson, & Furlong, 2008). For the purposes of this investigation, engagement is a meta-construct that measures students' propensity to immerse themselves in instruction for the purposes of learning. This meta-construct is further subdivided into behavioral, emotional, and cognitive engagement constructs (Fredericks et al., 2004).

Behavioral engagement relates to those behaviors that indicate the student is working towards competency or mastery of the content (Fredericks et al., 2004). Students use of mastery-based goals increased the use of positive self-regulating behaviors (Ames

& Archer, 1988). Self-regulation can be defined as the behaviors and perceptions under learner control that motivate the student to achieve or master a specific educational goal (Zimmerman, 2002) such as time management and prioritizing learning activities, a teacher's interactions with the student's behavior towards pre-determined competency goals also play a role in the behavioral engagement of the student (Skinner & Belmont, 1993). For example, negative student-teacher interactions, such when a teacher disciplines a studentt publicly for disruption, reinforce maladaptive behaviors—such as off-task behavior or lack of perseverance through challenges—and disaffection with learning had a significantly negative relationship with achievement (Skinner & Belmont, 1993). Because self-regulation behaviors of students positively correlate with their achievement (Skinner, Furrer, Marchand, & Kinderman, 2008), students who are behaviorally engaged in learning experiences more positive outcomes of their efforts than do students with low behavioral engagement.

However, students' persistence in learning and behaviors related to engagement is affected by other engagement sub-constructs and achievement. Emotional engagement refers to the sense of connection that the student internalizes toward the content and/or classroom, including feelings of happiness and anxiety (Fredericks et al., 2004). These feelings influence students' behaviors in class and motivations to put forth cognitive effort and persist in learning tasks (Pietarinen, Soini, & Pyhältö, 2014). Notably, emotional engagement has a strong positive correlation with behavioral engagement; however, this correlation is negative for very high achieving students due to increased anxiety for continued high achievement (Furrer et al., 2008). This persistence in affective

connection to content and/or the classroom has lasting effects outside the classroom (Archambault et al., 2013).

The final major sub-construct of engagement is cognitive engagement, the psychological investment of the student in learning that manifests with strategic and relevant academic behaviors (Connell & Wellborn, 1991; Fredericks et al., 2004), which relate to the student's achievement. The effective use of self-regulated behaviors reflect the student's perception of competence and the degree to which a student is willing to engage in autonomous behavior in the classroom (Ruzek, Hafen, Allen, Gregory, Mikami, & Pianta, 2016). Both the perception of competence and the level of the student's autonomous behavior positively influence the degree of cognitive engagement experienced during learning. Research in the field of cognitive engagement proposes that self-regulation is the expression of cognitive engagement (Fredericks et al., 2004); however, considering these two constructs separately yields a more thorough understanding of the relationship between student cognition and achievement (Pintrich & DeGroot, 1990). Since cognitive engagement is so closely related to these other types of engagement, it must be considered as part of the larger engagement construct. These connections between the three sub-constructs support the validity of the larger meta-construct of engagement in order to clarify the relationship between engagement and achievement.

**Motivational constructs of engagement.** Several studies on engagement have addressed student motivation as either a latent construct or a dependent variable (Deci & Ryan, 1996; Dweck & Leggett, 1988; Schunk, 2008). Of course, there are several types of motivation just as there are several types of engagement (Lee & Brophy, 1996; Meece,

Anderman, & Anderman, 2006). However, the previously cited studies clearly link motivation to the various sub-constructs of engagement. Because motivation has ties to achievement and engagement, understanding the motivation provides insight into the role of engagement on achievement and the components of personalized learning. Therefore, the sections below will address the most common models of motivation tied to engagement in the literature and their relationship to achievement.

Several types of self-regulation are differentiated to account for student motivation and subsequent engagement (Deci & Ryan, 1996). Both internalized self-regulation such as personal desire to achieve goals and externalized self-regulation such as parent expectations, satisfy motivation to learn; positive intrinsic self-regulation behaviors correlate with positive external student behaviors and result in higher achievement (Rudolph, Lambert, Clark, & Kurlowsky, 2001). Rudolph et al. (2001) demonstrated that poor self-regulation is associated with low engagement in students. Given the connections between motivation (as manifested by self-regulation) and engagement, there is a need for research into self-regulated learning (Schunk, 2008) and engagement by extension.

Though goal theory explains internalized cognitive and behavioral engagement, another theory of motivation addresses cognitive and emotional attributes of student learning and connects the cognitive and emotional engagement as two aspects of a single latent variable. Flow theory proposes that individuals in a highly motivated and cognitively engaged state are absorbed by the task and its rigor as opposed to becoming disaffected due to anxiety or boredom (Csikszentmaihalyi, 1996). This state of flow proposes that mastery-oriented learning (Ames & Archer, 1988) provides clear and

achievable objectives for students to work towards using self-regulated behaviors. Kapp (2013) describes the feeling of flow as a state in which the learner or player is engaged in learning due to the activity being just difficult enough to be engaging but not so difficult as to be discouraging to the learner. This state of flow is a predictor of motivation to achieve mastery of a learning task (Shernoff et al., 2003). Even so, the degree of motivation due to flow may increase student engagement, but does not always result in higher achievement (Annetta, Minogue, Holmes, & Cheng, 2009). Because engagement constructs rely on various types of motivation, any investigation of engagement should consider the impact of motivation. Furthermore, the individualized nature of flow indicates that there may be a relationship between motivation-driven engagement and personalized learning, and both of these constructs' effect on achievement.

## Purpose

Personalized learning and engagement have a significant effect on student achievement. Even so, there is little empirical evidence to support a significant relationship between personalized learning, engagement, and subsequent achievement (Dabbagh & Kitsantas, 2012; Song, Wong, & Looi, 2012). Furthermore, personalized learning has been studied at the classroom level (Hambleton et al., 1998; Keller, 1968; López & Sullivan, 1998; Schnakenberg & Sullivan, 2000; Walkington, 2013; Walkington et al., 2013), as has engagement and achievement (Connell & Wellborn, 1991; Fredericks et al., 2004); however, neither have been thoroughly studied at the school level. Motivation is a common thread between personalized learning and engagement (Ames & Archer, 1988; Csikszentmaihalyi, 1996; Dweck & Leggett, 1988; Zimmerman, 2002).

Therefore, the concepts of personalized learning and engagement merit investigation as components of the central research question: To what extent does student engagement mediate the relationship between personalized learning and student achievement? The following empirical research questions support the central research question:

1. To what extent do the implemented components of school-wide personalized learning predict student achievement?
2. To what extent does engagement predict student achievement?
3. To what extent do the implemented components of school-wide personalized learning predict student engagement?
4. To what extent does engagement mediate personalized learning and student achievement?

These empirical research questions merit consideration of the school-level, so certain covarying factors such as gender, school size, and free-reduced lunch status also merit investigation at the school-level. The overall model is outlined in Figure 1.

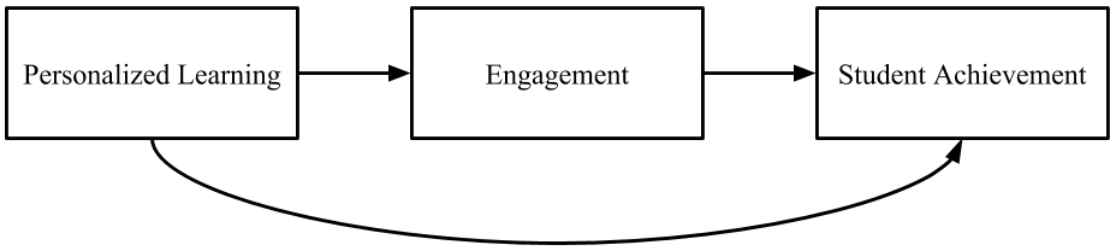


*Figure 1.* Mediation model of engagement's moderation effect on personalized learning and achievement and relevant covariates.

## Significance of the Study

The intent of this investigation is to determine the nature of the relationship of engagement to personalized learning and achievement. Though studies exist that detail the nature of individualized learning (Cakir & Simsek, 2010; Connell & Wellborn, 1991) and engagement (Fredericks et al., 2004; Moreira et al., 2013) separately, there are few studies that specifically examine the nature of personalized learning in conjunction with engagement constructs (Schunk, 1983; Walkington, Petrosino, & Sherman, 2013). Furthermore, the literature on motivation as a function of engagement contains elements that are similar to personalized learning requirements such as cognitive engagement as self-regulation, which is also a key skill for flexible pacing and attaining mastery (Rudolph et al., 2001). This investigation addresses the gap in the literature concerning what is known about the relationship between engagement and personalized learning.

First, this investigation clarifies the connection between school-level implementation of personalized learning components and achievement versus implementation at the classroom level. The majority of the existing research addresses personalized learning components implemented by the instructor (Cordova & Lepper, 1996; Eyre, 2007; Ku & Sullivan, 2002; López & Sullivan, 1991, 1992). Therefore, investigation of the mediating effect of engagement in the relationship between personalized learning and achievement may provide evidence for a school-wide range of implementation.

Second, the study seeks to determine the connection between engagement and achievement. Much of the literature on engagement differentiates the sub-constructs for investigation while simultaneously discussing their commonalities (Fredericks et al.,

2004). This investigation utilizes this single construct measure in order to more clearly interpret the connection between engagement and achievement.

Third, this research will explore the relationship between personalized learning and engagement. Though some studies indicate a connection (Cordova & Lepper, 1996; Slavich & Zimbardo, 2012), this connection has only emerged as as a secondary conclusion from the primary purpose of those studies. Studies of personalized learning reference engagement (Dweck & Leggettt, 1988; Lee & Anderson, 1993); however, they do not specifically focus on the relationship between personalized learning, engagement, and achievement. This study focuses specifically on the personalized learning-engagement correlation.

Finally, this study investigates the mediating effect of engagement in the relationship between personalized learning and achievement. The previously cited studies of personalized learning and achievement are informative, but investigating the impact of the second construct, engagement, on achievement provides more information on the relationship (Eyre, 2007; Fredericks et al., 2004, Tevaggia, 1976). This understanding will help future decisions regarding instruction that utilizes personalized instruction.

## Limitations

As with any study, there are limitations to address. First, the measure of engagement is a self-report measure, and self-report measures have the possibility of measurement error (Smith et al., 2015). To manage this limitation, the engagement measure includes a large sample size to adjust for inherent measurement error (Fowler, 2013). Second, previous studies of personalized learning (Anand & Ross, 1987; López & Sullivan, 1991; Song et al., 2012; Walkington 2013) used small sample sizes, which

makes smaller variations in the analysis appear to have great effect. To compensate for this issue, the participants in the present study received instruction to ensure accurate measurement of personalized learning constructs; in addition, the researcher validated the measure by interviewing selected participants to verify their self-evaluations. A third limitation is the treatment of engagement as a meta-construct. Even though measuring engagement as a single construct makes analysis of its ability to mediate the relationship between personalized learning and achievement more feasible, subtleties of the sub-constructs are lost. To address this limitation, a validated measure was used to provide an accurate factor score for the overall construct of engagement. Finally, considering school-level data provides more generalizability for school and district-based decisions, and provide more details for consideration in the current study.

## Summary

Education is a field in a constant state of flux (Connell & Wellborn, 1991; Darling-Hammond, 2015; Eyre, 2007; Fredericks et al., 2004; Ravitch, 2010) that is difficult to manage at the classroom and district levels. The role of personalized learning has evolved from addressing the differences in learning class-wide (Bloom, 1968; Carroll, 1963; Keller, 1968) to personalizing instruction with the needs and interests of individual students (López & Sullivan, 1991, 1992). The implementation of the components of personalized learning—such as assessment (Natriello, 1983), feedback (Gulikers et al., 2004), pacing (Rudolph et al., 2001), and mastery-based learning (Bloom, 1968)—have changed to include personalization to address the needs of individual students. In addition, the role of the learner has changed from simply receiving standardized content to engaging in learning through authentic tasks, defined mastery

goals, and usable feedback in regular formative assessments (Dalgarno & Lee, 2010). However, the inclusion of personalized information in assignments and assessments merits investigation regarding its effects on achievement.

Through mediation analysis, this investigation measured the correlations between the three variables: personalized learning, engagement, and student achievement. Furthermore, this study explored the nature of the relationship between personalized learning and achievement in addition to the role that engagement plays in this relationship. With these results, a more thorough understanding of the relationships between these three variables contributes not only to the literature, but also to the education profession in terms of instructional design considerations and education policy decisions.

# CHAPTER II: REVIEW OF THE LITERATURE

## Introduction

As society shifts towards a more globalized approach to industry and technology, education shifts from the traditional industrialized model of instruction to a more individualized model that focuses on the needs and goals of the individual students. However, individualized learning models have developed over several decades (Bloom, 1968; Carroll, 1963; Keller, 1968; Spady, 1977). Although the individualized models of instruction proposed by Bloom (1968) and Keller (1968) fell into disuse in the early 2000's in favor of class-wide instruction (Eyre, 2007; Marzano et al., 2001), personalized learning is becoming popular in the light of increased technology availability (Sturgis & Patrick, 2010; Wolf, 2010). Personalized learning also functions as a way to meet the needs of various underrepresented subgroups for state and federal accountability mandates. Experiments using individualized and personalized instructional and learning methods indicate a positive correlation with achievement (Carroll & Spearitt, 1967; Damavandi & Kashani, 2010; Mevarech, 1991). Individualized methods are associated with higher rates of motivation and engagement in comparison to traditional instruction (Ames & Archer, 1988; Cordova & Lepper, 1996).

The purpose of schooling is to provide a substantive and rigorous education to all learners (Civic Impulse, 2017; Darling-Hammond, 2015; Ravitch, 2010). Along with personalized learning, educational reforms focus on engagement as a possible reason for stagnant achievement (Fredericks et al., 2004). Given the rise in the focus on personalized learning, student engagement, and focus on student achievement, the current

study investigates the central research question: To what extent does student engagement mediate the relationship between personalized learning and student achievement?

In order to address this question, the investigation utilized the research from the databases ProQuest, ScienceDirect, Web of Knowledge, JSTOR, EBSCOHost, and Google Scholar. Furthermore, the researcher searched for relevant literature using the key terms *individualized learning/instruction, personalized learning/instruction, engagement, cognitive engagement, behavioral engagement, emotional engagement, flow, self-regulation,* and *goal-orientation.* What follows is a discussion of the history and context of personalized learning, engagement, and the overall framework of the proposed study.

## Personalized Learning

Personalized learning today is the production of pedagogical evolution. The practice was born of educational theory (Bloom, 1968; Carroll, 1963; Keller, 1968) and was investigated heavily for several decades (Block & Burns, 1976; Guskey & Gates, 1986; Kulik, Kulik, & Carmichael, 1974). As technology became more readily available, educators developed new approaches to personalized learning in teaching, learning, and assessment (Cakir & Semsik, 2010; López & Sullivan, 1991, 1992). Across this evolution, the components of personalized learning have been adapted to integrate student interests and technology but still retain basic components: mastery-based learning/progression, flexible pacing, assessment feedback, and manageable learning goals (Bloom, 1968; Carroll, 1963; Eyre, 2007; Keller, 1968; Sturgis & Patrick, 2010; Wolf, 2010).

