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The 2-Sigma Solution? Mastery Learning & Tech

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Abstract

This study looks at teachers attitudes about how they implement Mastery Learning and Grading in their classroom. Current research reveals that using Mastery Learning strategies in the classroom can increase student achievement when compared with a traditional classroom-teaching model. Reported drawbacks focus on difficulty scaling MLG practices to a densely packed classroom. Recent advancements in technology and the ready availability of PLS systems in school districts have offered a solution to these obstacles. For the network-sample group of teachers studied in this work, this was not the case. The purpose of this study was to find out what are the factors that influence a teacher's decision to incorporate Mastery Learning and Grading practices in their classrooms and does familiarity with and use of a PLS platform affect this decision? An open-ended survey was distributed to teachers, and responses were anonymously submitted online. Inductive analysis of qualitative participant data revealed that teachers do support MLG practices and would like to receive more planning time, resources, and instructional support to build their practice. Attention was focused on how technology alleviates some of the time demands for planning and resource creation. The sample group lacked computer literacy and access to classroom technology. Collected comparative data for this study points to the need for further study of teacher familiarity with personalized learning systems. It is apparent from the data that the systemic supports necessary for implementation are not present in the schools that the participants teach in. To ensure more successful implementation, these schools must have a plan that allows for both teacher innovation and school wide implementation of successful strategies to ensure equitable academic success for all students.

Keywords: mastery grading, master learning, personalized learning system, proficiency-based grading

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List of Terms

aptitude – a natural ability to do something, supported by prior learning/knowledge

competency-based learning – learning in which students advance through standards-based content based on demonstration of proficiency of competencies

fixed mindset - people believe their abilities are fixed traits that cannot be changed

mastery learning - an instructional approach or pedagogy proposed by Benjamin Bloom that supports the philosophy that students can achieve a high-levels when given the time to master content before moving forward to new material.

mastery grading – grading based on proficiency in learning goals or standards, usually represented as met or not met

personalized learning systems – technology platform that aides in the delivery of individualized instruction like Google Classroom, Schoology, etc.

proficiency-based grading – grading based on proficiency in learning goals or standards, usually represented as met or not met

traditional classroom/learning – a school environment in which all students receive the same lesson at the same time, and move through curriculum at a fixed pacing regardless of student understanding

traditional grading– a percentage based-grading system or other scaled system that reflects the student’s average performance on a test or across a unit

Chapter 1 – Statement of Problem

Districts have begun the initiative to shift away from a traditional learning and grading system to a more personalized approach. Fixed unit pacing and averaging students' scores are just a few of the schoolhouse customs that harken back to a time when educators shared the view that aptitude was the determining factor of school success (Motamedi, n.d.). Advances in neuroscience and educational research have disproved this myth, however many learning institutions still cling to customary learning and grading approaches; perpetuating the fixed mindset view that innate talents are necessary for educational success (Guskey, 2013). Fixing the time constraints of the variables for learning, rather than fixing the learning outcomes (Kahn, 2015).

In a modern resurgence, efforts have refocused on a shift to a mastery, competency, or proficiency-based approach to learning and grading (MLG). Districts have purchased personalized learning systems (PLS) or platforms to support just this. Research reveals that learning is a result of clear goals, skilled guidance, and adequate time to practice (Ericsson, Prietula, & Cokely, 2007). This is a contrast to what might be identified as a traditional classroom in which learning units are taught in a fixed amount of time, students assessed at the end of that time limit, and then all student move forward.

The MLG approach instead employs pedagogy that sets clear learning targets and offers continued feedback/instruction to students as they work toward proficiency. Personalized time is allotted for each learner as they master new material (Bloom, 1984). This approach is geared to ensure successful educational outcomes for all students, and develop a growth mindset in all learners (Guskey, 2013).

Technology has opened up the possibilities for this more individualized approach to education than previously existed in the traditional classroom. Personalized Learning System (PLS) platforms allow teachers more opportunity to differentiate instruction with less planning and preparation time (State Strategies to Develop Teacher Capacity for Personalized Competency Based Learning, 2018). The opportunity to change the paradigm of school even in densely populated, public-school classrooms is now a feasible reality.

The difficulty that exists is that teachers have not rushed to leverage district PLS systems when implementing MLG. In fact many teachers have been very resistant, using only the functions of a PLS that are mandated by a district, gradebook features, etc. This has developed the focus of this study.

Teachers participating in this study come from a variety of school sites, TK-12, and both general and special education classrooms. The administered survey screened for teachers that had exposure to MLG theory, and have adopted or attempted to adopt these practices in their classroom. These teachers often do not fully implement the practices in their classroom, and are prone to adopting only some elements of proficiency-based grading, like the use of formative assessment, without shifting student learning to a more individualized approach.

Purpose of Study

This study was designed to explore teacher attitudes about MLG practices as well as their view of personalized learning system platforms such as Schoology, Google Classroom, etc. This study investigated the question: what are the factors that influence a teacher's decision to incorporate MLG practices in their classrooms and does familiarity with or the use of a PLS affect this decision?

This study investigates teachers attitudes towards embracing new teaching practices and if access to a PLS platform alters these attitudes. The data collected offer a perspective that is not extensively represented in other research studies, mostly focused on the effectiveness of proficiency-based instruction in students. This study collected data regarding teacher attitudes toward school site and district and how that influenced their decision making process about implementation of new learning.

Preview of Literature

This study began with an examination of current research. First on the effectiveness of proficiency-based education. Then how PLS platforms have revived the possibility of delivering proficiency-based instruction in crowded, public-school classrooms.

The literature review goes on to explore the increased gains that MLG makes when coupled with technology. It looks at how schools can make effective choices when implementing technology in the MLG classroom. It also explores districts that are implementing, and examines what leadership factors make districts successful. In chapter two, we will explore research examining the effectiveness of MLG as a pedagogy and technology as a tool to support schools in effectively implementing.

Preview of Methodology

To answer these research question a questionnaire was designed, and administered to a sample group of teachers. Qualitative data were collected. The small convenience sample was assembled through a network sampling methodology. Participant responses were examined through an inductive analysis, and were coded to identify and then interpret emerging patterns in the data (Mertler & Charles, 2011).

Qualitative data collection and analysis were used because of the small sample size and the sample selection methods in the study. Collected data for this study could not be effectively generalized to the larger population because of lack of significance (Mertler & Charles, 2011).