One of the earliest models of individualized learning was proposed by Carroll in 1963. This model of school proscribes that educators should plan instruction to address

five characteristics of learning at the individual level: (1) aptitude, or the time required by the individual to complete a task; (2) ability to understand instruction, which is how successfully the student understands the lesson and goals; (3) quality of instruction, rated dichotomously as high or low; (4) time allotted for instruction, which is beyond the control of the learner; and (5) perseverance, which is the time that the learner is willing to spend learning the material (Carroll, 1963). Within this theoretical framework, Carroll proposed that these variables may interact with one another during the course of learning. However, proscribed implementation of this model is only theoretical as no individual, teacher or student, has control over each component of the model. For example, teachers may affect the quality of instruction and time allotted for instruction, though students' aptitude, ability to understand instruction, and perseverance are beyond teacher control. Therefore, Carroll's model is useful in reflecting on individualized instruction, but lacks the clearly defined details for the purpose of implementation.

In a study of Carroll's model of school learning, some components interacted when implemented with programmed, individualized instruction (Carroll & Spearitt, 1967). One such interaction included the ability to understand instruction, as measured by IQ, and the quality of instruction; poor instruction interacting with low IQ had a particularly detrimental effect on students' achievement. These indicate that the quality of instruction is a factor in student achievement. Poor quality instruction also affected high IQ students' desire to persevere throughout instruction, though instructional quality alone did not appear to affect low IQ students' perseverance, i.e., student took the same time to learn regardless of quality of instruction. These findings support the idea that individualized learning is influenced by the teacher's instructional method and quality.

Additionally, increasing the quality of instruction and time spent learning while students had low levels of perseverance decreased achievement.

Prior to implementation, one must be attentive to the nature of the evidence supporting individualized learning models like Carroll's (1963). Carroll's model consists of several components that theoretically interact with one another. Millman, Bieger, Klag, and Pine (1983) conducted a series of experiments using Carroll's model of school learning to test the individual components of Carroll's model. In a set of several experiments, Millman et al. found that students who receive encouragement are just as likely to persevere as students that do not. These findings are similar for students receiving financial incentives. This experiment demonstrates that a single component of Carroll's model (e.g., perseverance) may not be effective. However, students who had extended time to learn key terms performed better than students with limited time, which supports one component of Carroll's model. Ultimately, the series of experiments performed by Millman et al. indicate that the individual components of Carroll's model can have a significant impact on achievement, although when Millman et al. compared single components to several simultaneous components, the interacting nature of the components was more significant (Carroll & Spearitt, 1963; Millman et al., 1983).

Several reform initiatives (Sturgis & Patrick, 2010; Wolf, 2010) prescribe components of Carroll's model such as attention to time to learn and the quality of instruction. However, due to clarification of Carroll's model by researchers like Keller (1968) and Bloom (1968), schools and districts some components should be considered for their value to individualized learning. The series of experiments performed by Millman et al. (1983) explored Carroll's model of school learning despite the existence of

several others by this time (Bloom, 1968; Keller, 1968; Spady, 1977), which indicate that some of the theoretical components of Carroll's model are valid for implementation. Other models (Barron et al.,, 1998; Bloom, 1968; Keller, 1968; Spady, 1977) contain clarification and details for implementation of personalized learning such as designing student-friendly goals, flexible pacing, formative assessment with revision, and on. Because schools seek to implement personalized learning as extension and application of Carroll's model, further study is necessary to determine the mechanism of personalized learning components and its effect on achievement.

**Mastery Learning Models**

A significant manifestation of the personalized learning movement is mastery-based learning. Traditional mastery-based learning emphasized only flexible pacing for students to achieve specific cognitive and/or behavioral goals (Bloom, 1968); however, mastery-based learning has evolved into integrating instruction, assessment, and pacing for the purpose of mastering a learning objective. Bloom's (1968) model proposes that time to learn and perseverance affect student achievement (see Figure 1), and although the factors of Carroll's original model (e.g., quality of instruction and perseverance) demonstrate some positive effects on student achievement as well as some interaction with one another in their impact on achievement, mastery learning has a positive impact on achievement regardless of the presence of other individualized learning factors (Carroll & Spearitt, 1967).

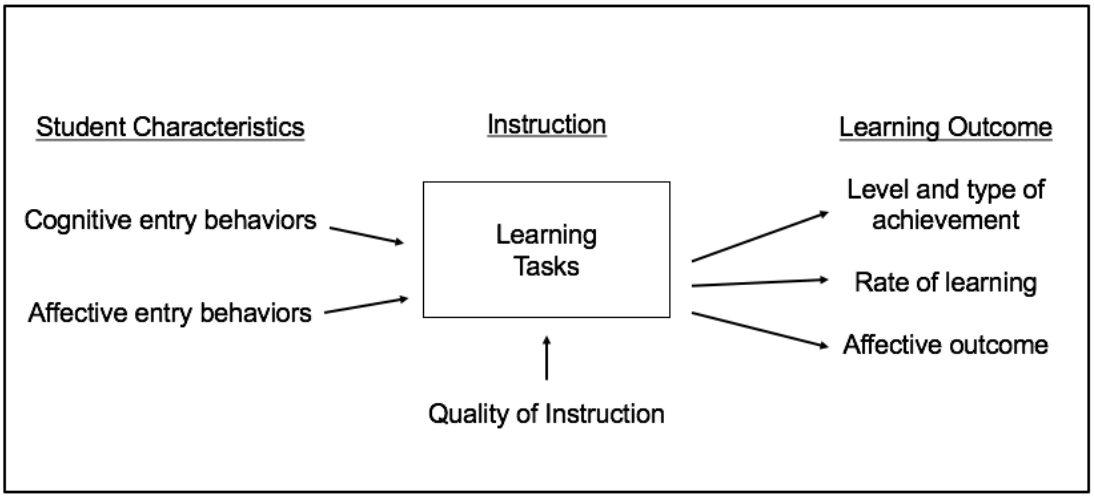


*Figure 2.* Model of factors contributing to mastery learning and their proposed outcomes (adapted from Damavandi & Kashani, 2010, p. 1576).

However, in experimental settings involving Bloom's model of mastery learning, underprepared chemistry students and those with low perceptions of chemistry demonstrated significantly greater academic achievement after mastery-based instruction than did their peers who received traditional instruction (Damavandi & Kashandi, 2010). Students in the treatment group received extra time with the material based on formative assessments while the control group moved at a teacher determined pace. These findings indicate that the student pace determined by feedback from assessment proposed by mastery learning components affected student achievement. Although Bloom's (1968) mastery model is derived from the Carroll's model of school learning (Carroll, 1963), Damavandi and Kashani's (2010) study provides evidence that both aptitude and time to learn are essential components of individualized learning, as specified in both Bloom's and Carroll's models. This support provides evidence for the components personalized learning theory that add to Bloom's model: pacing, assessment feedback, and attention to

student behaviors are factors in student achievement—each of which will be discussed in later sections.

A feature of mastery learning is the achievement of defined behavioral and cognitive standards. In essence, mastery is implemented with goals that are reasonably achievable based on the student's current level of mastery (Bloom, 1968; Guskey & Gates, 1986; Mevarech, 1991). Students taught under a mastery-based approach have outperform those students taught via traditional pedagogy (Damanvandi & Kashani, 2010; Mevarech, 1991). The mastery-based progression through the curriculum encourages students to learn and think at level given the requirement for mastery prior to progression through the content. In addition, Block and Burns's (1976) seminal review indicates that learning for mastery also produces less variability in learning outcomes for students. Block and Burn's findings support Bloom's (1968) theoretical framework and Carroll's (1963) model of school learning components of time spent learning and perseverance.

Initially, Bloom (1968) posited that effective instructor-paced learning produces only a class-wide shift in learning, i.e., the mean of class achievement may have shifted higher but the variance has not decreased significantly; however, mastery-based learning should reduce the variance among achievers while also increasing the mean achievement of the class. Individual clinical experiments in perseverance and achievement indicate that providing students with encouragement and extended time for learning increases learning (Millman et al., 1983). Furthermore, results from the learning by mastery method support the idea that learner efficacy is an effect of goal-directed use of in-class time at the individual level (Thompson, 1980). Learner efficacy does not only increase

student achievement at the classroom level—supporting Bloom's model for learner achievement—but also at the individual level. Ergo, an outcome of mastery learning is higher class achievement along with smaller variations in achievement in comparison to traditional instructional methods.

Another feature of mastery learning is the need for frequent assessment (Bloom, 1968; Carroll, 1963; Roediger & Karpicke, 2006b). Regular assessment allows teachers to identify the needs of students on their path to achieving mastery while simultaneously allowing them to shape instruction effectively (Natirello, 1987; Roediger & Karpicke, 2006a). This frequent instructional adjustment is a feature of mastery learning that may contribute to whole-class achievement and a decrease in achievement variance. In addition, as students increase the frequency of meaningful assessment and instructor feedback, they become more acutely aware of their own understanding and mastery of the content (Fernald & Du Nann, 1975; Ritchie & Thorkildsen, 1994). Although the frequency of assessment has been criticized in the United States (Robinson, 2006), when used with precision, these assessments serve to diagnose student achievement so that the teacher may re-design instruction and performance goals appropriately (Linn, 1983). Assessment is a critical element of mastery learning.

As with any instructional method, mastery-based learning is not without flaws. Whereas many studies demonstrate statistically significant gains in mastery-based learning program in comparison to traditional courses, Fernald and Du Nann (1975) cautioned that these small gains in experimental conditions may not be practically significant in the classroom. In addition, the inherent principles and values of mastery-

based learning do not necessary serve low level learners due to lack of previous knowledge and/or skill (Denton & Seymour, 1978; Pascarella, 1977;).

**Keller's Personalized System of Instruction**

A logical step towards this study's paradigm of personalized learning is Keller's (1968) personalized system of instruction (PSI), which entails five essential components: flexible pace; demonstration of mastery; lectures and demonstrations to motivate student work; emphasis on written work; and assessments proctored by an individual that has mastered the material; this individual could be a peer, proctor, or the teacher. Originally, Keller proposed this model of instruction for postsecondary institutions as a means to meet the individual needs of students in larger courses because students would choose individual paths to mastering objective instead of mass delivery of content. Similar to Carroll (1963) and Bloom (1968), PSI indicates the need for clear goals, quality instruction, and regular assessment. Keller also proposed increased student choice of instructional methods based on both preference and individualized feedback from proctored assessments. For example, individual students may choose to watch videos of content versus reading texts on the context; then, proctored assessment would help them determine whether they learned the content effectively.

In practice, PSI requires foresight and care in implementation on the part of the instructor and the student, and the benefits may exceed simple achievement, such as attitude towards learning and retention of knowledge and skills (Ames & Archer, 1988; Burns, 1987; Cakir & Simsek, 2010; Schwartz, 1981; Watson, 1986). Instructional materials that directly address the content objectives may include readings, recorded materials, laboratory exercises, and so on (Keller, 1968). These materials allow the

student to explore the content while individually proctored assessments encourage students to provide evidence of deeper understanding to the proctor than simple selected response assessment may allow. Through the combination of student choice of instructional materials and simpler individualized assessment, students may develop a more positive internal motivation about their work and their performance.

As with any instructional method, the foundational goal is student achievement, and PSI is no different; moreover, multiple studies support mixed student achievement outcomes in PSI-type courses versus traditional-type courses (Kulik et al., 1979). In a meta-analysis of 75 studies, Kulik et al. (1979) concluded that PSI is generally a better instructional method than traditional methods in terms of student achievement and student course perception. In addition, Kulik et al. summarize, "Because individualized classes give students the time and instruction they individually need, the model suggests, high level of achievement should be reached by all students, not just a few" (p. 314). Results within the meta-analysis indicate support for this statement, and, therefore, lend credence to the connections between the components of personalized learning and student achievement. Finally, PSI maintains its instructional significance across a wide range of subjects such as science, social studies, mathematics, and engineering (Kulik et al., 1979). Since PSI is not subject specific, it may be personalized as student subject-based preference is personalized.

In a comparative review of 14 experimental and quasi-experimental studies, PSI-style courses that allowed the students to select their learning method with regular formative assessment outperformed conventional (e.g., lecture, group-discussion, recitation, etc.) college science courses (Tevaggia, 1976). These findings indicate that

PSI-style teaching components may be effective at the classroom-level for a variety of subjects. In addition, the use of flexible pacing and only formative assessment increased the difficulty of the workload in PSI courses, which Tevaggia (1976) suggested encouraged lower-performing students to drop the class and course work. This led to an increase in achievement among the remaining students due to increased attention from undergraduate teaching assistants; however, this may have skewed the true treatment effect of PSI. A concern to the hallmarks of PSI-style courses are the variety of implementation methods. There is no set curricular model for what a PSI course looks like or what it contains (Eyre, 2007; Kulik et al., 1979; Tevaggia, 1976), which indicates that one must take considerable care when interpreting PSI findings for future research or implementation.

PSI is a system of instruction for the postsecondary classroom that was most popular from the 1960s to the 1980s; most review and research occurred during this time. However, in the last twenty to thirty years, PSI has fallen into general disuse due to complicated definitions (Ainsworth, 1977; Eyre, 2007; Taveggia, 1976) or complications of implementation. Yet, Eyre (2007) reviewed researchers' renewed interests in the components of PSI. Meeting mastery criteria for progression to new content is proving to be a benefit for students as it encourages students in their work though it may not necessarily cause them to achieve. Likewise, increasing individualized feedback from assessment in PSI courses correlated with gains in student achievement in research reviewed by Eyre. Although Eyre did not report effect sizes, she did cite examples of different styles of feedback that led to greater student achievement. A final argument that Erye makes for the disuse and possible resurgence of PSI parallels Taveggia's (1979)

review of PSI-related comparison-studies, “Not one of the independent comparisons of PSI with conventional methods *favors* [emphasis added] the conventional methods […] Of course, the studies on which these conclusions are based are few in number and vary tremendously in quality” (p. 1029). The advent of more precise quantitative measures and a wider variety of schools implementing PSI-style instruction make the current study more viable.

As mentioned above, PSI contains several prominent components from Carroll’s (1963) original model. For example, proctors that oversee student assessment at the individual level are practical aspects of the perseverance and time to learn components of Carroll’s model since they assist students in interpreting formative assessment results and recommend next steps. However, several researchers have criticized the use of proctors as impractical at the primary through secondary level (Guskey & Gates, 1986), and evidence is mixed as to whether they are an essential feature (Denton & Seymour, 1978; Kulik, Kulik, & Smith, 1976). As such, this review focuses on the components of mastery-based progression (discussed above), flexible pacing, assessment feedback, and learning segments or units as the features most pertinent to personalized learning.

**The effects of flexible pacing.** Flexible pacing is a crucial element of PSI; it is a component over which the student has control and lends personalization to the instructional method. Flexible pacing means that students’ progress from one topic to another based on mastery versus a teacher determined pace for the entire class (Keller, 1968). The freedom to select one’s own pace provides opportunity for prioritizing study time and may produce greater student achievement in specific circumstances, such as scheduled assessments or credit-based final examinations (Block, Burns, 1987; Kulik et

al., 1974). However, one should interpret the achievement of singular studies regarding flexible pacing with caution given the range of component interactions (Carroll & Spearitt, 1967). In experimental studies comparing achievement using flexible pacing to teacher-determined pacing, researchers posit that flexible pacing may improve achievement because students work towards sustainable mastery versus studying immediately before a test (Denton & Seymor, 1978).

Procrastination is a key issue with PSI, so any research design that utilizes flexible pacing may contribute to the varying reports of student achievement; thus, teachers and postsecondary instructors have implemented varying degrees of learner-control over pacing with varying degrees of impact on student achievement. Monitored student-pacing, in which the teacher provides timelines and suggestions for pacing, can produce greater mathematics achievement in students even though the total number of completed assignments may decline because students complete what assignments they can (Burns, 1987). The control of pacing is not limited to teachers; in a comparison of computer-controlled study pace and learner-controlled study pace, students demonstrated greater achievement in an array of content areas during self-paced conditions (Schnakenberg & Sullivan, 2000).

Even so, flexible pacing alone does not indicate a causal link to student achievement. When flexible pacing is the only factor of Keller's (PSI) implemented, some studies indicated no significant difference in student achievement on the final examination (Burns, 1987; Reiser, 1984; Reiser & Sullivan, 1977). Therefore, flexible pacing is a component that contributes to success in tandem with other components of personalized learning. However, one should interpret these findings carefully given that

the measure (a final exam) was not given for credit in these studies or was only given to those who completed the class.

**Assessment feedback.** Assessment is an influential component of personalized learning (Bangert-Drowns, Kulik, & Kulik, 1991; Natirello, 1987) and is an essential aspect of PSI (Keller, 1968). The frequency, whether the assessment is required for completion, and feedback relating to the assessment is pivotal to how the assessment informs learning and instruction and subsequent achievement (Natirello, 1987). In a comparison of no testing, optional testing, and required testing under PSI, Maclin, Williams, and Clark (1976) found that whether the assessments were required for students to progress to the next topic predicted students' achievement as measured by assessment. Early in the unit of study, required assessments yielded higher overall achievement than optional assessments and using required assessments at the end of a unit given the student's access to relevant feedback on his or her performance.

Formative assessment feedback is an essential component of the success of mastery-based learning (Black & Wiliam, 1998; Bloom, 1968; Schnakenberg & Sullivan, 2001). At the classroom level, teacher use of formative assessment influence instruction, though assessments tend to model the accountability assessments which are not necessarily mastery-oriented (Black & Wiliam, 1998). Furthermore, Black and Wiliam (1998) posit that students use formative assessment feedback in ways that correlate with their self-efficacy and motivation; i.e., students with high self-efficacy and motivation will use feedback for learning, but students with lower self-efficacy or motivation will overlook the value of the feedback for learning. Thus, feedback provides students with evidence of their achievement and affects their self-efficacy.

Given that individualized feedback is useful, the most easily available form of feedback for student assessment is assessment using rubrics. Rubrics use assessment criteria to provide a consistent measure of performance and promote students' understanding of assessment expectations (Buntat et al., 2013; Fastré, van der Klink, Amsing-Smit, & van Merriënboer, 2014). In a review of vocational education programs, Buntat et al. (2013) proposed that clear criteria provide essential feedback for students who do not perform at a satisfactory level of competency. This feedback is then used for remediation—per Keller (1968)—and eventual reassessment. Feedback, as a component of mastery-based learning, composes the essential components of individualized learning; these components eventually evolve into truly personalized learning with topics and ideas in which students have interest.

The power of feedback depends on the teacher using it to help students conceptualize their mastery of the content or material based on previous performance (Hattie & Timperly, 2007). Different types of feedback provide students with tools to address different educational needs. For example, simply praising students for effort on work assists students in learning how their self-regulated behaviors contribute to achieving the defined goals of the class. Another type of feedback, assessment feedback, provides content information so that students may reconfigure their own understandings. Finally, feedback at the individual level provides the students with the opportunity to reflect on their own motivation and performance compared to feedback to the class as a whole (Hattie & Timperley, 2007). Once students conceptualize what mastery looks like, they may modify behaviors and motivation with the assistance of teachers to reach learning goals.

In line with Keller's (1968) PSI model, feedback from proctors serves a vital and effective role in both student learning and engagement. A case study found that feedback from proctors triggered students to take on complex learning activities and identify their learning preferences (Cramp, 2011). First, written feedback allows students to gain additional perspective of their own understanding and use of the content. Second, students learn interpret feedback as specific to their conceptualization of the material and general in terms of good practice (e.g., APA-style writing). Third, proctored feedback encourages student engagement with the material and the teacher by helping the student interpret feedback in the most personal and meaningful way, which assists in long-term learning (Cramp, 2011; Ormrod, 2004). Finally, the feedback assists the students in developing an academic identity such as how they learn, what they need to do to get better, and so on. The recurring presence of these feedback components indicate the quintessential nature of feedback in personalized systems of instruction (Black & Wiliam, 1998; Buntat et al., 2013; Evans, 2013; Keller, 1968).

**Other Personalized Learning Models**

Although Carroll's (1963) original model of school learning and Bloom's (1968) mastery learning model focus on student growth, Keller's (1968) introduced a "personalized" component in the respect that students chose their own pace and learning materials such as lectures and or readings. However, some researchers (Anand & Ross, 1987; López & Sullivan, 1991, 1992; Ross & Anand, 1987) propose that true personalized instruction is tailoring instruction to students' unique interests and needs; for example, using the names of students' friends and hobbies in learning and assessment materials, versus general or abstract terms (Ormrod, 2004).

The role of personalizing instruction is still under investigation. Thus far, research indicates that personalization does correlate with increased achievement (Anand & Ross, 1987; Ross & Anand, 1987; Song et al., 2013; Walkington, 2013). In comparative studies of personalized instructional methods, researchers compared three levels of personalized learning: abstract instruction (use of general or non-descript terms), concrete instruction (use of specific or authentic examples), and personalized instruction. In the case of authentic examples, the students used mathematical skills in real-world context while students in the personalized group had math problems that incorporated their interests and biographical information. Across both studies, results indicated that personalized instruction has a positive impact on student math achievement compared to abstract or authentic instruction (cf., Anand & Ross, 1987; Ross & Anand, 1987). Ross and Anand's investigation utilized computer-assisted instruction over paper-based instruction for personalization with student interests, resulting in a positive correlation between personalized instruction and achievement. The use of technology permitted researchers to more easily incorporate individual student's interest in instruction through programming.

In a 1992 experimental study of Hispanic boys and girls, López and Sullivan found that instruction personalized with student or student-group's interests and/or personal details at the individual or group level correlated with higher achievement significantly more than non-personalized instruction though there was no significant difference between group and independent personalization; that is, either type of personalization had a positive impact on achievement. This study is consistent with López and Sullivan's 1991 study investigating abstract, concrete, and individual personalized instruction for mathematics in Hispanic students. Personalized instruction in

this study correlated positively with greater gains in mathematics achievement regardless of gender.

Nonetheless, not all studies regarding the personalization of instructional materials indicate a rise in the level of student achievement. Using a repeated measures design, Cakir and Simsek (2010) assessed the effect of paper-based and computer-based versions of non-personalized and personalized instruction on achievement. There was no significant difference in achievement scores between the four groups over time. The researchers partially attributed this lack of significant difference to the reluctance of students to solve all parts of a math problem versus difficulties with personalized learning that bear further investigation. Cakir and Simsek suggested that perhaps personalization of instruction increases student interest but does not necessarily improve instruction.

Cordova and Lepper (1996) proposed that the personal contextualization of instruction is relevant to both student motivation and achievement. General cultural perceptions of traditional instructional methods decontextualize instructional content with the intent of students learning the general content for novel application; personalized learning contextualizes learning situations so that the student forms an intrinsic connection with the material for learning and future application. Cordova and Lepper, among other questions, investigated the effect of personalization of programmed learning on learning outcomes. Students with instructional programs that included personal details—such as the students' interests, names, and birthdays—scored significantly higher on learning outcomes. The integration of personalized details may increase sustained attention and motivation of the student while providing a basis for knowledge construction which contributes to achievement gains.

An additional model of personalized learning is project-/problem-based learning (Barron et al., 1998; Blumenfield et al., 1991). In this model, students are instructed to solve a social problem, such as pollution in their community. The personalized components include biographical details and shared community interests, learner-appropriate goals, flexible pacing through appropriate scaffolding, frequent formative assessment with possible revision, and personal agency to address social concerns (Barron et al., 1998). These components evoke several benefits for the students and teachers such as contextualization of learning material and personalized engagement in the problem or project. Furthermore, project-/problem-based learning research indicates that the use of such a model improves student achievement outcomes (Barron et al., 1998; Blumenfield et al., 1991).

The connection between personalized learning and student achievement is neither as direct nor as clear as indicated by previous models like Keller's (1968) (Eyre, 2007; Kuliket al., 1974; Kulik et al., 1976; Thompson, 1980). As such, the models of personalized learning have changed from Carroll's (1963) through Keller's (1968) to current model's implement personal details of students' lives and interests into instruction and assessment (Cakir & Semsik, 2010; Cordova & Lepper, 1996; López & Sullivan, 1991, 1992; Ross & Anand, 1987). Over time, the essential components of personalized components have remained: mastery-based progression, flexible pacing, assessment for learning with feedback, and personalizing instruction with students' interests and biographical details. However, some of these investigations lack the empirical data on the scale of implementation. The majority of studies investigating personalized learning and achievement do so at the classroom level—or a single

department level in the case of post-secondary institutions. Research is needed to determine the effect of personalized learning on achievement when it is implemented at larger scales, such as the school or district level.

## Student Engagement

Engagement is an essential component of the completion of a task; however, it is difficult to define theoretically or measure empirically (Connell & Wellborn, 1991; Fredericks et al., 2004). As such, investigations that focus on motivation and engagement carefully operationalize the terms and constructs for study (Cordova & Lepper, 1981; Dweck, 1986; Mih, Mih, & Dragos, 2015). Therefore, three key constructs of engagement have emerged from the literature: cognitive engagement, behavioral engagement, and emotional engagement (Fredericks et al., 2004). Within the confines of these often overlapping constructs, methodologies for engagement studies primarily focus on either motivation or achievement as the outcome of engagement (Fachnie & Schillace, 1973; Ruzek et al., 2016; Wonglorsaichon, Wongwanich, & Wiratchai, 2014). Since motivation and engagement have a complex interaction with one another within student learning, the following section will outline the role of each pertaining specifically to student achievement.

### Engagement as a Meta-Construct

Student engagement is a complex construct that subsumes three essential latent constructs: behavioral, emotional, and cognitive engagement. In a thorough review of theoretical and empirical literature, Fredericks et al. (2004) provide the following definition of the subconstructs of engagement:

> *Behavioral engagement* draws on the idea of participation; it includes involvement in academic and social or extracurricular activities and is considered crucial for achieving positive academic outcomes and preventing dropouts. *Emotional engagement* encompasses positive and negative reactions to teacher, classmates, academics, and school and is presumed to create ties to an institution and to do the work. Finally, *cognitive engagement* draws on the idea of investment; it incorporates thoughtfulness and willingness to exert the effort necessary to comprehend complex ideas and master difficult skills [original emphasis]. (p. 60)

These many similar but distinguishable definitions are operationalized in various ways across studies in order to empirically measure them. The three constructs that define engagement are inter-related and difficult to tease apart; however, each one has key features that distinguish the constructs. For example, Wentzel (1997) conducted a longitudinal study on the behavioral motivation and engagement of students as an outcome of relatedness with teachers and peers, which is characteristic of emotional engagement. Furthermore, studies of students' cognitive engagement as a function of autonomy suggest a significant relationship with students' behavioral engagement as a construct of their relatedness—the connectedness students have with their academic-social environment (Connell & Wellborn, 1991; Ruzek et al., 2016). Finally, Dweck and Leggett (1988) proposed that all types of engagement have some degree of effect on motivation. Therefore, it is necessary for any investigation of engagement to consider each of these subconstructs of engagement as endogenous variables of a meta-construct. While a study of this meta-construct presents clear limitations, such as validity concerns

and generalizability of results, the interaction between the subconstructs is too important to overlook. Therefore, one must consider each style of engagement in turn.

**Behavioral.** As defined above, behavioral engagement refers to the actions and behavioral choices of students as they seek to achieve learning and performance goals. The reasons that students engage or disaffect towards these goals are myriad (Fredericks et al., 2004). In addition, the manifestations of these behaviors are often difficult to observe or self-report in isolation. Behavioral engagement is closely tied to student's ability to self-regulate (Connell & Wellborn, 1991; Fredericks et al., 2004; Mih et al., 2015). Therefore, behavioral engagement merits investigation in active classrooms.

Initially, Connell and Wellborn (1991) provide an empirical connection between student autonomy and students' behavioral engagement with learning using path analysis. The behaviors that relate most closely to autonomy refer to the self-regulatory choices that students make towards learning and performance goals. Specifically, Connell and Wellborn refer to these behaviors as identifying expectations, working within the structure of the home, school, and the classroom, and involving themselves in the learning process (p. 56). Although some of these behaviors are associated with external motivators, such as parents or teacher pressures, versus internal motivators, such as interest, Connell and Wellborn (p. 63) is a moderate correlation between the student autonomy and teacher-perceived student engagement. In addition, students who demonstrate high levels of behavioral engagement have higher levels of internal self-regulation, while the reverse is true for students that evince disaffection for positive behaviors. Although the connection between behavioral engagement and autonomy has been established, its interaction with other components of engagement is still unclear.

Given the nature of engagement as a meta-construct, the subconstruct of behavioral engagement is also tangled with other styles of engagement. Behavioral engagement in the classroom is a function of teachers' actions as much as students' actions, and both may have the same degree of effect (Connell & Wellborn, 1991; Fredericks et al., 2004; Ruzek et al., 2016; Skinner & Belmont, 1993). Specifically, teachers' perceptions of student behaviors positively correlate with teachers' behaviors in terms of providing autonomy and self-regulation support for students (Skinner & Belmont, 1993). In other words, when teachers perceive students as behaviorally disengaged (that is to say that students are off-task), they may remove the opportunity for autonomy and vice versa. The relationships identified by Skinner and Belmont (1993) may influence the nature of student self-regulation, autonomy, and subsequent behavioral engagement. In fact, upon investigation of student behavior through self-report, Skinner and Belmont posited that teachers' behavior has a direct effect on students' behavioral engagement. Therefore, further investigation into behavioral engagement as a function of teacher perception of student engagement is necessary.

The behavioral aspect of the engagement meta-construct is composed of numerous positive, constructive behaviors and negative, maladaptive behaviors (Connell & Wellborn, 1991; Fredericks et al., 2004). While these behaviors appear to be distinct, the nebulous nature of engagement indicates that student behaviors exist as a schema of positive and negative manifestations and would have varied effects on achievement. Students who exhibit increased withdrawal and inattentive behaviors demonstrate lower academic achievement (Finn, Pannozzo, & Voelkl, 1995). In contrast, mastery-oriented approaches that support student involvement in classwork and relatedness have a positive

correlation with academic achievement (Mih et al., 2015; Ruzek et al., 2016). However, maladaptive and stressful behaviors also develop as a function of the student's relationship with the teacher; more positive relationships lend to more positive self-regulatory behaviors while the opposite is true for less positive teacher-student relationships (Rudolph et al., 2001). Accordingly, behavioral engagement in the classroom is also something of a two-sided construct that requires careful definition and analysis.