Participant opinions were solicited through open-ended surveys, using questions geared to gain deeper understanding of the participating teachers' views about MLG and the interrelationship; or lack of, with technological supports like a PLS.

The survey also probed for insight into the factors that influence teacher implementation and what further support could be provided to broaden adoption of a PLS by teachers who strive to use MLG practices. The in-depth analysis of teachers' perspectives that qualitative analysis allowed, provided more detailed information that helped the researcher identify patterns in participant responses that could be generalized and studied further in a larger study group if funding allowed.

Significance of Study

This study merited investigation because of the substantial impact MLG practices have been shown to have on student achievement and the equity of educational outcomes for all students (Bloom, *The Two Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring*, 1984). Fully integrating a PLS into daily classroom instruction would alleviate much of the time and management issues often associate with MLG (Motamedi, n.d.).

A larger swath of teachers adopting technology as a tool to support MLG may mean a more effective implementation of proficiency-based education in their classrooms. More effective implementation would increase the number of students learning in a proficiency-based classroom, and thus higher rates of student achievement (Bloom, *The Two Sigma Problem: The*

Search for Methods of Group Instruction as Effective as One-to-One Tutoring, 1984). By understanding teachers' attitudes, perceptions, and individual perspectives, substantive adaptations can be made in schools, that will increase teacher receptivity to adopting a PLS as a tool to support their MLG instructional design.

The data collected in this study offers some new information, not previously amassed through qualitative or quantitative data collection methods when assessing school and district performance overall.

All participants who volunteered are employed in urban districts, and a majority of participants taught in urban schools with a record of low student achievement as measured by state testing. Funds have been allocated in most of these districts to support efforts to implement MLG and efforts to increase the use of the district PLS. This study was important in providing an analysis of possible obstacles to classroom implementation, which can later be developed into a more comprehensive experimental action-research study. A revised study could provide more statistically significant quantitative data that more accurately predicts the behaviors of teachers working towards developing a proficiency-based classroom structure. These data could then be used to design professional development experiences that garner higher rates of and more effective implementation.

Conclusion

To determine what factors influence a teacher's decision to integrate a PLS when using MLG practices in their classroom, the researcher collected qualitative data to gain deeper understanding of teacher perspectives about implementation MLG. Does use of a PLS increase the likelihood of implementation and/or the longevity of implementation of MLG in classrooms? Qualitative methodologies were used so that a wide range of responses could be analyzed. This

method of analysis fit the small sample size used. While data from this study can be interpreted, generalizations about correlation would require a larger study with data that can be shown to be more significant.

In the next chapter, we will examine research surrounding the effectiveness of Mastery Learning and grading practices, successes other districts and schools have had in implementing, and research about what influences teacher receptivity to this change.

Chapter 2 – Review of Literature

The American public-school system as we know it today was born of the industrial revolution, which called for a more educated and literate workforce. During that time, a more diverse range of students enrolled in schools with hopes of entering the *modern* workforce, mostly factory-based positions. To accommodate the influx, schools favored efficiency in grading and teaching practices (Guskey, 2013) and shifted their organizational structure to mimic the streamlined hierarchical make-up of the factory work environment. Students were prompted by bells and beholden to deadlines, compliance a highly valued characteristic (Robinson, 2010).

This paradigm supported the needs of the American economy for years. However, schools continue to socialize and educate students in this organizational model, even though both the workplace and educational research have changed significantly. Schools identify and track students based on learning aptitude and perceived talents (Motamedi, n.d.). Implicit in this separation, is the notion that not all students have the same capacity to learn, or value to the workforce.

As the economy sets course for the information revolution, this school model is furthering the economic divide. How can we offer more equity and access to learning in our classrooms, and better prepare all students for the economy of tomorrow? Proficiency-based learning models like Bloom's Mastery Learning Theory or Keller's personalized systems of instruction offer a classroom structure that does just this. This literature review serves to identify the findings of research focused on proficiency-based grading and analyze the educational effects of these learning models in the classroom. It analyzes what research-based resources are available to schools making the transition to proficiency-based learning models, and examines research connected with implementation of personalized learning in districts that are shifting the

classroom paradigm to support a more autonomous and individualized approach to learning. What are the factors that influence a teacher's decision to incorporate MLG practices in their classrooms and does familiarity with or the use of a PLS affect this decision?

Educational Research and Proficiency-based Instruction

The research on proficiency-based grading that defines the field came to light almost 50 years ago. Mastery Learning began with a very basic premise. The idea that all students can learn given the right conditions. Thomas Guskey (1985) attributes both Benjamin Bloom and John Carroll with the introduction of Mastery Learning Theory to the mainstream educational lexicon. Carroll, a noted researcher at Harvard, espoused the value of Mastery Learning as a counterpoint to a contemporaneous ideology that determinism was at the route of academic success. Carroll's hypothesis was a departure from the existing tracked educational model that is structured to identify aptitude and talent. He challenged the idea that "aptitude" for learning directly correlated to learning outcomes. Carroll instead theorized that degree of learning was a function of time given divided by time needed.

$$\text{Degree of learning} = f\left(\frac{\text{time spent}}{\text{time needed}}\right)$$

Figure 1. John Carroll's Model for New School Learning. This figure shows Carroll's formula for learning.

This learning formula would yield a result of one when complete comprehension took place (Guskey, 1985). Guskey's later work too asserts that aptitude serves only as an index for speed of acquisition, and is not a predictor of learning ability. Other variables like student perseverance, opportunities to learn, quality of instructional design and metacognition also serve as predictors of speed of acquisition, but are not predictive of rate of learning (1985).

Bloom builds on Carroll's work. His research supports the idea that all students can learn. He also focuses to the realities of the traditional, student-packed classroom. Can a teacher with a student ratio of 30:1 yield analogous learning growth to that of a one-to-one tutor?

Bloom's study observes three sample groups. The control group receiving traditional direct instruction and the two experimental groups supported with proficiency-based practices. One experimental group maintains the 30:1 ratio of the control group, but instruction is focused around clearly defined and communicated learning goals. These students receive regular feedback about their progress towards the defined goals, and are allowed the time they need to develop competency in the subject matter. This means the classroom structure accommodates the variable learning times needed by each student, using Carroll's learning formula (*Figure 1*). The other experimental group receives support through one-to-one tutoring (Bloom, *The Two Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring*, 1984).