Furthermore, behavioral engagement is intimately intertwined with an individual's cognitive processing of class material. Student behaviors, whether positive or negative, may be the realization of the level of cognitive engagement (Lee & Anderson, 1993; Lee & Brophy, 1996). Therefore, any measure of behavioral engagement must include a measure of cognitive engagement, thus supporting the concept of engagement as a meta-construct. Regardless of instructional style, students not cognitively engaged in instruction—as measured through interviews and observation—exhibited low or disruptive behaviors in class, indicating low behavioral engagement (Lee & Anderson, 1993). Furthermore, when observed through a motivational lens, behavioral and cognitive engagement interacted to affect the students' goal orientation (Lee & Brophy, 1996). Since behavioral engagement is so closely tied to cognitive engagement, the measure of it as a meta-construct requires careful review. Ultimately, behavioral engagement relates to both cognitive and emotional engagement.

**Emotional Engagement.** Like behavioral engagement, emotional engagement is a construct that is often defined indirectly. Researchers tend to operationalize emotional engagement in terms of how students relate to content, instruction, classroom climate,

student-student relationships, and/or student-teacher relationships (Fredericks et al., 2004). Given the large range of possible operational definitions, empirical investigations of emotional engagement generally focus on singular aspects of a student's or teacher's emotional perspectives of a course or curriculum, with emotional engagement as the outcome variable (Archambault et al., 2013; Mih et al., 2015; Pietarinen et al., 2014; Ruzek et al., 2016). However, several investigations also posit that emotional engagement can be a mediating variable that may affect achievement outcomes (Connell & Wellborn, 1991; Dweck & Leggett, 1988; Wang & Eccles, 2013).

Although a student may not demonstrate emotional engagement with learning and instruction strictly because of content, the nature of student engagement with learning and teachers' perceptions of students' relatedness with each other influence learning and instruction, which subsequently affect achievement. Dweck and Leggett (1988) proposed that the direction of a student's emotional engagement—positive or negative—was the outcome of the perception of the effort necessary to attain the goals of learning and instruction. Dweck and Leggett define two types of goals for instruction: performance and learning. Performance goals are clearly defined goals based on what the students will be able to do in concrete terms (e.g., I will be able to calculate density); however, learning goals are less definitive and more subjective descriptions of what students should achieve (e.g., I will learn to calculate density). Whether the teacher structured the goals as performance or learning goals affected emotional engagement and eventual achievement (Ames & Archer, 1988; Dweck & Leggett, 1988). However, the nature of the student's emotional engagement may not only be affected by externally derived instructional features. Relatedness refers to the sense of emotional security the student

feels with the instruction, the teacher, and their social context—which includes peers and parents (Connell & Wellborn, 1991). The student's emotional security with parents, peers, and classmates significantly and positively correlates with the teacher's perception of the student's emotional engagement and later academic achievement (Connell & Wellborn, 1991). Therefore, designing instruction while considering emotional security may encourage emotional engagement.

Many researchers seek to disentangle the constructs subsumed by emotional engagement (Connell & Wellborn, 1991; Wang & Eccles, 2013); these studies often lead to understanding the moderating effects of emotional engagement. Although environmental setting and emotional attributes do have a relationship with student GPA, motivation constructs as moderating variables better explain variation about emotional engagement subconstructs, such as teacher emotional support and peer emotional support (Wang & Eccles, 2013). This suggests that emotional engagement is an outcome of numerous variables and affected by several internalized constructs that subsequently affect student achievement. Therefore, emotional engagement is a complex construct within a complex meta-construct.

Instructional design may also impact emotional engagement and subsequent behavioral engagement. Although the various forms of student-oriented instructional approaches that affect student attitudes are enumerated in previous sections, mastery-focused approaches also affect behavioral engagement and emotional engagement (Finn et al., 1995; Mih et al., 2015). In an investigation of emotional perceptions of school versus outcomes like absenteeism and dropout likelihood, data indicated that higher rates of mastery-focused approaches to student learning were associated with higher rates of

both emotional and behavioral engagement. Therefore, instructional methods affect both emotional and behavioral engagement.

As with behavioral engagement, there may be a link between emotional engagement and aspects of cognitive engagement. The nature of emotional engagement—as determined through the lenses of peer and teacher relatedness—correlates with student perceptions of cognitive engagement (Pietarinen et al., 2014; Wang, Chow, Hofkens, & Salmela-Aro, 2015). In addition, emotionally supportive environments foster supportive interactions that lead to effective cognitive engagement (Ruzek et al., 2016), though not necessarily competence as defined by Connell and Wellborn (1991). Evidence indicates that emotional engagement is a precursor to cognitive engagement; therefore, student well-being is closely tied with emotional and cognitive engagement and subsequent GPA (Pietarinen et al., 2014). However, the direction of causality is debatable given the lack of direct evidence and the social interactions of peers on autonomy, competence, and relatedness (Connell & Wellborn, 1991).

An additional caveat of the empirical evidence on emotional engagement is the effect of prior achievement. Achievement is positively correlated with emotional engagement (Connell & Wellborn, 1991; Ruzek et al., 2016; Wang & Eccles, 2013). When measured over time, changes in academic achievement (as measured by GPA) positively correlate with changes in emotional engagement as measured by depression and school burnout scales (Wang et al., 2015). These findings indicate that prior achievement may be a precursor to emotional engagement constructs while findings from other studies (Connell & Wellborn, 1991; Finn et al., 1995; Wang & Eccles, 2013)

indicate the reverse. Though these findings do not indicate a direction of causality, they do indicate that further research should address emotional engagement as part of a mechanism for achievement. Like behavioral engagement, emotional engagement is tangled with cognitive engagement due to the overlap in the constructs' characteristics and impact on outcomes such as achievement.

**Cognitive Engagement.** According to Fredricks et al. (2004), the extant literature on cognitive engagement is sparse due to the latent qualities of student cognition and the lack of observable attributes. In research that investigates cognitive engagement, other psychological theories and instruments are utilized. For example, self-regulation instruments are often cited as observable measures of cognitive engagement (Fredricks et al., 2004, p. 67). While some investigations utilized only a self-regulating framework, others demonstrate a link between other motivational frameworks and cognitive engagement (Piertarinen et al., 2014; Wang & Eccles, 2013; Wellborn & Connell, 1991); they are not necessarily interchangeable with cognitive engagement.

Self-regulation is a function of goal-oriented perceptions and behaviors in which the learner interprets assignments, achievement, and goals as something that he or she can do and implements appropriate behavior (Zimmerman, 1990); this is different from self-efficacy given that the student must plan and implement behaviors *based* on self-efficacy. Utilizing this framework, the learner's actions and achievement are a product of the degree of cognitive engagement experienced by the learner. Students demonstrate cognitive engagement through their sustained engagement with a task even though it progresses to more challenging materials, like perseverance (Lee & Anderson, 1993).

These findings indicate that cognitive engagement predicates behavioral engagement with a subsequent effect on achievement.

An additional framework often referenced as an expression of cognitive engagement is autonomy (Connell & Wellborn, 1991; Deci & Ryan, 1996; Klem & Connell, 2004; Ruzek et al., 2016). Autonomy is the control that learners have over their educational decisions and behaviors (Connell & Wellborn, 1991). When researchers rated the level of autonomy experienced by the students, they found a weak positive correlation between the level of autonomy and the perceived engagement of students by teachers (Connell & Wellbon, 1991). In connection with this relationship, Connell and Wellborn (1991) also reveal that there is a moderate positive correlation between teachers' perception of students' cognitive engagement (as measured through students' sense of autonomy) and eventual achievement outcomes.

These findings support the negative correlation between levels of autonomy and engagement discussed by Janosz, Archambault, Morizot, and Pagani (2008). Several factors affect students' risk of dropping out such as attendance or socioeconomic status; however, the level of cognitive engagement, as measured by students' perception of autonomy, in school as it changes over a learner's educational career also relates to the likelihood of dropping out. Janosz et al. discerned that there is a significant and inverse correlation between learners' change in engagement and the likelihood of dropping out of school.

**Theoretical Models of Motivation**

Motivation is a key component in student engagement and has an effect on student behaviors and learning outcomes (Skinner, Kindermann, Connell, & Wellborn,

2009). The role of engagement is to affect learner's intrinsic motivation to achieve learning goals and objectives (Dweck, 1986; Dweck & Leggett, 1988; Lee & Brophy 1986), which are a function of cognitive engagement. Intrinsic motivation is also positively correlated to students' learning outcomes and behaviors (Deci & Ryan, 1996). Intrinsic motivation is also part of a feedback loop that contributes to student engagement and achievement: intrinsic motivation contributes to the degree of students' self-directed learning behaviors (Loyens, Magada, & Rikers, 2008). These self-directed behaviors may be interpreted as behavioral engagement. The degree of student choice is a positive predictor of intrinsic motivation (Patall et al.,2008), which is an extension of how students perceive safety and relatedness in the classroom (Connell & Wellborn, 1991). Therefore, the role of motivation in developing student engagement cannot be overlooked.

**Theory of flow.** One motivational theory pertaining to engagement as a meta-construct is the concept of flow (Csikszentmihalyi, 1990; Shernoff et al., 2003) which is a state of engagement in which learners are completely engrossed and motivated to succeed at the challenge rather than suffer boredom or anxiety. A state of flow yields emergent motivation from the scaffold challenges that consumed all of the learner's attention without over-/underwhelming cognition (Nakamura & Csikszentmihalyi, 2014). This state is characterized by the students' lack of distraction due to external classroom stimuli such as irrelevant conversation or passersby in the hall. A motivational state of flow encourages learners to develop a sense of curiosity and interest, persistence, and low self-centeredness, which leads to motivation by intrinsic factors. When studies identify flow, they can determine the extent of the student's engagement with instruction.

Flow theory, as it pertains to learners, explains that a task must simultaneously be challenging, require concentration, and be interesting while the learner enjoys the task (Shernoff et al., 2003). These qualities address intrinsic motivation and foster it throughout the learning task. Shernoff et al. (2003) used the experience sampling method to measure students' activity, affective, and cognitive engagement determine the degree of flow and engagement they were experiencing. Shernoff et al. determined that engagement as measured by interest, enjoyment, and concentration was positively correlated to flow. These results indicate that motivation by flow is related to engagement, and Shernoff et al. also posit that flow has a reciprocal effect on autonomy and engagement, (c.f. Connel & Wellborn, 1996). However, the study did not specifically measure these qualities.

Adaptive e-learning systems, similar to online instruction, utilize flow to determine engagement and subsequent student achievement (Katuk, Kim, & Ryu, 2013). Flow determines the engagement in e-learning systems by affecting personal interest, curiosity, and attention. However, it is difficult to accurately determine the optimal flow experienced by a learner using adaptive e-learning software given the difficult of perfectly matching e-learning instruction into the learner's level of expertise. Because e-learning systems have margins of error in pre-/post-assessment of learner ability and utilize pre-existing learning progressions, ideal adaptation to the learner's needs and abilities is difficult to attain. Ultimately, flow may explain the nature of student engagement with learning activities.

**Self-regulation.** The nature of behavioral and cognitive engagement is often expressed through the motivational construct of self-regulation (Dabbagh & Kitsantas,

2013; Loyens et al., 2008; Wellborn & Connell, 1991). Using this theoretical construct, students "plan, set goals, organize, self-monitor, and self-evaluate at various points during the process of acquisition" (Zimmerman, 1990, p. 5). These skills require intrinsic motivation that fosters engagement and may contribute to teachers' and students' implementation of personalized learning strategies.

Students' engagement is related to their internalized motivational constructs (Dweck & Leggett, 1988) . In addition, higher motivation leads to a greater use of self-regulatory behaviors, which lead to greater achievement (Pintrick & De Groot, 1990). These behaviors are related to students' prior achievement and success during learning such that higher achieving students demonstrate greater self-regulatory behavior (Pintrich & De Groot, 1990). The reciprocal relationship between cognitive engagement and self-regulatory behaviors is such that cognitively engaging students with the motivation to use self-regulatory behaviors is more effective for student achievement than either one alone. For these reasons, self-regulation is an effective measure of cognitive engagement.

Self-regulation is a manifestation of intrinsic motivation because the behaviors associated with self-regulation include feeling a connection to the content and the social environment, a sense of autonomy, and an internalized positive perception of competence (Deci & Ryan, 1996). These align with Connell and Wellborn's (1991) construct of engagement including relatedness, autonomy, and competency. Furthermore, according to Deci and Ryan (1996), self-regulation is composed of self-determination and goal-orientation (Ames & Archer, 1988). Consequently, self-regulation subsumes numerous engaging behaviors and motivational constructs.

Just as self-regulation has positive behaviors, it can also account for maladaptive behaviors. As students transition from elementary to middle grades, they adapt to school norms by constructing a set of beliefs and behaviors consistent with their experiences during the transition (Rudolph et al., 2001). Analyses of student maladaptive behaviors as measured by teacher perception and student self-report indicate that maladaptive behaviors interact with student anxiety and depression to yield significantly greater use of maladaptive behaviors such as academic helplessness and low levels of self-regulation.

As a motivational construct, self-regulation is a recursive skill that serves as a means to master challenging material. Self-regulation depends on intrinsic motivation to complete a task and a positive sense of self-efficacy (Zimmerman, 2002). The intrinsic motivation and self-efficacy positively correlate with self-motivation and the self-awareness of individual limitations. When students engage in self-regulated behavior, they are actively engaged in planning their learning actions, performing these actions, and then self-reflecting on their performance to either progress to a new and more challenging learning goal or re-direct their attention towards mastery of the current learning goal (Hattie & Timperley, 2007; Zimmerman, 2002). This reflective cycle affects the students' intrinsic motivation and self-efficacy. With such a correlation, high achieving students internalize successful self-regulating behaviors while low achieving students attribute success or failure to external factors, such as poverty or the natural-born intellect of others (Deci & Ryan, 2000; Rotter, 1966).

**Self-Determination.** Similar to self-regulation, self-determination involves learners managing their own behaviors to attain mastery of a learning goal; however, a key distinction between the two is the degree of learner control over learning tasks

(Loyens et al., 2008). Self-determined learning results from the learner's active choices regarding learning tasks while self-regulation is more strongly related to the student's approach to the task and its completion in terms of planning and execution. Though this distinction is minute, it is fundamental to understanding the nature of engagement.

Additionally, self-determination is a measure of engagement sub-constructs. In a review of student-reported behaviors and emotional rapport with the classroom, Skinner et al. (2008) concluded that the emotional engagement for a learning task was a function of autonomy and relatedness to the content, instruction, and teacher. This state of emotional connection predicates the level of disaffection that students internalize, which, in turn, influences the degree of self-determined actions in which the learner engages.

Furthermore, self-determination exists on an operationally defined continuum. These levels of self-determination can be defined as

> *external* regulation, in which participation is based on demands from authority, rule compliance, or fear of punishment, to *introjected* regulation, in which participation is based on internal esteem-based pressure to act, to *identified* regulation, in which participation is based on one's own personal goals, and, finally, to *integrated* regulation, in which performance is based on values that have been incorporated into the authentic self. (Skinner et al., 2009, p. 14)

Each of these levels bears a distinct relationship with the levels of engagement and disaffection perceived by the students. These perceptions of engagement are a result of students' perceptions of themselves as learners and their self-efficacy in choosing instructional methods that help them attain mastery.

Since self-determination acts as a motivator for students, it is natural to utilize the degree of supports that an environment has on student engagement and learning. The nature and extent of self-determined practiced by a student also mediates student behaviors that are a result of identified or integrated regulation (Skinner et al., 2009; Wang & Eccles, 2013). The environment should contain degrees of emotional support and support the student's autonomy. Through these supports, self-determination serves as a mediator of the relationship between instruction and achievement.