Bloom's (1984) data reveals that students in the mastery-learning classroom achieve proficiency on summative exams at a rate of one standard deviation (84% of participants) above the control classroom. The tutored students perform at two standard deviations (98% of participants) above the control group (Bloom, *The Two Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring*, 1984). These findings support Carroll's and Bloom's assertions that aptitude and achievement have a low correlation coefficient. Learning is dependent on classroom practice and time, not student characteristics. Bloom's research does not support a clear path to the two-standard deviation increase in learning that one-to-one tutoring produces. Bloom defined this quest for one-to-one tutoring outcomes in a traditional 1:30 setting as the two-sigma problem (Guskey, 1985).

Bloom's encouraging results gave rise to further educational research around proficiency-based learning models. One noted researcher is Fred Keller (Motamedi, n.d.). In Keller's studies, students receive the same clearly defined proficiency goals as Bloom used, but the targets are broken down into much smaller modules. Keller defines proficiency as a percentage of material mastered; straying slightly from Carroll's learning formula. Students still work toward a single goal, but move on when the required percentage of proficiency is obtained. Keller has identified his pedagogy as a personalized system of instruction and in his research strives to emulate the "two-sigma" tutoring classroom as defined by Bloom, but through a more differentiated approach. Keller's research shifts the classroom structure to a learner and facilitator dynamic (Eyre, 2007). Bloom also forewarned of the pitfalls of rigidly paced, traditional learning instruction (Guskey, 1985). Keller's work found his proficiency-based approach to have substantial impact on student learning outcomes. Keller's research "indicated that personalized systems of instruction (are) a more effective teaching method than traditional lecture methods" (Eyre, 2007, p. 318).

Ericsson, Prietula, & Cokely (2007) further analyze the effects of talent on long-term learning outcomes, which they identify as expertise. Their study is a qualitative examination of respected experts. Through extensive interviews, they too conclude that expertise is not connected to an innate genius or talent, but rather an outcome of time devoted to learning. Expertise develops through extended deliberate practice and regular objective feedback from a skilled coach or teacher. As expertise develops, students need less coaching as they improve their ability to self-coach. Experts throughout their study all benefited from sufficient time, deliberate practice, quality feedback, skilled teaching/coaching, access to resources, and of course the desire to persevere. Timeliness of educational opportunity also impacts the development of

expertise (Ericsson, Prietula, & Cokely, 2007). This work furthers the original assertions made by Carroll that aptitude does not have to be a predictor of learning.

Criticism of proficiency-based learning models mainly focus on the logistical demands and structural shifts that a more personalized approach to instruction require. Eyre (2007) looks at concerns surrounding Keller's work. Critics point out the time demands effective implementation of proficiency-based models necessitate. Time demands are placed on teachers who must give immediate, personalized feedback. This is a shift from the efficiency-based approach of lecture-style instruction and percentage or points-based scoring developed to accommodate the rapidly expanding classroom size at the turn of the twentieth century (Guskey, 2013). Time demands also challenge the current classroom schedule and structure. Allowing all students the time they need to reach proficiency can conflict with the time available (Motamedi, n.d.). Keller's autonomous approach is viewed as problematic for students who procrastinate and do not display the agency necessary to self-direct their learning (Eyre, 2007). These are all very real obstacles, and until recently stymied educational research and widespread implantation of proficiency-based learning in classrooms.

The Resurgence of Personalized Systems of Instruction

The availability of technology in the classroom has ushered in a resurgence of research connected to proficiency-based learning. The fervor and fiscal rewards surrounding teaching technologies should give pause however. Educators should conduct a careful examination of the available research so that teachers, schools, and districts interested in shifting to this instructional model can make research-based evaluations of products. Distinctions must be made between silicon-valley marketing and products created using education theory like the work of Bloom and

Keller. Eyre (2007) warns of computer-aided personalized learning systems' tendency to veer from the self-pacing and mastery components foundational to Keller's research.

A definition of the buzzwords connected to computer-aided personalized instruction is necessary to understand where the actual research lies. Dann (2017) attempts to do just this through a qualitative evaluation of current research in the field of technology-assisted learning. She organizes descriptive accounts of technology used in competency-based learning programs into three categories: technology-rich learning, blended learning, and personalized learning.

Dann (2017) finds that technology-rich is a subjective label with little true evaluative meaning. Research does not exist to substantiate this term, quantify impact on student learning, or shift in teaching practice. It often has little foundational connection to research. Furthermore, gamification of learning often used in technology-rich environments has shown to breed negative outcomes in student learning when used as a standalone teaching tool. While technology-rich learning can support components of Keller's research, it often strays too far from his original work to tout the researched benefits of proficiency-based learning (Dann, 2017).

Blended learning is a more defined term, with greater available research for analysis. A true blended approach has a self-monitored online component as well as a brick-and-mortar requirement. Research around blended-learning requires that the online and classroom work align and augment each other. The instructor must be heavily involved in creating conditions much like one-to-one tutoring and should not constrain creative use of technology. Blended learning offers educators many opportunities for data collection and collaboration to assess and build students' proficiency (Dann, 2017).

Personalized learning systems are often confused with adaptive learning, but true personalized learning utilizes non-computer-aided classroom components, like that of Bloom's

and Keller's works. Research-based personalized learning classrooms have teachers at the center, driving the learning with the use of assessment as well as components of Universal Design for Learning (Dann, 2017).

Dann's evaluation finds that subjectivity exists in definitions of technology-assisted, proficiency-based learning systems, and labeling offers little indication of the programs content or quality. Building capacity for these programs takes skilled selection, carefully planned professional development, and both must focus on the soundness of instruction.

The Quest for the Two-sigma Solution

Criticism of proficiency-based learning mainly identify the impracticalities surrounding implementation and the problem of student engagement as stumbling blocks. Personalized learning systems offer some interesting solutions to these barriers and can help yield higher rates of learning in students.

Ongoing assessment of different students at different times is a necessity of proficiency-based learning. Without data used to assess student understanding, personalized systems of instruction are not effective (Eyre, 2007). Previously only the teacher could evaluate the higher levels of the cognitive learning process, a time-consuming task, difficult with large class sizes. Web Based Expert System (WBES) are now available to support with this assessment and research seems to validate their reliability. Idris Goksu (2016) conducted an experimental study to analyze the effects of Mastery Learning practices on students' educational outcomes and gauge whether there is increased learning with the use of WBES in the study of mathematics. Goksu collected and analyzed test scores from a group 50 eighth graders that he evaluated using questions aligned to the revised Bloom's taxonomy (RBT). Both groups received supportive instruction from the same classroom teacher and were evaluated using similar question types.