Finally, self-determination supports the development of autonomy, relatedness, and competency (Ruzek et al., 2016), all of which are fundamental components of engagement (Connell & Wellborn, 1996). Over the course of the year, students' motivation for mastery increased as emotional relatedness increased; furthermore, the students' perceptions of competence changed in a similar fashion (Ruzek et al., 2016). Ruzek et al. proposed that student engagement increases as a result of the development of self-determination components.

**Goal-orientation theory.** An additional motivational construct that appears in the literature on engagement is mastery towards learning goals, also called goal-orientation theory (Ames & Archer, 1988; Dweck, 1986;). The premise of motivation by goal orientation is that students seek to achieve specific performance or learning goals that are set by the teacher in a manner that students understand. These relate to engagement given that students use goals to determine necessary cognitive tools and behaviors in which to engage to achieve these goals (Dweck & Leggett, 1988; Lee & Brophy, 1996).

Ames and Archer's (1988) work expounds the details and values of goal-orientation as they affect student motivation, and therefore engagement with instruction.

A clearly defined and attainable learning goal more readily motivates the student by instilling a sense of mastery. A clear goal of mastery over performance engages students to regulate their behaviors, which predicts higher achievement. Most important to goal-orientation, according to Ames and Archer, is the students' perception of the mastery-based objectives in the classroom. The greater students' perception of mastery versus performance, the greater prediction of success as measured by academic achievement.

The nature of instructional design can influence student motivation at the individual and school level. Per a review by Meece et al. (2006), students that adopt a mastery-based approach—analogous to Ames's and Archer's (1988) goal-orientation—to learning do not disengage as much as those that have a performance-based approach. In additional to the individual level benefits, this relationship is prevalent among at the classroom level as they transition from elementary to middle to high school (Meece et al., 2006). Also, goal oriented instruction is associated with higher intrinsic motivation and overall academic achievement, provided that students have the opportunities to adapt their learning strategies to the instruction and learning goals.

## Framework of Study

Several limitations exist in the current literature on personalized learning and engagement. The role of this study is to address the limitations in the wider range of research.

A significant theoretical limitation in the literature is the treatment of personalized learning as individualized learning (Keller, 1968; Huang, Liang, Su, & Chen, 2012). Personalized learning emphasizes integrating the interests of the individual into instruction and assessment (Anand & Ross, 1987; López & Sullivan, 1991, 1992); in contrast, individualized instruction allows for student choice in assignment and pace

while the details of assignments and assessments are not unique to the students interest and/or biographical details (Eyre, 2007; Slavic, 2012). Personalized instruction research frequently occurs at the classroom level with a successful impact on student learning (Walkington, 2013).

The current investigation attempts to address these theoretical limitations and added to the literature on personalized instruction. The operational definition of personalized learning is instruction that incorporates the interests of the students and centered around student-driven pacing, mastery-oriented learning, and a reflective assessment process. Through professional learning communities and reflective discussion, the personalized learning strategies of each classroom are assessed and aggregated at the school level to yield an overarching impression of personalized learning implementation. Finally, the research tool (see Appendix A) acknowledges personalized learning through pencil-paper based instruction in addition to more advanced technological options.

In addition to the limitation with personalized learning, there is a gap in the literature regarding engagement. Engagement is usually treated as several distinct constructs (Connell & Wellborn, 1991; Fredericks et al., 2004; Ruzek et al., 2016). This style of analysis provides detailed insight into a construct, but overlooks possible effects of other constructs. Studies often combine two constructs for possible interactions through path analysis, but do not address the missing construct (Wang et al., 2015; Wang & Eccles, 2013). Furthermore, engagement is typically measured using teacher perceptions of student engagement (Connell & Wellborn, 1991) or observation of student

self-regulatory behaviors (Rudolph et al., 2001; Shernoff et al., 2003; Zimmerman, 2002), which neglects students' perceptions of their engagement.

The current study seeks to overcome these limitations by treating engagement as a meta-construct and utilizing both teacher and student perceptions of engagement. As a meta-construct, the interaction effects of the sub-constructs—behavioral, emotional, and cognitive—will not be lost. In addition, measuring teachers' perceptions and students' perceptions will provide a deeper understanding of the nature of how engagement plays out in the classroom on both sides of instruction.

The overarching purpose of the present study was to elucidate the mediating nature of engagement on personalized learning and achievement. The literature provides evidence that personalized learning is effective for learning (Eyre, 2007; Song et al., 2012; Walkington, 2013) and that engagement is effective for promoting student achievement (Connell & Wellborn, 1991; Fredericks et al., 2004; Skinner et al., 2009). However, there is a gap in the literature regarding the connection between engagement and personalized learning that this study seeks to fill.

## Summary

As education reform moves towards student centered instruction (Wolf, 2010), personalized learning and engagement move to the forefront of educational pedagogy. The nature of personalized learning began with individualized instruction that focused on mastery, student-determined pace, and assessment for learning purposes (Bloom, 1968; Carroll; 1963) and student choice (Keller, 1968). The step to personalization incorporated student interests into assignments and assessments (López & Sullivan, 1991; Song et al.,

2012; Walkington, 2013). Given these steps at the classroom level, this study seeks to investigate personalized learning at the school level.

Of course, engagement is a complex construct that subsumes behavioral, emotional, and cognitive engagement (Fredericks et al., 2004). Each of these sub-constructs contribute to students' social interactions and subsequent educational outcomes (Connell & Wellborn, 1991; Wang & Eccles, 2013). Even so, engagement is predicated on the intrinsic nature of motivation as theorized by flow (Shernoff et al., 2003), self-regulation (Skinner et al., 2009), or goal-orientation (Ames & Archer, 1988; Dweck & Leggettt, 1988). Therefore, this investigation considers engagement at the school level as well through the lenses of motivational constructs.

Ultimately, the purpose of this investigation is to determine the nature and extent of the mediating effect that engagement has on the relationship between personalized learning and achievement. As cited above, personalized learning has positive correlations with achievement; also, engagement—and its subconstructs—have moderate positive correlations with achievement. Furthermore, the behaviors associated with engagement, such as self-regulation, correlate with engagement constructs (cf. Eyre, 2007; Fredericks et al., 2004). Thus, the role of engagement in the relationship between personalized learning and achievement merits investigation.

# CHAPTER III: METHODOLOGY

## Introduction

Personalized learning and engagement are of interest to both teachers and educational researchers (Eyre, 2007; Fredericks et al., 2004; Skinner et al., 2009; Wolf, 2010). Initially, individualized instruction was that in which teachers focused on the needs and abilities of the class as a whole versus the school itself (Carroll, 1963). Eventually, distinct components that were later added that determined that individualized instruction focused on individual students' needs and abilities instead of the class as a whole (Bloom, 1968; Keller; 1968); this eventually led to the incorporation of the students' interests as part of personalized instruction (López & Sullivan, 1991; Song et al., 2012; Walkington, 2013). Additionally, engagement is a complex construct composed of several subconstructs (Fredericks et al., 2004) and is driven by motivational factors (Ames & Archer, 1988; Csikszentmihalyi, 1990; Skinner et al., 2009). Due to gaps in the literature discussed in Chapter II, the current study addresses the central research question: To what extent does student engagement mediate the relationship between personalized learning and student achievement?

The central research question of this study addresses not only the needs of the field, but also an educational reform initiative called Kids-Focused, Responsible, Imaginative, Engaged, Determined to Learn (kid•FRIENDLy; Link & Sells, 2017). The goal of the program is to improve students' learning, leadership, and college/career readiness. The kid•FRIENDLy program was funded by a $41 million federal Race to the Top – District grant for the purpose of addressing college and career readiness needs in rural and urban K-12 school districts in Kentucky. Given the size and scope of the

program, qualitative and quantitative evaluation is necessary to determine progress towards its goals. Though the program includes several smaller initiatives, the proposed study focuses on the programs within kid•FRIENDLy called "Personalized Learning" and measures taken from within the program "Students as Leaders." The proposed study will not be conducted as part of the federally required program evaluation, but it provides a richer understanding of the workings of the kid•FRIENDLy program's efforts as a whole.

The nature of this study is to investigate the extent to which engagement serves as a mechanism for the impact of personalized learning on achievement. This was accomplished through mediation analysis (i.e., the analysis of a third variable as a means of facilitating the predictor's effect on the outcome variable (Barron & Kenny, 1986; Jose, 2013). Aspects of personalized learning such as formative assessment (Buntat et al., 2013; Fastré et al., 2014), flexible pacing (Bangert-Drowns et al., 1991; Block & Burns, 1987), mastery-oriented structure (Bloom, 1968; Keller, 1968), and personal interest (López & Sullivan, 1991; Song et al., 2012; Walkington, 2013) have positive correlations with student achievement; as do the sub-constructs of engagement (Connell & Wellborn, 1991; Fredericks et al., 2004). Given that components of personalized learning are similar to the sub-constructs of engagement, engagement was expected to play a mediating role in personalized learning's effect on achievement.

To elucidate this mechanism, it was essential to measure the extent of personalized learning and engagement in schools. Since schools implementing the kid•FRIENDLy program intentionally focus on personalized learning and engagement, this investigation focused on participants within the kid•FRIENDLy program. The

mediation process involved a series of multiple regressions (Barron & Kenny, 1986; Jose, 2013), so this study was quantitative by nature and relied on self-report surveys of engagement and school-level self-reports of personalized learning implementation. The following empirical research questions support the central research question:

1. To what extent do the implemented components of school-wide personalized learning predict student achievement while the following variables serve as covariates:
    - Gender
    - Ethnicity
    - Free-reduced lunch status
2. To what extent do the implemented components of school-wide personalized learning predict student engagement while the following variables serve as covariates:
    - Gender
    - Ethnicity
    - Free-reduced lunch status
3. To what extent does engagement predict student achievement while the following variables serve as covariates:
    - Gender
    - Ethnicity
    - Free-reduced lunch status
4. To what extent does engagement mediate personalized learning and student achievement while accounting for the effects of the following

variables?

- Gender
- Ethnicity
- Free-reduced lunch status

These components produce an overall model and predictions as seen in Figure 2:

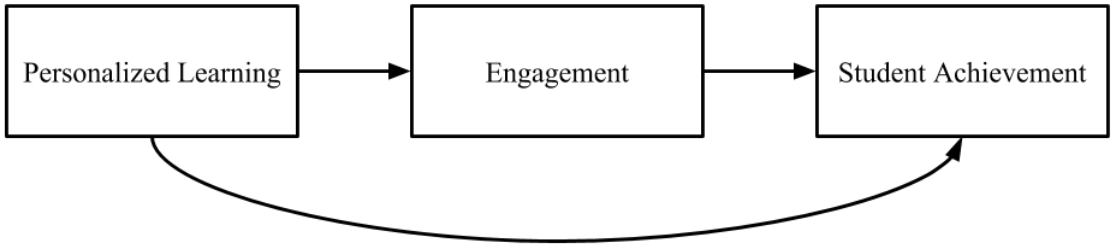


*Figure 3*: Model of the mediation of personalized learning by the variable engagement.

Given the lack of evidence on the relationships between school size, socioeconomic status and personalized learning and engagement, predictions for these relationships are difficult to generate. However, these variables were included due to their established relationship with academic achievement (Anand & Ross, 1987; Cakir & Simsek, 2010; Connell & Wellborn, 1991; Fredericks et al., 2004; López & Sullivan, 1991, 1992).

## Strategic Method of the Study

In order to address the evaluation needs of the kid•FRIENDLy program and the quantitative needs of the study, not only should the strategy involve careful consideration of participants but also the careful construction of instruments. This section outlines the strategy of participant selection, variable determination, and instrument construction.

## Participants and Components

Two educational cooperatives implemented the kid•FRIENDLy program, which includes 111 K-12 schools in 22 districts across Kentucky that vary in socioeconomic status and demographic status. These schools make up the sample of the investigation. Under the terms of the grant, every school must complete a self-report survey of students' perceptions of their engagement with learning and teachers' perception of their students' level of engagement, and assess the level to which they implement personalized learning schoolwide. Therefore, the sample includes every school in the grant, but the results may be generalized to similar schools in the state of Kentucky, so the population would include schools in rural and urban districts willing to implement changes in student leadership *and* personalized learning.

School stakeholders determined their level of implementation of personalized learning using the kid•FRIENDLy Personalized Learning Innovation Concept Map (see Appendix A). Leaders in the kid•FRIENDLy program used thorough training materials to guide school stakeholders in reporting their personalized learning score. Schools were allowed to use numerous pieces of evidence to support their scores, such as teacher lesson plans, school improvement plans, and student/teacher interviews. Each school in the kid•FRIENDLy program completed this self-evaluation as part of the program evaluation.

## Variables

The two variables of influence in the present study, as seen in Figure 2, are personalized learning and engagement. Each of these variables was measured using a

continuous scale, which is ideal for interpreting mediation analysis results (Jose, 2013). Each variable will be discussed further in the following sections.

As a variable, personalized learning was constructed from core components that are each incorporated into the kid•FRIENDLy Personalized Learning Innovation Concept Map (see Appendix A) in the form of standards: The Learning Process, Climate, Teachers, and Students. The Learning Process details the components mostly closely related to the instructional aspects of personalized learning (i.e., mastery-oriented, autonomy, assessment). Climate refers to the extent to which the classroom structure promotes personalized components such as flexible pacing in both classroom schedule and the school's master schedule. The Teachers and Students parts of the map measure the implementation of personalized interests or needs into instruction for the student, classroom, school, and/or community.

However, the schools were encouraged to design their own personalized learning components in ways that aligned with these components. For example, one school may choose to address learning climate using online services, while another school chooses to modify its master schedule to provide more flexibility. These variations in implementation are a limitation to the reliability of the map. Even with these variances, the map ultimately measures personalized learning as a sum score for further analysis as a single continuous variable.

**Instruments**

The Rock Solid Evaluation team developed the kid•FRIENDLy Personalized Learning Innovation Concept Map (see Appendix A) based on a thorough review of the literature regarding personalized instruction models (Midgley et al., 2000), competency-

based instruction, students and teachers as leadership models, engagement, and factors relating to student drop out. Following construction and review by the kid•FRIENDLy program staff, schools in the program self-evaluated their degree of implementation of personalized learning. Members of the evaluation team visited three elementary, two middle, and two high schools in the program to validate the scores; the present researcher was a member of the validation group. Inter-rater reliability was high, $\kappa = 0.83$, $p < 0.01$ (Field, 2009).

Given the literature on engagement (Connell & Wellborn, 1991; Fredericks et al., 2004), several items from the Student-Teacher Engagement Performance Instrument (STEP) survey (see Appendices B and C) constitute the measure of the meta-construct. The STEP survey measures perceptions of emotional, behavioral, and cognitive engagement in both students and teachers in addition to other constructs such a sense of futility and social perceptions; however, only the engagement constructs were retained for this study. These sub-constructs were then scaled into factor scores and together yielded an overall score for engagement.

Following construction of the STEP survey and review by the evaluation team, kid•FRIENDLy distributed the survey at the end of the first year of the three-year program. This survey served as the pilot for further confirmatory factor analysis of engagement sub-constructs (Bentler, 1990; Marsh, Hau, Balla, & Grayson, 1998). Items with low loadings (< 0.7) were deleted and the survey was revised. The evaluation team used this process to refine the student and teacher versions of the STEP survey. The evaluation team issued the final form of the 98-item survey in the third year of the

program. Although the STEP measures several subconstructs, the emotional, cognitive, and behavioral engagement components were the elements utilized in this study.