The only variable observed was whether evaluation was done using a WBES or by the classroom teacher.

The control group and the experimental group both experienced academic achievement gains using Bloom's Mastery Learning practices. Students taught and evaluated using the WBES had increased educational outcomes at each level of RBT when compared to the control group however. Goksu concludes that the WBES can actually amplify the effects of a mastery system. His work suggests WBES may even be a more effective evaluation method than the classroom teacher. "In the end, it's been seen that the WBES based supportive education created a significant difference in the academic success of the students, compared to the traditional supportive education." (Goksu, 2016, p. 145) The study concludes that the number of "completely learned" students (those mastering all levels of RBT) increases using the WBES in conjunction with Mastery Learning when compared to Mastery Learning alone (Goksu, 2016, p. 145).

Game-based instruction is another tool that has been studied help effectively implement Mastery Learning practice. Gamification can provide support for student engagement, though conclusions drawn from a variety of studies are mixed. Alignment to sound instructional theory is important when using gamification programs. Lin, Liu, Chen, Liou, Chang, Wu, and Yuan (2013) examine if the use of instructional videogames can enhance proficiency-based learning by offering extended practice to students in need of corrective instruction, two elements present in both Bloom's and Keller's works.

Researchers studied both an experimental group and a control group. Both groups were instructed using Mastery Learning practices. The control group received remedial instruction through educational videos and the experimental group through a monopoly videogame linked to

the same videos used by the control group, but embedded throughout the game. The groups were evaluated with problem solving exercises. A nonrandom sampling of 6th grade students were selected to participate, interest and understanding of unit prerequisites were selection factors. Data were collected through a pretest, used to screen for prerequisite understanding. A formative assessment was administered after initial instruction to assign students tasks, based on learning needs. A summative assessment was administered upon completion of the correctives or enrichment activities. Participants' test scores were analyzed through a statistical analysis of achievement levels. It was found that Mastery Learning and game-based learning separately did improve student-learning outcomes. When coupled the achievement levels were higher than with Mastery Learning alone. This study reiterates the positive effects proficiency-based learning can have on student achievement, and the role technology can play in amplifying student learning outcomes and easing teacher responsibilities (Lin, et al., 2013).

Making the Shift to a Proficiency-based Classroom Model

The research around proficiency-based learning models demonstrates a pattern of increased learning for most students. Technology removes many of the barriers that previously existed for teachers and schools, and when coupled with Mastery Learning they offer a possible solution to the *Two-Sigma Problem* defined by Benjamin Bloom (Bloom, 1984). Schools have already begun the shift to this instructional model. How have schools and districts been supporting the shift away from the traditional tracked school structure to the proficiency-based approach?

The Center on Reinventing Public Education began looking at implementation of personalize learning systems in schools across the nation. DeArmond and Maas executed a quantitative study of thirty-nine schools with a wide range of demographic make-ups. They

examined how schools implemented personalized learning systems and analyzed styles of implementation (DeArmond & Maas, 2018).

Implementing schools face more than an obstacle of change management, because a precedent for effective implementation does not currently exist. Thus, schools must engage in an evaluative process when implementing. DeArmond and Maas define two leadership practices through examination of their research. One style, identified as open leadership, encourages innovation and trial and error in schools and classrooms. The other closed style, sets expectations and holds staff accountable to those standards. Successful implementation of the personalized learning system is defined by the number of classrooms in the school that are using the personalized learning system to support personalized systems of instruction for students. The study also notes to what level these systems were integrated into daily classroom routines (DeArmond & Maas, 2018). No data were collected on student learning outcomes.

The study highlights the actions of two school leaders, one at Discovery Elementary School and the other at Enterprise Elementary School. Through examination of descriptive data collected at each site, these schools were recognized by the study for their progress in implementation of proficiency-based learning with the use of PLS practices (DeArmond & Maas, 2018).

The study identified a fluctuating blend of open and closed leadership styles employed at these school sites during the implementation phase. Though the timeline and styles of implementation were slightly different at both sites, methods of implementation were similar. Leaders allowed for innovation periods where teachers experimented in their classrooms and debriefed on successes and failures. Successes were then integrated into the school vision and

used as a structure for evaluation so administration could facilitate both teacher-to-teacher and administrative observations (DeArmond & Maas, 2018).

Struggling sites relied too much on one leadership style, or were effected by internal or external pressures that forced closed leadership throughout implementation. Integrating personalized learning systems “is messy and difficult work. It involves giving employees the space to innovate but also providing direction. It involves sparking new ideas but also supporting the use and spread of the best new ideas”. (DeArmond & Maas, 2018, p. 10) The effectiveness of personalized- learning and technology is not just about embracing the ideas, but how successfully the school implements the practices across classrooms.

Elliot Levine (2019) offers a qualitative look at a Minnesotan school’s efforts to implement proficiency-based education school-wide, which they identify as competency-based education. Through descriptive data collection and questioning Levine reveals school efforts in implementation and tracks the outcomes with varied stakeholders. Teachers share with him that implementation supports increased student engagement and reduced anxiety in the classroom. According to teacher interviews, once parents understood how competency-based learning worked and what role the technology would play, they were receptive. They feel competency-based learning and grading make it is easier to understand their child’s level of achievement, and enjoy using the school learning management system to track student progress from home. While the data from this study are taken only from successful implementers, and is thus subjective, it does help lay a foundation for further research into the effective implementation of competency-based practices.

Patrick, Worthen, and Frost (2018) also research the effects of personalize learning systems in classrooms. Their focus turns to student outcomes. They find that personalized

learning systems increase equity in education and offer opportunities for data collection that supports schools in optimizing student learning outcomes. Schools that utilize personalized learning systems are better equipped to support ongoing growth for all students; this is especially evident in traditionally underserved populations, who tend to receive more timely interventions and supports with these systems. Through the collection of descriptive data, they find that well-established personalized learning systems exist in schools that support: innovation, proficiency-based graduation, adjustments to problematic policies, and increase learning for all students.

iNACOL and the Midwest Comprehensive Center at AIR both fund research into computer-aided proficiency-based learning. Their work provides a more systematic outline of how successful schools implement and what barriers can exist. Successful districts tend to set clear goals for teachers, design high quality, flexible, professional development that builds tech competency, offer credential and job embedded learning opportunities, and invest in building assessment literacy in teachers. The results of this study demonstrate that to modernize classrooms with competency-based education, you must also build teacher capacity through updated credentialing programs and rigorous professional development (State Strategies to Develop Teacher Capacity for Personalized Competency Based Learning, 2018).

The Midwest Comprehensive Center at AIR has a very similar focus in their study. They conducted numerous interviews to collect data on how Wisconsin school districts are implementing proficiency-based learning using personalized learning systems. They too found leadership patterns evident in districts with successful implementation practices. Again defined though routine classroom use, when commencing implementation these schools focus on the knowledge of students and current standards-based proficiency, so that they may effectively design their personalized learning system curriculum. Parent communication and support are

essential at this stage. Successful schools engage parents as partners early in the implementation process. Implementation design generally includes a clearly defined plan before classroom implementation even begins to take place. Once successful districts are ready to expand, they set clear goals for teachers about the use of personalized learning systems. When well executed, this expansion period eventually supports systemic shift. System-wide buy in occurs during this stage, and skeptics are won over (Transforming Systems for High Levels of Learning for All Students: Personalized Learning in Wisconsin, 2018).

Conclusion

Mastery Learning practices garner increased learning outcomes for all students in a large classroom setting. Teachers using MLG practices, provide students the time and individualized attention they need. Valid concerns surrounding the implementation of mastery practices in the classroom often focus on logistics. Technology is quickly alleviating the stresses of assessment and learning management. Making proficiency-based learning a much more viable classroom model.

The economic shifts the information revolution bring to our workforce begs for paradigm shifts in classrooms (Kahn, 2015). The changes in demographics and the widening divide between the rich and poor also call for equity in education. Proficiency-based learning offers an approach that can shift schools away from the traditional tracked learning model and offers a more equitable and autonomous learning experience.

The question becomes what is the best method to bridge this transition. Districts have successfully incorporated computer-aided Mastery Learning into their classrooms. Models exist. What are the factors that influence a teacher's decision to incorporate MLG and does familiarity

with or the use of a PLS affect this decision? In the next chapter, the researcher examines how teachers view this paradigm shift in the classroom.

Chapter 3 - Methodology

This study examined the obstacles perceived by teachers when implementing MLG and how teachers view the use of a PLS platform when implementing MLG. Research indicates that technology can significantly relieve the time demands placed on teachers using MLG practices in their classroom (Eyre, 2007). The research question that was developed is, what are the factors that influence a teacher's decision to incorporate MLG practices in their classrooms and does familiarity with or the use of a PLS affect this decision?

To examine this question, the researcher studied a small snowball/convenience sample of teachers. Qualitative data were collected using an open-ended questionnaire. The participants must have had previous exposure to MLG concepts to participate. The survey screens teachers to ensure they have the prerequisites. The responses that were provided were coded to identify patterns that emerged and categorized for further analysis. Results were analyzed through an inductive lens, and conclusions were then drawn from the coded data. This chapter will serve to clarify the design of the study, identify the participants, setting, and procedures used, as well as how data were analyzed.

Design

This study was qualitative and used an open-ended questionnaire. This open-ended questionnaire was designed and directly administered to a small convenience sample of teachers, who were selected using snowball or networking sampling techniques (Mertler & Charles, 2011). The participant responses were coded and analyzed and the researcher identified emerging patterns in the data.

Qualitative data collection and inductive analysis were used because of the small sample size and the sample selection methods used in the study. The use of a network/snowballing

sample means collected data for this study could not be effectively generalized to the larger population because of lack of significance (Mertler & Charles, 2011).

Participant opinions were solicited through open-ended surveys, using questions geared to gain deeper understanding of the participating teacher's views about MLG practice and the role a PLS platform plays in implementation. It also provided insight into the factors that influence teacher implementation of a PLS platform in a MLG classroom. The in-depth examination of teachers' perspectives that qualitative analysis offers, provides more detailed information about the range of thoughts and patterns in participant responses. This data could be used as a stepping-stone to examine this topic further in a larger study that supports more statistical significance.

Participants

This study focuses on 20 participants in a small cohort of teachers. They were selected using snowball/convenience sampling methods. All participants were notified of the study through a brief overview from the researcher and given a URL that will link them to the survey. The survey states that through its completion the participants are consenting to the terms of the study. The teachers represented a variety of educators TK-12, including teachers who support special day classes. All teachers that participated were required to complete a series of open-ended survey questions.

Setting

The study took place online. Teachers were invited to participate outside of the workplace and did not engage further with the researcher regarding the study, beyond the initial invitation. The researcher asked participants to volunteer fifteen minutes of their personal time. Teachers were employed by large urban districts. The majority of participants worked in a

district that in 2017-18 employed 32,405 teachers who support 621,414 students. Of the 32,405 teachers, 11,196 are white, 13,164 are Latino, 871 are Filipino, 3,269 are black/African American, and 2,882 are Asian.

Teachers have an average of 15 years of service with that district. In the 2017-18 school year, 2,223 teachers completed their first year and 1,871 completed their second year of teaching (LAUSD, 2019).

Instruments

To collect data throughout the study the researcher used an open-ended questionnaire. Participants were selected through a snowballing, network-sample of teachers (Mertler & Charles, 2011). Most participants were familiar with Mastery Learning and Grading Theory and they may or may not have used these practices in their classroom. Qualitative data were collected using Google Forms as a survey tool. Delimitation were placed on the scope of the sample because of limited access to the population and time constraints of the study.

Procedures

To conduct the study the researcher invited teachers to join the study, this was ultimately the convenience sample that the researcher then focused on. This sample was selected in the beginning of the 2019-20 school year. Participation was strictly voluntary, and participants were made aware that the survey was in no way affiliated with their employer, and that collected data would not be shared in any other place than the final published study. All results were anonymous and no personal identifying information was collected.

Analysis

The researcher analyzed the collected data to identify any commonalities in responses. The data were coded so responses could be more easily categorized. Categories were set based on predominant themes that emerged during the inductive analysis. The categories identified are listed in Table 1 below. These findings represented the most common responses participants shared.

| Table 1 Coding Categories for Participant Survey Responses | | |
|---|--------------------------------------|------------------------------------|
| <u>Teacher Identifying Data</u> | <u>Obstacles to Implementation</u> | <u>Supports for Implementation</u> |
| Supportive of MLG Practice | Lack of Access to Resources | Access to Resources |
| Not Supportive of MLG Practice | Lack of Experience/Expertise | More training and Support |
| Access to a PLS | Lack of Collaboration, Planning Time | Time for Collaboration, Planning |
| No Access to a PLS | | |

Table 1. Coding Categories for Participant Survey Responses. This table lists the coding categories that were used to organize participant survey data.