## Analytical Method of the Study

Mediation is a statistical term that is often used interchangeably with moderation; however, these procedures are equivalent neither in meaning nor in calculation (Barron & Kenny, 1986; Jose, 1986). Mediation explains the mechanisms of the relationships between three variables, but moderation explains an interaction in the relationship between three variables (Barron & Kenny, 1986). In their seminal article on mediation and moderation, Barron and Kenny (1986) describe mediation as partial correlations between predictor variables, mediator variables, and outcomes variables. Partial correlations may be calculated via multiple linear regression utilizing covariates; however, the mediation effect is determined by comparing the regression pathways involving the mediating variable to the regression pathway without the mediating variable. The central hypothesis that engagement's correlations with personalized learning and achievement merits investigation into the mediating effect of engagement. What follows is a description of the multiple linear regressions conducted for each research question.

Research Question 1 addresses the correlation between personalized learning and achievement. In order to address the predictive nature of this relationship, the analysis utilized multiple linear regression treating personalized learning as a continuous predictor variable. Several covariates were included: gender (coded dichotomously), ethnicity (dummy coded into five categories), school-size (continuous), and free/reduced lunch status (continuous). The correlation coefficient of the relationship of personalized

learning with achievement served as the baseline comparison for the correlation coefficients of the mediation pathway.

Research Question 2 involves the relationship between personalized learning and engagement; however, in this question, engagement was *not* treated at a mediating variable. Given the continuous nature of both predictor and outcome variables, multiple linear regression was suitable with covariates coded similarly to Research Question 1. In order to measure the correlation of these two variables, engagement measures were aggregated to the school level. The sample size ensureds that assumptions of normality were not violated (Fields, 2009).

Research Question 3 concerns the correlation between engagement and student achievement. As for Research Question 2, engagement was not treated as a mediating variable because, for this empirical question, engagement served as the predictor variable. Multiple linear regression with covariates coded similarly to Research Questions 1 and 2 was the statistical method used.

In order to discern the nature of the mediating effect of engagement, the analysis employed a second layer of regressions to determine the change in the correlation of personalized learning with achievement when engagement was included in the model. To assess the significance of this difference, further analysis employed Sobel's test of significance (Sobel, 1982) at the 0.05 level.

## Limitations

As with any study, this investigation has limitations, addressed here. The first limitation to the analysis is the size of the sample data. Given that the total number of schools participating in the kid•FRIENDLy program is only 111, there may be issues

with normality in the analysis of school-level variables. Second, each of the 22 districts in the program elected to be involved with the program and are required to adhere to specific components for the sake of fidelity of implementation. Therefore, stakeholders may have experienced bias in responses (Fowler, 2013). This required fidelity may have affected measures of personalized learning and engagement. Third, the small sample size of personalized learning increases risks of propagated measurement errors (Fields, 2009); furthermore, the aggregation of engagement data to the school level poses the risk of losing some nuances of the data. Fourth, the operationalization and implementation of personalized learning at the school level varies due to individual differences within and at the school level. Finally, a theoretical assumption of mediation is that, once the mediating variable is introduced into the mechanism, the correlation between the predictor variable and the outcome variable will drop to zero (Barron & Kenny, 1986). However, Jose (2013) suggests that this is both unlikely and unrealistic for the social sciences in light of ever-present measurement error. Therefore, partial mediation is more likely than full mediation for the present study.

## Summary

The goal of this investigation was to determine the extent of the mediating effect of engagement on the relationship between personalized learning and achievement. Central to the study was the kid•FRIENDLy program offered to schools and districts in Kentucky for the purpose of increasing student leadership and personalized learning. The kid•FRIENDLy program instructs schools in several components of personalized learning (Ames & Archer, 1988; Erye, 2004; Sturgis & Patrick, 2010; Wolf, 2010) and engagement (Connell & Wellborn, 1991; Frederick et al., 2004). Through the use of

survey and self-evaluation reports, this investigation determined the extent of the relationships between these variables.

The size and scope of the kid•FRIENDLy program includes 22 districts and 111 schools with the intention of expanding the findings from this program to the population of the education profession in Kentucky. These participants self-evaluated their personalized learning and self-reported engagement as conditions of the program. These evaluations and reports yielded two variables for analysis in this study: personalized learning and engagement. These scores provide secondary data for mediation analysis (Barron & Kenny, 1986; Jose, 2013).

The mediation analysis of the study sought to elucidate the mechanism by which students utilize engagement as a pathway from personalized learning to achievement at the school-level. This style of analysis required several linear multiple regressions between the predictor variable, personalized learning, and the outcome variable, achievement. Analyses also addressed several covariates such as gender, ethnicity, school size, and free/reduced lunch population.

During analysis and later interpretation, there were limitations that should be considered. Small sample size and aggregation of data present concerns with the assumptions of multiple linear regression (Fields, 2009) and there is always the threat of social desirability bias during self-report or self-evaluation (Fowler, 2013).

# CHAPTER IV: RESULTS

## Introduction

In order to determine the mediating effect of engagement, personalized learning scores, engagement scores, demographic data, and achievement were aggregated to the school level. Missing values in achievement, which constituted 12% of the data for achievement and less than 1% of the overall data, were handled with expectation maximization with bootstrapping algorithm for imputation using the *amelia* R package for 13 of 111 participants (Honaker, King, & Blackwell, 2011). Personalized learning had a mean of 11.21 (*SD* = 0.99) and engagement had a mean of 19.74 (*SD* = 1.15) on a scale of 15 to 25. The mean of overall achievement was 210.27 on a scale of 100-260 (*SD* = 4.25). The sample consisted of 52% white students, 52% male, and 67% low socioeconomic status (SES). Correlations between individual variables included in the mediation analyses can be found in Table 1.

## Personalized Learning and Achievement Results

To test the hypothesis of research question 1 that personalized learning is significantly related to achievement, student level achievement data were aggregated into school level achievement data. In other words, elementary school data included achievement for students in grade 4-5, middle school data included grades 6-8, and high school data included for grades 9-12. The following regression proposes personalized learning's effect on achievement:

$$\text{Achievement} = \beta_0 + \beta_1(\text{Personalized learning}) + \beta_2(\text{Gender}) + \beta_3(\text{SES}) + \beta_4(\text{Race})$$

Table 1

*Correlations between achievement, personalized learning (PL), engagement, and covariates*

| | PL | Engagement | Gender | Race | SES | Achievement |
|---|---|---|---|---|---|---|
| PL | 1.00 | | | | | |
| Engagement | -0.07 | 1.00 | | | | |
| Gender | 0.05 | 0.04 | 1.00 | | | |
| Race | 0.03 | -0.12 | -0.15 | 1.00 | | |
| SES | -0.12 | 0.21* | 0.18 | -0.01 | 1.00 | |
| Achievement | 0.05 | 0.50* | -0.06 | 0.19* | -0.12 | 1.00 |

* $p < 0.05$

Results of the regression analyses indicate that achievement is not significantly predicted by personalized learning scores, gender, SES, or race ($F(4, 106) = 1.371$, $p = 0.249$), $R^2 = 0.013$. Table 2 indicates coefficients and significance levels for coefficients and intercepts. Contrary to the hypothesis that personalized learning has a significant effect on achievement, results indicate that neither gender, SES, nor race have a significant effect on the relationship between personal learning and achievement. These results contradict the proposed relationships in previous research on goal-orientation (Ames & Archer, 1988), flexible pacing, and formative assessment (Kulik et al., 1979; Tevaggia, 1976) and the hypothesis of the first research question.

## Engagement and Achievement Results

Using factor scores that served as coefficients for each engagement construct score that were summed to produce a single engagement score for the school, the researcher generated a score for engagement from the teacher and student perception survey (see Appendix B).

Table 2

*Multiple regression coefficients of the relationship between personalized learning and achievement.*

| | Coefficient | Std. Error | t-value | *p* |
|---|---|---|---|---|
| Intercept | 207.22 | 8.77 | 23.30 | <0.001 |
| PL | 0.06 | 0.20 | 0.31 | 0.751 |
| Gender | -2.18 | 15.07 | -0.14 | 0.885 |
| SES | -3.16 | 2.77 | -1.14 | 0.256 |
| Race | 6.60 | 3.49 | 1.88 | 0.062 |

Factor analysis of engagement results by Houchens et al. (2014) provided the scale reference to determine the engagement score for each school. The proposed model between engagement and achievement is

$$\text{Achievement} = \beta_5 + \beta_6(\text{Engagement}) + \beta_7(\text{Gender}) + \beta_8(\text{SES}) + \beta_9(\text{Race})$$

This model hypothesizes that achievement is significantly related to engagement when controlling for gender, SES, and race.

Multiple linear regression with bootstrapping (Preacher, Rucker, & Hayes, 2007) was used to calculate how engagement predicts achievement with gender, SES, and race as covariates. The regression equation for the effect of engagement on achievement is significant, $F(4, 70) = 8.69$, $p < 0.001$,($R^2 = .306$), in which 30.6 % of the variance in engagement explains the variance in achievement and covariates. Beta values are present in Table 3. This relationship predicts that as the individual's score for engagement increases so should achievement. In addition, SES was negatively correlated with achievement indicating that as the number of students receiving free-reduced lunch decreases, achievement will increase. Furthermore, results indicate that as the ratio of white students to disadvantaged groups increases, then achievement increases as well.

However, gender was not a significant predictor of engagement's effect on achievement. Therefore, engagement, SES, and race are significant predictors of achievement. Given the significant nature of engagement's ability to predict achievement, engagement may demonstrate a significant mediating effect between personalized learning and achievement that merits further investigation.

Table 3

*Multiple regression coefficients of the variables predicting achievement*

| | Coefficient | Std. Error | t-value | *p* |
|---|---|---|---|---|
| Intercept | 164.64 | 9.11 | 18.069 | < 0.01 |
| Engagement | 2.15 | 0.29 | 7.381 | < 0.01 |
| Gender | -0.17 | 12.22 | -0.014 | 0.98 |
| SES | -6.80 | 2.28 | -2.979 | < 0.01 |
| Race | 9.25 | 2.86 | 3.237 | < 0.01 |

**Mediating Effect of Engagement**

Prior to determining the overall mediating effect of engagement on the relationship between personalized learning and achievement as hypothesized in research question 3, personalized learning did not significantly predict engagement, $F(4, 105) = 1.678$, $p = 0.16$. Even when gender, SES, and race were removed from the model, personalized learning did not significantly predict engagement. Although the individual effect of personalized learning on engagement is not significant, the overall mediating effects of engagement on personalized learning's ability to predict achievement merits further investigation. The results of the regression analysis of personalized learning predicting engagement are provided in Table 4.

Table 4

*Multiple regression coefficients of the relationship between personalized learning and engagement.*

| | Coefficient | Std. Error | *t*-value | *p* |
|---|---|---|---|---|
| Intercept | 20.27 | 2.37 | 8.52 | < 0.01 |
| PL | -0.024 | 0.055 | -0.43 | 0.66 |
| Gender | -0.60 | 4.08 | -0.14 | 0.88 |
| SES | 1.59 | 0.75 | 2.12 | 0.03 |
| Race | -1.19 | 0.94 | .1.26 | 0.20 |

To determine the extent of engagement's mediating effect on the relationship between personalized learning and achievement, the researcher utilized the *mediation* R package (Tingley, Yamamoto, Hirose, Keele, & Imai, 2014). Results indicate that personalized learning is not a significant predictor of achievement ($\beta$ = 0.12, SE = 0.16, $p$ = 0.12) but engagement is a significant predictor of achievement ($\beta$ = 2.16, SE = 0.28, $p$ < 0.001). In addition, personalized learning is not a significant predictor of engagement ($\beta$ = -0.02, SE = 0.05, $p$ = 0.65). Given that personalized learning is not a significant predictor of achievement, engagement has no mediating effect on the personalized learning and achievement relationship (see Table 5). Using the bootstrap method of mediation analysis, the direct effect of the mediation model (see Figure 2) was not significant ($\beta$ = 0.12, SE = 0.16, $p$ = 0.470), nor was the indirect effect ($\beta$ = -0.05, SE = 0.12, $p$ = 0.67).

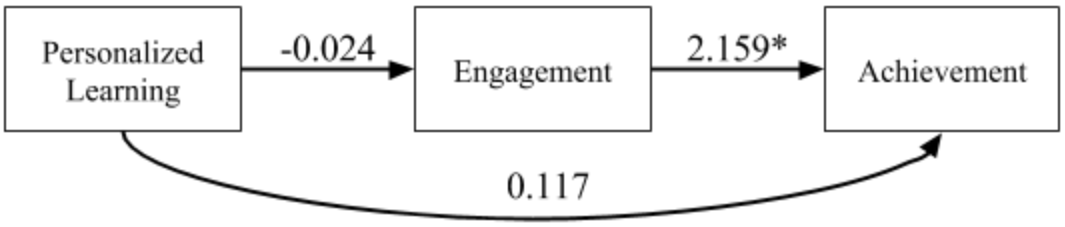


*Figure 4*. The estimated mediating effects of engagement on the relationship between personalized learning and achievement.

Furthermore, no significant correlation between personalized learning and engagement ($r$ = 0.02, $p$ =0.66) was found, though 37% of the variance in achievement is explained by the variance in engagement ($R^2$ = 0.37). Finally, the only covariates that are significant in the indirect path were Race ($\beta$ = 9.19, SE = 2.79, $p$ < 0.01) and SES ($\beta$ = -6.61, SE = 2.24, $p$ < 0.01). These findings indicate that as the ratio of white to disadvantaged groups increases, then overall school-level achievement increases; also, as the ratio of low SES students to high SES students decreases then overall school achievement increases.

The indirect effect of engagement on achievement is -0.05 (SE = 0.11, $p$ = 0.65), 95% CI [-0.16, 0.06] on the average mediated causal effect (ACME), which is less than 0.01 at both the upper levels ($p$ > 0.05), while the average direct effect (ADE) is -0.024 ($p$ = 0.61), 95% CI [ -0.11, 0.06]. These results indicate that the mediating effect of engagement on the relationship between personalized learning and achievement is not significant, contrary to the hypothesis for Research Question 2.

Table 5

*Mediation analysis of the effects of engagement on the relationship between personalized learning and achievement*

| Effects | Path | Path Coefficient | Indirect Effects | SD | Total Effect | *t*-values | *p* | Decision |
|---|---|---|---|---|---|---|---|---|
| Direct without mediator | PL → Ach | 0.06 | Not applicable | | | 0.31 | 0.75 | Rejected |
| Indirect with mediator | PL → Ach | 0.11 | Not applicable | | 0.06 | 0.47 | 0.05 | Rejected |
| | PL → Eng | -0.02 | -0.05 | 0.11 | | 0.65 | 0.04 | Rejected |
| | Eng → Ach | 2.15 | | | | 7.54 | <0.01 | Accepted |

## Conclusion

The results of the present study indicate that engagement does not have a significant mediating effect on personalized learning's prediction of schoolwide achievement. Though engagement does significantly predict achievement, personalized learning significantly predicts neither engagement nor achievement. These findings contradict the literature regarding personalized learning (Anand & Ross, 1987; Ross & Anand, 1987; Song et al., 2013; Walkington, 2013). However, these results support the literature that engagement is significantly related to achievement (Ames & Archer, 1988; Archambault et al., 2015; Connell & Wellborn, 1991; Dweck & Leggettt, 1988; Fredericks et al., 2004).