Findings were summarized and then interpreted for the purpose of further analysis (Mertler & Charles, 2011).

Conclusion

This study investigated the question: what are the factors that influence a teacher's decision to incorporate MLG practices in their classrooms and does familiarity with or the use of a PLS affect this decision? Qualitative Methodologies were used to collect data from a small convenience sample. An inductive analysis methodology was then applied. Themes emerged in the collected data, and provided insight into possible obstacles to implementation. The next chapter will share the specific finding of the study.

Chapter 4 – Data Analysis

While Mastery Learning practice, as defined by Benjamin Bloom, is proven to increase student achievement, teachers are hesitant to implement these practices (Bloom, *The Two Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring*, 1984). There are varieties of factors that might influence teacher reticence. In this study, the researcher investigated the question: what are the factors that influence a teacher's decision to incorporate Mastery Learning and Grading practices in their classrooms and does familiarity with or the use of a PLS affect this decision?

In this chapter, the collected data from this study are presented, analyzed, and interpreted. The researcher collected qualitative data, through an open-ended survey. Teachers shared their experience in implementing proficiency-based teaching and grading into their classroom identified as Mastery Learning and Grading (MLG), as well their familiarity with using a Personalized Learning System (PLS) to enhance MLG practices. They reflected on any obstacles they have faced when implementing/trying to implement MLG. They also shared their own projections about how fidelity in practice can be enhanced. The survey goes on to collect data about how use of a PLS might influence a teacher's decision to implement MLG. When the participant data was analyzed, several general themes began to emerge. Most teachers that have been exposed to MLG practices support its use, and feel it influences student learning positively. Several of these teachers were or still are intimidated to implement MLG because of lack of experience. Teachers felt implementation was time consuming and found that to be an obstacle. Lack of experience with the use of a PLS and lack of student access to technology were themes that emerged when analyzing teacher survey data. Most teachers felt that to increase

implementation of MLG and the use of the PLS as support would take extensive training and resources allocated for ongoing support, as well as consistent student access to technology.

Data Presentation

The researcher surveyed 19 teachers for this study. This was a network sample, and participation was voluntary. Participants completed the survey at their leisure, and anonymously submitted the completed survey through Google Forms. Answers provided insights to possible ways schools and districts might better encourage the use of a PLS to support MLG practices. Many teachers are not taking advantage of the available tech resources to further individualized learning for students. The major themes found in the data are shared below.

Teacher experience with MLG practice.

One of the initial survey questions screened for teachers who have implemented or have considered implementing MLG practices in their classroom. *Have you used/considered using Mastery Learning practices in your classroom?* This narrowed the survey population down to teachers familiar with MLG practice. This selected group of educators all offered a positive view of Mastery Learning and Grading practice when responding to the question, *in your opinion do MLG practices enhance student learning? Explain.* Teachers offered endorsements like, *“...focuses students on their opportunities to learn and improve, and it aligns the incentives with learning and improving...”*

A diversity of responses began to emerge in the survey data as teachers shared their experience with MLG practice in the classroom at their specific school site. When responding to the question, Did you find that implementing Mastery Learning takes added time to plan and manage when compared to a more traditional approach to teaching? Explain. Teachers provided responses that highlighted obstacles that fell into three categories. One category has to do with access to resources. Many teachers felt they could save time if their school or district provided curriculum that aligned to a proficiency-based approach to learning, “...yes because curricular resources are not well-designed to support Mastery Learning and Grading...” Another obstacle that was discussed repeatedly had to do with understanding of practice. Participants referenced the theory that supports MLG in the classroom. They were hesitant to take steps to implement MLG until they had a complete understanding of how MLG worked, “...there’s this idea that Mastery Learning is so out of reach when implementing and that it’s for experts. At least, that’s what

I thought...” The final common category connected responses that referenced a need for more time to collaborate with colleagues. Survey participants felt they could implemented more readily if collaboration time was offered at their school site, especially time for self-reflection.



Figure 2. *Mastery Learning and Grading: Obstacles to Implementation – Coding Categories*

Teacher experience with PLS platforms. Data shared about using a PLS to support MLG in the classroom was limited. All participants could identify a PLS system that was available to use with their students, but many teachers participating in the survey did not have enough familiarity with the school’s PLS, and thus not enough comparative data could be collected about the implementation of MLG without and with the use of a PLS. The few participants that had familiarity with a PLS platform, cited a lack of consistent access to technology for all students as a hindrance to using a PLS with fidelity, *“I never had consistent enough access to computers for my students, so I couldn't rely on Schoology as a way to deliver content and instruction.”*

Teachers views on improvements in implementation. Participants did provided some advice on how MLG and PLS systems could be supported and brought into classrooms. These data fell into a few general categories. One was access to resources. Teachers need access to materials that are aligned to a proficiency-based approach to learning as well as technology so that they may use PLS systems consistently in their classrooms. Participant data also consistently

indicated a desire for more training time. Teacher responses shared that school site leadership should deliver teacher professional development using MLG practices and PLS resources. The final data category included responses that support more school-based training and support. Preferably immediate access to a department or grade-level appointed “expert” provided reflective data about how effective practice might be supported, *“But definitely a person within the grade or content level that is willing to support questions.”* The final category for responses supported further time for collaboration, planning, reflection on practice, etc. This would allow colleges to support each other.



Figure 3. Mastery Learning and Grading: Suggestions for Improved Implementation of MLG and PLS. Categories organizing participant responses suggesting how MLG implementation can be improved.

Data Analysis

Obstacles of access: MLG aligned resources. Suitability of resources is an issue that continually came up when data coding were performed on survey responses. Many teachers who are working to adopt a proficiency-based approach to grading are limited by the materials they are provided. These include curricular resources that offer a stringently paced curriculum, with little spiraling. Assessment that is not clearly aligned to learning goals, and that seemly promote a percentage based grading approach.

Obstacles of access: time for peer collaboration and development of expertise. Participants also would like more time to work with peers. There was consensus in response to the question, *is time an obstacle for teachers interested in adopting MLG practices?* All participants responded in the affirmative. Time to collaborate with peers, time to plan and align classroom curriculum, time to assess and reassess student progress. All of these were reasons provided in support of the need for more time. Teachers also felt they lack expertise. This is a perception based on self-analysis. No teachers mentioned any feedback from peers or referenced evidence of failed implementation that supported this feeling on inadequate understanding. Teachers were hesitant to dip their toes in, which may have a connection to what teachers claim to be a lack of time to collaborate.