# CHAPTER V: DISCUSSION

## Discussion of Findings

In the case of Research Question 1, school-wide implementation of personalized learning in the GRREC/OVEC Race to the Top districts did not significantly predict achievement regardless of whether covariates are included in the model (see Table 2). Furthermore, personalized learning failed to significantly predict engagement as hypothesized in Research Question 2 (see Table 3). However, as hypothesized in Research Question 3, engagement did significantly predict student achievement (see Table 4).

Previous research indicates that personalized learning and engagement may be related (Anand & Ross, 1987; Connell & Wellborn, Fredericks et al., 2004; Ross & Anand, 1987; Song et al., 2013; Walkington, 2013) with some similar components such as goal-oriented learning (Ames & Archer, 1988) and self-regulated behaviors (Skinner & Belmont, 1993). However, in the present study, engagement does not significantly mediate achievement (see Table 5). Therefore, in the present study, engagement did not serve as a potential mechanism when personalized learning was implemented at the school level.

### Personalized Learning and Achievement

Overall, personalized learning did not show a significant relationship to school-level achievement, which contradicts findings in the literature that personalized learning has a positive correlation with achievement (Eyre, 2007; Keller, 1968; Kulik et al, 1979). One potential explanation for this contradiction is that most personalized learning studies tend to focus on classroom level learning and achievement (Cordova & Lepper, 1996;

Eyre, 2007; López & Sullivan, 1991, 1992; Walkington, 2013). At the school level, unique nuances in classroom level data that may contribute to the significant of the relationship may be lost and yield false results. Furthermore, personalized learning consists of several components conceptualized as mastery-oriented learning, flexible pacing, and use of formative assessment feedback (Eyre, 2007; Keller, 1968; Kulik et al., 1979; Walkington, Song et al., 2013; Walkington, 2013). Because the current study investigated personalized learning as a single construct, the effect of individual components may also be lost versus had they been measured separately. The aggregation of personalized learning data may have made the personalized learning-achievement relationship difficult to detect.

To the researcher's knowledge, no single reliable model of personalized learning exists, though the components have been researched thoroughly (Eyre, 2007; Keller, 1968; Kulik et al., 1979; Taveggia, 1979). As such, the model extracted from existing literature on the components of personalized learning by the kid•FRIENDLy program may have varied from the models employed by different schools. The kid•FRIENDLy model for engagement was considered a function of a student leadership program. Because schools implemented the program differently based on their demographics and specific needs, the engagement outcomes may have been different. Such differences may also account for the non-significant relationship between personalized learning and achievement. For example, focusing more or behavioral aspects of the leadership program might yield a different overall personalized learning score than a school that focused on emotional and/or cognitive engagement. This represents a limitation to the findings as discussed later in this section.

## Engagement and Achievement

Findings from the current study indicate that engagement and achievement are significantly and positively correlated, which is in line with previous literature (Dweck & Leggett, 1988; Fredericks et al., 2004; Lee & Anderson, 1993; Skinner & Belmont, 1993). Although previous studies indicate that the individual constructs that make up engagement—behavioral, emotional, and cognitive—affect achievement, the results of the present study indicate that engagement can be conceptualized as a single construct at the school level. Additionally, the nature of engagement at the individual level has been investigated and defined in such a way that one may reasonably infer that engagement also predicts achievement at the school level (Connell & Wellborn, 1991; Fredericks et al., 2004). Ultimately, engagement makes a difference in achievement at both the individual/classroom and school levels.

Engagement involves students interacting with instruction in terms of behaviors and taking an active role in their own learning (Fredericks et al., 2004). This role indicates that student would have accountability in their learning (Skinner & Belmont, 1993; Wentzel, 1991) and therefore increased achievement. Furthermore, since there are several types of engagement, it is interesting to note that engagement is still significant when they are considered as a single construct.

## Engagement's Role as Mediator

Because personalized learning did not significantly impact achievement in the present study, there was no support for the idea that engagement mediates the relationship between personalized learning and achievement (Barron & Kenny, 1986; Jose, 2013). Although some research suggests a connection between personalized learning and

engagement (Deci & Ryan, 2000; Wang & Eccles, 2013), in the present study, the relationship between these variables was not significant; mediation of the relationship could not be tested. In addition, some research suggests that engagement mediates the relationship between personalized learning and achievement (Connell & Wellborn, 1991; Fredericks et al., 2004); however, this relationship was not found in the present study. Ultimately, the overall model of engagement mediating personalized learning and achievement was not significant; although engagement and achievement do have a significant relationship. Thus, measuring engagement as a single construct should be considered in future studies of the relationship between personalized learning and engagement.

## Limitations

This study had several limitations that merit correction in future studies. The limitations, though addressed in the study design, may have been sources of error for analysis.

### Sample Size

Although non-parametric methods were utilized for analysis, the small sample size may have impacted the results. The mediation analysis in the current study is a minimum form of structural equation modeling that would benefit from a larger sample size (Acock, 2013; Jose, 2013). Because the current study focused on school level analysis, the limited number of schools in the kid•FRIENDLy program used for this study may have hindered analyses. One way to compensate for this in future studies may be to gather data from a larger number of schools. Additionally, student-level personalized learning and engagement scores would increase the sample size and provide

a more reliable analysis.

An additional limitation due to sample size is the aggregation of variables. In this study, all variables were aggregated to the school level. Therefore, the overall student data lost some nuances; if these variables were measured at the classroom and/individual levels , a significant relationship may have been found. Future researchers should focus on individual data that may reveal subtleties not present in school-level data.

A final limitation from the sample size was the effect of missing values on the overall data set. Although less than 1% of missing values were replaced by imputation, the small sample size may not have provided enough raw data to generate the most valid imputations. Furthermore, case-wise deletion was not a valid statistical method for analysis given the small sample size. Future researchers should consider using individual-level data to increase the validity of imputation, should it be necessary.

**Construction of Variables**

An additional limitation to the overall study was the operationalization of the variable engagement. Engagement is vaguely defined in the literature (Connell & Welborn, 1991; Fredericks et al., 2004), so surveys measuring engagement propagate any latent error resulting from participants misinterpreting their own engagement. Furthermore, engagement consists of several constructs, which also confounds interpretation and analysis. The engagement score for participant schools was calculated from factor scores that carry their own error that contributes to error in the final score for analysis. Future researchers may wish to consider measurement of the sub-constructs of engagement in addition to the overarching construct.

Another limitation pertains to the construction of the personalized learning score.

In this study, personalized learning was a measured as a single variable (Houchens et al., 2014). However, the literature considers the individual components of personalized learning as parts rather than a whole (Eyre, 2007; Keller, 1968; Kulik et al., 1979; Kulik et al., 1974; Taveggia, 1976). This reduction of personalized learning components may obscure potentially significant components of the construct. In the future, studies may consider measuring all of the personalized learning components, as opposed to or in addition to a singular score.

**Fidelity of Implementation**

The final limitation in interpreting these findings is the fidelity of implementation by each school. kid•FRIENDLy provided training and guides to implementation for both engagement and personalized learning. However, the program allowed schools a degree of latitude to interpret the trainings to fit their demographics and school climate. Therefore, not every school implemented the components in a uniform or consistent way. For example, two different schools implemented flexible pacing differently; one school added a period for students to work on remediation while the other school's personalization consisted of extended deadlines for students as needed.

kid•FRIENDLy did not have a specific program to foster engagement in schools. Instead, engagement derived as a secondary benefit of a student leadership program and other student-focused components. In addition, teacher leaders and administration had no engagement-specific training. Given that schools did not have a clear guide for implementing engagement, a connection to personalized learning would be difficult to obtain.

The fidelity of implementation of personalized learning is perhaps vaguer than for

engagement. Although kid•FRIENDLy provided training on the components of personalized learning, schools had a large amount of freedom to personalize their implementation. According to kid•FRIENDLy (Link & Sells, 2017), schools could implement personalized learning at the school level with flexible scheduling or teachers could implement their own model of flexible pacing. Naturally, this could also vary from school to school. Considering personalized learning at the school level masks this variability; lack of fidelity in some schools may have contributed to the failure to find a significant relationship between personalized learning and achievement in the present study.

## Recommendations

### Implementation of Personalized Learning

As cited above, personalized learning exists as several components working in isolation or in tandem. In other words, one class may implement only flexible pacing, another may implement mastery-based learning, while still another implements all components faithfully. Because no significant relationship between personalized learning and achievement was observed across the 111 schools in the present study's sample, schools seeking to implement personalized learning as instructional practice should consider a single model consisting of evidence-based components for schoolwide implementation. Additionally, schools may want to consider periodic assessment of implementation, which is considerably easier if a single model for personalized learning is used across the entire faculty. A single model with ongoing quantitative and/or qualitative assessment for teachers and schoolwide reflection would narrow the scope of personalized learning implementation.

Another practice that may assist schools in implementing personalized learning would be for all faculty to focus on individual components of personalized learning. The large standard deviation of personalized learning compared to the measures of central tendency indicate that schools did not implement every component of personalized learning with fidelity. This may be due to lack of awareness of the parts of personalized learning across the faculty. Therefore, teacher training on personalized learning for the entire school may benefit implementation of personalized learning practices.

**Encouraging Engagement**

Engagement was positively and significantly correlated with schoolwide achievement; this finding merits serious consideration for implementation. As with personalized learning, engagement is composed of several constructs (Ames & Archer, 1988; Connell & Wellborn, 1991; Dweck, 1988; Fredericks et al., 2004; Skinner & Belmont, 1993). These studies and the current study indicate that as engagement increases, so does achievement, whether engagement is measured as a meta-construct or several separate constructs. Therefore, teachers and schools may either consider the implementation of engagement as specific constructs or a larger meta-construct.

One recommendation for implementation of engagement is that teachers begin their focus on the single construct of engagement with the intent of implementing all the components eventually. Teachers would require training on individual components of engagement and the treatment of engagement as a larger construct. Part of this training would be a single model of engagement for implementation across the school. Because the findings of the current study indicate that engagement significantly predicts achievement in schools regardless of implementation style, schools may define their own

program to foster engagement in their schools within the definition of the construct.

## Implications for Further Study

The current study provides fertile ground for future work. The complex nature of the relationship between personalized learning and engagement merits further study at the student, class, and school levels. There are several ways that the relationships of personalized learning and engagement may be explored.

First, one method of clarifying the role of personalized learning and engagement would be to tackle the interconnected nature of personalized learning and engagement components through path analysis. In the current study, personalized learning is scored from levels of mastery-based learning climate, types of assessment, and the degree of flexible pacing. The components of personalized learning may show different correlations with engagement and/or achievement at the school level that merit further investigation. Additionally, individual constructs of engagement may mediate personalized learning and achievement in a way that is masked when engagement is considered as a meta-construct. Furthermore, the aggregated nature of these data consider reading and math achievement as overall achievement. Though related, reading and math achievement may have different relationships with personalized learning and/or engagement that future studies should consider.

Second, the nature of school structure favors investigation of the between-subjects nature of individual students, classes, and school through hierarchical modeling. The current study contributes findings at the school-level, but this may mask some of the individual or group nuances of personalized learning and engagement. Future researchers should consider the hierarchical nature of school operations when investigating school-level constructs like engagement or personalized learning.

Finally, many of the seminal studies on personalized learning and engagement are quantitative in nature (Connell & Wellborn, 1991; Eyre, 2007; Fredericks et al., 2004; Kulik et al., 1979). Although quantitative studies may explain patterns in schools and/or classroom, the highly individualized learning merits qualitative investigation. Qualitative study would clarify the degree to which personalized learning components affect learning. Additionally, engagement is difficult to define quantitatively in such a way that provides rich insight into student thinking (Ames & Archer, 1988; Connell & Wellborn, 1991; Csikszentmihalyi, 1990; Shernoff et al., 2003; Skinner & Belmont, 1993). Future qualitative study would clarify engagement's significant relationship with achievement.

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## **APPENDIX A:** IRB APPROVAL LETTER

*INSTITUTIONAL REVIEW BOARD*
*OFFICE OF RESEARCH INTEGRITY*

| | |
|---|---|
| DATE: | September 8, 2017 |
| TO: | John-Patrick Clark |
| FROM: | Western Kentucky University (WKU) IRB |
| PROJECT TITLE: | [1111102-1] Engagement's Mediation of the Relationship Between Personalized Learning and Achievement |
| REFERENCE #: | IRB 18-063 |
| SUBMISSION TYPE: | New Project |
| ACTION: | APPROVED |
| APPROVAL DATE: | September 8, 2017 |
| REVIEW TYPE: | Exempt from Full Board Review |

Thank you for your submission of New Project materials for this project. The Western Kentucky University (WKU) IRB has APPROVED your submission regarding de-identified data set analysis. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Exempt from Full Board Review based on the applicable federal regulation.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

This project has been determined to be a Minimal Risk project.

Please note that all research records must be retained for a minimum of three years after the completion of the project.

If you have any questions, please contact Paul Mooney at (270) 745-2129 or irb@wku.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Western Kentucky University (WKU) IRB's records.