Lack of access to resources and planning, though not specifically highlighted was implied by teachers responses to the questions, *have you used a PLS platform to design course instruction?* Teachers lacked exposure to how to use a PLS, though all teachers had access. The majority of respondents had not used a PLS to design course instruction at all.

School leadership and successful implementation. Literature indicates that technology, as a tool, is an essential element of successful implementation (Kahn, 2015). Research also

identifies a clear plan of school-based supports for these efforts to ensure success (State Strategies to Develop Teacher Capacity for Personalized Competency Based Learning, 2018). It seems that these elements might be either ineffective or non-existent in many of the schools these teachers work in. Few teachers that responded to the survey support MLG practices using technology at all, and those who did have the knowhow lacked the resources for students to use technology with regularity. A difficult obstacle to overcome when considering leveraging technology to support a more individualized educational program.

It is not surprising from the analysis that survey participants include responses that support the need for more MLG aligned resources, more collaborative time at school sites for both MLG and integrating it with the use of the PLS, and additional training. The group of teachers that participated in this survey, are ready and willing, but need additional supports to make the benefits of MLG a reality in our classrooms.

Interpretation

Due to the sample size and data collection techniques, this research cannot support conclusive correlation between variables examined in this study. The teachers who participated in the study did indicate that they are supportive of Mastery Learning and Grading practices and are not averse to bringing practice into their classroom. However, they specify that the time it takes to implement the individualized instruction necessary to support all students to proficiency is part of their resistance to implementation.

The purpose of the additional time needed for implementation aligns differently for different teachers. This may be an indication of their level of comfort or expertise with the subject matter. Teachers citing a need for planning time may have a deeper understanding of MLG practices than those asking for more time for collaboration, observations, or school site

instructional support. In either case, it is evident that to increase the prevalence of MLG practices in classrooms, teachers will need additional time to adjust traditional learning and grading practice.

Moving forward with MLG. Research supports the increased benefits a PLS can offer to teachers striving to bring MLG into their classroom. The lack of familiarity with using technology to support learning is evident from this study. To leverage the benefits of technology teachers will require extensive exposure to and support to tech resources. To make MLG an effective pedagogical approach it seems very necessary to build familiarity with the use of PLS platforms to minimize time demands placed on teachers to create individualized instructional paths for students. Learning how to support personalized instruction with technology, will require resources and time for teachers. Schools must develop more comprehensive implementation plans to support this or failure seems inevitable (Transforming Systems for High Levels of Learning for All Students: Personalized Learning in Wisconsin, 2018).

Possible bias and limitations of the research. The author in this study is an insider and is employed by the same large urban district in which many of the study participants work. During work, the author supports teachers in adopting a proficiency-based approach to teaching and learning, and as a classroom teacher made use of MLG theory and technology to support differentiation in the classroom.

This had an impact on who the researcher networked with to find study participants. As a network sample, many teachers were former participants in professional development that the researcher delivered in the employing district. This has an impact on the association that the participants have with MLG.

Limitations on this study are access to a representative sample that can be used to support statistical significance. This study reveals more than the research anticipated about the teachers' lack of familiarity with how a PLS works and can save time when developing individualized learning in the classroom. This brings to light additional questions about how to increase computer literacy effectively, which would benefit from further investigation on a larger scale.

Conclusions

This study investigated the question, what are the factors that influence a teacher's decision to incorporate MLG practices in their classrooms and does familiarity with or the use of a PLS affect this decision? The data analyzed and interpreted in this chapter reveal time and resources to be a significant limiting factor when teachers make decisions about implementing MLG. Few participants were comfortable using a PLS in their classroom, and thus a comparative analysis cannot be studied through the data collected. In the next chapter, we will further reflect on the data from this survey, its limitations, and examine next steps and application of this research.

Chapter 5 - Findings

Public schools are in the spotlight for the challenges they face in preparing our nation's youth for college and career. Fingers are quick to point at students, teachers, and parents, but it may in fact be the system that is working against itself (Kahn, 2015). Public school has long been an institution designed specifically to efficiently separate and filter based on aptitude (Guskey, 1985). Today a stronger push for equity in education demands more from public institutions than the status quo (Motamedi, n.d.). Mastery Learning and Grading is a research-proven solution to this dilemma (Patrick, Worthen, Frost, & Gentz, 2018), and technology makes individualized learning a manageable reality for today's classroom teacher (Kahn, 2015). This study served to investigate what the factors are that influence a teacher's decision to incorporate MLG practices in their classrooms and does familiarity with or the use of a PLS affect this decision?

This study collected data through qualitative methods using a network sample of participants. These data were coded through an inductive methodology, searching for patterns in responses as data were collected through a Google Forms Survey.

In this chapter, the author will summarize and interpret the findings made during this study, and compare the findings in the context of other research done in the field. The author will consider the implications of the research, explore its limitations, and look forward at how this work might support more in-depth study.

Findings Summary

This study found that teachers who participated were aware of Mastery Learning and Grading and were supportive of the practice. They were also willing to bring Mastery Learning and Grading in to their classroom, but were intimidated with what they perceived to be a very

time consuming amount of planning and preparation. They feel that the individualized instruction necessary to support all students to reach proficiency was overwhelming.

Teachers also felt that their level of understanding of how to make assessment tools and design corrective instruction affected their ability to implement with fidelity. They felt that this could be combated by access to resources that are already created and aligned to a MLG approach to learning and assessment. Additional time to collaborate with like-minded colleagues was also an ask. As was instructional support from school leaders.

Technology can combat many of the management and time demands that teachers feel overwhelmed by. Many districts license access to a PLS platform, but teachers who responded during the study lack the technological knowhow to leverage the benefits of the PLS to support personalized learning. Access to technology was also a stumbling block. Some teachers that were interested in using technology to support personalized learning, lacked regular access to devices for their classroom.

These outcomes are in line with the research around effective implementation of MLG. Participant's schools seem to lack a comprehensive plan of how MLG is to be implemented and the role the school's PLS would serve. As the literature reveals, a comprehensive plan is necessary for successful implementation of MLG and increasing teacher use and familiarity of a PLS platform (DeArmond & Maas, 2018). Requests for planning time, collaboration, observation, and resources are all elements that should be addressed at the leadership level, so a structured rollout can be implemented.