## **APPENDIX B:** kid•FRIENDLy Personalized Learning Innovation Concept Map

| # | *Standard* | *Description* | | | | | | *Average (1-5)* |
|---|---|---|---|---|---|---|---|---|
| **1** | **The Learning Process** | **The school community works collaboratively to develop instructional and assessment practices that are in harmony with personalized learning.** | | | | | | |
| | **Indicators** | **Data Sources** | **5 Sustaining** | **4 Scaling Up** | **3 Implementing** | **2 Starting** | **1 Continuing Status Quo** | **Score (1-5)** |
| 1.1 | Pre-Assessment | Classroom assessment, lesson and unit plans, teacher and student interviews | Pre-assessment activities determine student's prior knowledge of learning targets before learning tasks occur. These assessments are used to inform the design of learning tasks and performance assessments. | | Pre-assessment activities inform meaningful differentiation of learning tasks for students. | | With a few exceptions, all students are introduced to new curricular concepts at the same time. | |
| 1.2 | Planning [1] | Lesson and unit plans, syllabi, teacher and student interviews, classroom observations | There is school-wide commitment to student learning and assessment using a framework of learning targets and competencies that are established based on students cognitive development/readiness. | | Some teachers/leaders demonstrate commitment to student learning and assessment by using a framework of learning targets and competencies tied to defensible and age/grade appropriate standards. | | Student learning and assessment is primarily textbook driven in that teachers closely follow the organization of the prescribed text with little deviation. | |

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| 1.3 | Assessment Development | Classroom assessment samples, classroom observations, documentation of completed student assessment tasks, teacher and student interviews, SBDM policies | Most paper and pencil tests have been replaced by various authentic performance based assessments that are interdisciplinary and represent real-world demonstrations of learning. | | Some paper and pencil tests have been replaced by performance based assessments. | | Assessments are summative in nature, typically given only once, and are usually paper and pencil tests delivered in a standardized format (multiple choice, short-answer, essay; one assessment for all students). | |
| 1.4 | Challenge [2][3] | Lesson plans, student and teacher interviews, classroom observations | Activities are designed to adequately challenge students by targeting not just the concepts and tasks they are ready to learn and do but also those they will be able to tackle with additional assistance from peers and teachers. | | Activities are restricted to just the concepts and tasks that students are ready to learn and can master independently. Teachers avoid anything challenging that would cause discomfort among students. | | Activities are not differentiated and students are all assigned similar tasks based on the readiness/cognitive development of a steering group. | |

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| 1.5 | Pacing [4] | Lesson and unit plans, pacing guides, assessment samples, student and teacher interviews, classroom observations, School PLPs, Student work samples. | Students advance through learning targets at their own pace, mostly unencumbered by the limitations of class period, school day, grading period or academic year or traditional grade-level assignment. Students have the opportunity to move beyond their assigned grade level in topics and subject content. | | Within the limitations of a single school year, students may move through curricular concepts at their own pace. School day schedules allow the flexibility for students to work on interdisciplinary performance tasks across multiple class periods. | | Learning segments are defined by the length of the class period, school day, grading period, and academic year. Age-determined grade levels dictate the content and pacing of curricular concepts. | |
| | | | Students are responsible stewards of their own time, learning how to manage tasks efficiently and effectively. | | Students demonstrate increasing levels of responsibility with time management and pacing towards achieving learning goals. | | Students learn to be compliant with adult directives on when and what to learn. | |
| | | | Students work collaboratively with teachers to develop their own timelines for completing learning targets. Students regularly communicate with teachers on their progress. | | Students mostly rely on teachers to set the pace of learning, but take advantage of classroom structures of remediation and enrichment to accelerate their | | Students rely on teachers to set the pace of their learning, completing assignments based on schedules established by the teacher. | |

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| | | | | | progress towards learning targets. | | | |
| 1.6 | Collaboration | Lesson and unit plans, teacher and student interviews, classroom observations | Students' voice and choice are integral to the instructional process and teachers and students are co-creators of knowledge, with teachers acting as facilitators of knowledge and skill development. Students actively seek engagement and demonstrate their responsibility for learning based on mutual understanding with the teacher, of their needs and aspirations. (Personalized Learning) | | Students have some opportunities to act as partners in learning through activities designed to actively engage them. Classrooms show evidence of some facilitation of learning and not just traditional directed learning strategies. Teachers view learning as unique and actively incorporate student interests and aspirations into their instructional processes. (Student-Centered Learning) | | Students have some opportunity for choice within instructional processes. The classroom is predominantly teacher-directed; plans show little evidence of understanding/consideration of student backgrounds. (Teacher-centered learning) | |

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| 1.7 | Autonomy [5] | Lesson and unit plans, student and teacher interviews, assessment samples, classroom observations | Students play an extensive role in developing their learning goals. With teachers serving as guides, students develop strategic plans for accomplishing these goals by designing appropriate learning tasks, and seeking help, resources, and other assistance as needed. | | Students are encouraged and sometimes required to take responsibility for articulating their own learning goals. Students also suggest ideas for learning tasks and/or may choose from a menu of choices for learning tasks. | | Students typically exercise little to no choice in their learning goals. Teachers develop all learning tasks with no input from students. | |
| | | | Students design their own performance-based assessments with support and advice from teachers, parents, peers, and community-based mentors and engage in thoughtful self-assessment of their progress. | | Students participate heavily in the development of individualized performance-based assessments and are encouraged to assess their own work; teachers still make most judgments about student progress toward learning targets. | | Students complete summative assessments developed by teacher, typically with no input into the assessment's construction or assessed learning targets. | |

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| 1.8 | Mastery [6] | Assessment samples, student and teacher interviews, unit plans, pacing guides, classroom observations | Students have multiple opportunities to demonstrate mastery of learning objectives. Based on teacher feedback as well as peer- and self-assessment, students will revise their work and perform tasks repeatedly until mastery is demonstrated. | | Students may occasionally have multiple attempts on evaluations. These attempts are generally geared towards improving a test score or grade. There may exist some opportunities for enrichment or remediation for crucial (state-mandated) performance targets. | | Once a concept has been taught and assessed, learning moves forward regardless of student mastery of the concept. Similarly, few enrichment opportunities exist for students who have already demonstrated mastery of learning concepts or who do so more quickly than their peers. | |

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| 1.9 | Grading [7] | Grade book samples, grading and reporting policies, assessment samples, teacher and student interviews, classroom observations | Traditional letter grades may not be given; work is entirely assessed through feedback and performance statements describing student progress toward mastery of the assessment's stated learning targets. | | Traditional letter grades may be given, but grades are intentionally and clearly tied to student mastery of specific learning objectives. Most variables other than student mastery of learning objectives have been eliminated from the grading and reporting process. | | Traditional letter grades are given but some teachers implement a standards-based grading process that limits the percentage of student grades on homework or other tasks that do not measure learning. | |
| # | ***Standard*** | ***Description*** | | | | | | ***Average (1-5)*** |
| **2** | **Climate** | **School administrators and the wider school community demonstrate a commitment to providing an adequate setting in which personalized learning can thrive.** | | | | | | |
| | **Indicators** | **Data Sources** | **5 Sustaining** | **4 Scaling Up** | **3 Implementing** | **2 Starting** | **1 Continuing Status Quo** | **Score (1-5)** |

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| 2.1 | School Structures | Master schedule, bell schedules, teacher and student interviews, classroom observations | Policies and/or procedures for school bell and master schedules reflect efforts to create meaningful student opportunities to engage in learning across subject areas for extended periods of time without interruption. | | Select groups of students engage in small-scale experiments in project-based learning across multiple class periods. | | Students move through an adult-established schedule that compartmentalizes learning by subject area and limits the time students can devote to any one task without interruption. | |
| 2.2 | Success [8] | Teacher and student interviews, classroom rubrics, grading policies, assessment samples, classroom observations | Success is described as making progress in learning by accomplishing tasks and acquiring new skills. | | Success is described as making progress in learning but there remains an emphasis on actual score and grades. | | Success is defined by getting high scores on assessments, getting good grades, and other activities as well as demonstrating good behavior. | |

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| 2.3 | Networks Beyond School | Master schedule, bell schedules, student and teacher interviews, community stakeholder interviews, classroom observations | Students have the flexibility to engage in learning tasks at home, at school, and in the community both during and after the regular school day. | | Some students have the opportunity to engage in learning tasks outside of school either during or after the normal school day. | | Students attend school daily during regular school hours except in extraordinary circumstances (field trip, illness, etc.). | |

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| 2.4 | Location | Master schedule, bell schedules, student and teacher interviews, community stakeholder interviews, classroom observations | A student's assigned school is a hub for learning that occurs in a variety of locations. Students engage in learning tasks at and outside the school, both during and outside the normal school day. | | Most meaningful learning tasks and all performance tasks take place at school during the regular school day. Some teachers experiment with blended learning techniques that begin to encourage seamless student learning between home and school. | | Learning occurs throughout the day during a series of fragmented subject-based time periods throughout the day. | |
| # | ***Standard*** | ***Description*** | | | | | | ***Average (1-5)*** |
| **3** | **Teachers** | **Teachers understand personalized learning concepts and are committed to implementing them in guiding students to achieve learning goals.** | | | | | | |
| | **Indicators** | **Data Sources** | **5 Sustaining** | **4 Scaling Up** | **3 Implementing** | **2 Starting** | **1 Continuing Status Quo** | **Score (1-5)** |
| 3.1 | Self- Efficacy [9] | Teacher and student interviews, lesson and unit plans, assessment | Teachers demonstrate high levels of confidence in their abilities to develop and maintain | | Teachers demonstrate moderate levels of confidence in their | | Teachers demonstrate low levels of confidence in their ability to release any control | |

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| | | samples, classroom observations | personalized learning environments. | | abilities and are willing to develop personalized learning environments. However, they maintain levels of uncertainty regarding their ability as well as students' abilities to succeed in this new model. | | over the learning process to students. | |
| 3.2 | Modeling [10] | Teacher and student interviews, lesson and unit plans, assessment samples, classroom observations | Teachers get students involved in the process of modeling interest and enthusiasm towards all the topics studied highlighting the potential value to be gained. | | Modeling efforts are primarily teacher-centered modeling interest in some topics while making it evident that other topics are studied solely because they are compulsory parts of the curriculum. | | Teachers model a lack of interest and enthusiasm for most topics. It is evident that learning is simply a matter of checking off boxes without meaningfully engaging with the material in a way that would promote long-term growth. | |
| | | | Teachers communicate with students an emphasis on mastery | | While teachers mostly communicate in a way that ascribes | | Teacher communication with students is primarily focused on performance and reflects | |

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| | | | views of intelligence and a growth mindset. | | some importance to mastering knowledge and skills, they continue to also emphasize performance. | | ability based views of intelligence. | |
| 3.3 | Monitoring | Teacher and student interviews, lesson and unit plans, assessment samples, classroom observations | Teachers maintain close watch over students' progression towards learning goals, providing appropriate feedback. Students and teachers work in close collaboration to make adjustments to the learning plans as needed. | | Teachers generally monitor students and adjust their instruction (re-teaching, flexible grouping for intervention, enrichment, etc.) based on student progress toward learning targets. | | Teachers deliver instruction, assess, record grades, and then move on to the next objective. There is little/no monitoring of individual student progress during the learning process. | |
| 3.4 | High Expectations [11] | Teacher and student interviews, lesson and unit plans, assessment samples, classroom observations | Teachers regularly communicate high expectations for all students regardless of students' prior performance. | | Teachers occasionally communicate high expectations for students who are known as high achievers but are more accommodating of students who are typically regarded as low achievers. These expectations are commensurate to students' prior performance. | | Teachers do not communicate high expectations for students highlighting instead their prior achievements as a basis for their current or future performance/progress. | |

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| 3.4 (cont.) | | | Teachers do not accept mediocre work encouraging students to take as many opportunities as necessary to revise and resubmit. | | Teachers do not accept mediocre work from high achieving students, but allow low achievers to turn in low quality work. | | Teachers accept low quality work from all students as a means of protecting students' self-esteem. | |
| 3.5 | Student-Teacher Relationship [12] | Teacher and student interviews, lesson and unit plans, assessment samples, classroom observations | All teachers identify and work to develop strong, positive and caring relationships with all students as critical components of the instructional process irrespective of whether or not they teach these students. | | Most student-teacher relationships are characterized by trust, caring, and demonstrated commitment to support all students within the class to be successful at school. | | Student-teacher relationships are not considered a primary focus of improved student achievement and are rarely evident within the school community. | |

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| | | | Teachers actively seek to understand the student, his or her life experiences, cultural background, talents, and strengths, in order to better meet learning and developmental needs. | | Schools have developed and implemented plans to strengthen the connection and relationships with vulnerable students are in process. | | Many students, particularly vulnerable students, do not feel that teachers in the school care about them outside of the classroom. There are no plans in place to develop connections with students. | |
| # | ***Standard*** | ***Description*** | | | | | | ***Average (1-5)*** |
| **4** | **Students** | **Students understand personalized learning concepts or activities and use them as the foundation for progression towards clear and meaningful learning targets and growth goals.** | | | | | | |
| | **Indicators** | **Data Sources** | **5 Sustaining** | **4 Scaling Up** | **3 Implementing** | **2 Starting** | **1 Continuing Status Quo** | **Score (1-5)** |
| 4.1 | Goal Setting [13] | Patterns of Adaptive Learning Survey, Student Interviews, School honor roll (reverse), Documentation of Student/School PLPs | Students focus on understanding a concept or skill so that they can apply the knowledge gained or skill acquired in other classes or settings in/outside of school. | | Students focus on understanding a concept or skill in a way that their grasp extends beyond the period of study of the topic and/or the school year. | | Students focus on learning a concept in order to pass the assessment of that concept. Once the evaluation process is complete the knowledge gained is quickly forgotten. | |
| | | | Students focus solely on comparing their current level of achievement to prior accomplishments. Students maintain self-improvement as their goal. | | Students may compare current achievement to prior accomplishments but outperforming others (or performing on par with others) remains the primary focus. | | Students focus on how their performance compares to other students in the class as a measure of their understanding of the material. Comparing scores on a test is a regular occurrence. | |
| 4.2 | Goal Monitoring [14] | Patterns of Adaptive Learning Survey, Student | Students view mistakes as an essential part of learning and regard them | | Students feel encouraged to continue trying after making | | Students become quickly frustrated and unwilling to continue trying if they do not | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Interviews, Documentation of Student/School PLPs | as an opportunity for learning. | | mistakes and that the effort expended is just as important as the end result. | | immediately meet learning target. | |
| 4.3 | Self-Regulation [15] | Patterns of Adaptive Learning Survey, Student Interviews, Documentation of Student PLP | Students take the initiative to create goals that target improvement in the areas of weakness identified. They consult with teachers, parents, and/or community members for tips and pointers for accomplishing these goals. | | Students adopt suggestions offered by teachers, parents and/or community mentors to improve identified where growth is needed. | | Students do not engage in activities of their own volition to address the identified areas where growth is needed. | |

**APPENDIX C:** Teachers' Perceptions of Student Engagement

| Engagement Sub-Construct | **Statement** |
|---|---|
| **Cognitive Engagement** | Students in my classes go to school because they love to learn. |
| | Students in my classes go to school because they like their friends. |
| | Students in my classes go to school because they like their teachers. |
| | Students in my classes go to school because they want to go to college. |
| | Students in my classes go to school because they want to get a good job. |
| | Students in my classes go to school because they want to prepare for the future. |
| | Students in my classes work hard on their schoolwork. |
| | Students in my classes learn as much as they can from their classes. |
| | Students in my classes do their best to get good grades in school. |
| | Students in my classes do their schoolwork on time. |
| | Students in my classes pay attention in class. |
| | Students in my classes enjoy woring on difficult tasks. |
| | Students in my classes keep up with their schoolwork. |
| **Emotional Engagement** | Students in my classes think their teachers treat students fairly. |
| | Students in my classes are happy to be at school. |
| | Students in my classes think their classroom is a fun place to be. |
| | Students in my classes feel their teachers care about how they are doing. |
| | Students in my classes feel excited about doing work in school. |
| | Students in my classes feel like their opinions are respected. |
| | Students in my classes can talk to their teachers about their problems. |
| | Students in my classes feel like they play an important role in their classes. |
| **Behavioral Engagement** | Students in my classes follow the rules. |
| | Students in my classes rarely get in trouble. |
| | Students in my classes rarely fight with their classmates. |
| | Students in my classes rarely lie to others. |
| | Students in my classes rarely use bad words. |
| | Students in my classes are well behaved. |

**APPENDIX D:** Students' Perception of Engagement

| Engagement Sub-Construct | Statement |
|---|---|
| **Cognitive Engagement** | I go to school because I love to learn. |
| | I go to school because I like my friends. |
| | I go to school because I like my teachers. |
| | I go to school because I want to go to college. |
| | I go to school because I want to get a good job. |
| | I work hard on my schoolwork. |
| | I learn as much as I can from my classes. |
| | I do my best to get good grades in school. |
| | I do my schoolwork on time. |
| | I pay attention in class. |
| | I keep up with my schoolwork. |
| **Emotional Engagement** | I am happy to be at my school. |
| | My classroom is a fun place to be. |
| | My teachers care about how I am doing. |
| | I feel excited about doing work in school. |
| | I think the teachers at my school treat students fairly. |
| | I feel like my opinions are respected in this school. |
| | I can talk to my teachers about my problems. |
| | I play an important role in my class. |
| **Behavioral Engagement** | I follow the rules at school. |
| | I get in trouble at school. |
| | I lie to others. |
| | I use bad words. |
| | I am well behaved. |