Findings Interpretation

The researcher found very little resistance from teachers, who had exposure to the research-based benefits of MLG. They were supportive to the idea of implementation.

Participants viewed the logistical elements as stumbling blocks. This is very much in alignment with the findings of the reviewed literature. The perceived time needed to plan for and develop the resources to implement MLG seemed like a tax too great to make the proven benefits worthwhile (Bloom, 1984).

To the study participants, technology was another layer of new learning to negotiate. MLG was one pedagogical approach to classroom instruction, and the use of technology was another one entirely. From participants' answers, it does not seem that they view the two in a symbiotic manner. This is revealing of an implementation technique that is far too broad or open (Transforming Systems for High Levels of Learning for All Students: Personalized Learning in Wisconsin, 2018). Successes must be amplified to teachers, so they understand the benefits, and then expectations must be set for adoption of these successful PLS usage strategies.

Findings in Context

Studies like those done in Wisconsin's Discovery Elementary School and Enterprise Elementary School layout the need for structured implementation of MLG and PLS (DeArmond & Maas, 2018). Bloom was able to leverage significant improvements with his 2-sigma study, it did not garner the benefits technology enhanced MLG does (Lin, et al., 2013). Schools serious about reaping these rewards need to remove the obstacles to implementation for teachers (DeArmond & Maas, 2018).

Advancements in technology have offered the tools for teachers to make the 2-sigma problem a reality. Keller's vision of teacher facilitated personalized learning, combined with the technological resources of on-demand content and adaptive exercises, seems much more feasible in the context of the typical public school classroom. Schools like the Minnesotan schools studied by Levine (2019) have had success with implementing MLG with the support of

technological resources. These schools planned for the time needed to implement and the instructional leadership and collaboration that would be required.

The technological divide created by a lack of computer literacy among the teachers I surveyed, makes the correlation between the use of classroom technology and teacher openness to implementation of MLG difficult to compare. This need must be addressed in any efforts to combine MLG and technology. The literature that was reviewed for this study, does not address how computer competency was built in teachers before using a PLS to implement personalized learning, but this information would have to be part of any implementation plan.

Lack of access to technology is another stumbling block that would need to be addressed for teachers who are trying to implement personalized learning program in their classroom, but struggle with regular availability to students. This also extends to MLG aligned resources. Expecting teachers to “recreate the wheel” in each classroom is a big ask. Schools must organize either teacher-developed resources so all staff can access them, or invest in technology/curriculum that can support an MLG approach.

Much like the research done in Wisconsin, this study clarifies that it will take a balance of innovation and implementation to build proficiency in using a mastery or personalized-learning approach in the classroom (Transforming Systems for High Levels of Learning for All Students: Personalized Learning in Wisconsin, 2018).

The author found in the survey research that teachers felt that if their schools’ instructional leadership modeled using technology to implement personalized learning for teachers and provided ongoing support for teachers in how to support Bloom’s Mastery Learning approach in the classroom with computer-aided enhancement, they would be able to implement. Time to collaborate with colleagues also was in line with reviewed studies recommendation for

implementation. Teachers who were allowed time to experiment and innovate, and then share best practices pushed implementation along. Then leadership used these recommendations to develop expectations and guidelines to bring along those that might be more hesitant (State Strategies to Develop Teacher Capacity for Personalized Competency Based Learning, 2018).

Implications, Recommendations and/or Lessons Learned

This research supports that when knowledgeable about MLG practices, teachers are open to implementation. Common themes emerged, that are in alignment to many of the reviewed studies around MLG practice. When teachers are asked to implement in a traditional public school classroom, they feel that it is too time consuming to plan. Resources for implementation of individualization take extensive time to produce and existing classroom resources are not useful since they are not in alignment with MLG.

Technology holds a promise to alleviate some of the common time consuming implementations problems, and offers a level of personalization to students that is difficult to achieve in a busy, student-packed classroom when technology is not leveraged. However lack of access to technology, and lack of computer literacy among teachers prevents personalize learning systems from being leveraged for this purpose.

This both makes this study hard to draw conclusive results from, and speaks to a larger question of computer literacy. It is imperative for our students, especially those in school with staggering rates of poverty to gain proficiency in the foundational learning outlined by the state standards as well as in the use of technology. This study supports a call to action for schools, especially those that are struggling with students seemingly unable to meet the requirements of the state standards.

Implementing personalized learning in schools is an imperative. It is a research-proven method to ensure students are not suffering from a model of schooling that is meant to sort and filter, rather than to support and ensure growth (Bloom, 1984). Technology is proven to enhance an MLG approach. Using a PLS can support learning and develop valuable experience engaging with technology. School though must have a structured plan of action to help teachers overcome obstacles. It will take strong leadership and a flexible approach to developing teachers' abilities to embrace these tools.

Educational Implications

As an advocate for learning reform, the author does have a bias that is supportive of the benefits of competency-based education, and has successfully used technology in the classroom to support personalized learning for students. The author has a background in technology, working in information technology before earning a teaching credential 16 years ago. The researcher grew-up in a home with access to technology, once personal computers became available on the mass market. Therefore engaging with technology was not a barrier for the author when considering how to implement MLG.

Additionally, most of the teachers that the researcher has access to work in urban public schools that service a socioeconomically disadvantaged population. While for the researcher, this makes the call-to-action even more urgent, there is an equity gap when it comes to tech access in these classrooms. If the study sample had included a variety of schools that serviced a more diverse spectrum of socioeconomic groups, there may have been more data to make more conclusive connections between MLG and PLS usage. The broader range of participants may have provided a more effective sample for the purposes of this study.

The data collection methodology and the small population size also makes the results of this study difficult to generalize reliably to the broader population. This is compounded by the short window in which the research was performed. Access to fiscal resources and/or a longer time-period to perform the research, may have made a more statistically significant study possible.

Future Direction

The study does support the idea that teachers are willing to implement mastery practices in their classrooms, and that they are open to learning about PLS. Future studies should employ more selective sampling techniques, with the goal of offering more statistical significance. The study should use an experimental approach, that tracks the likelihood and longevity of MLG implementation based on a teacher group that receives regular training in use of a PLS when compared with teachers that do not receive training.

Through this, the study could evaluate the benefits of investing in teacher technology training. MLG has already show to offer sizable impact on educational outcomes in our classrooms (Bloom, 1984). Using a PLS has also resulted in enhanced outcomes for teachers who are striving to individualize education to the needs of learners. We also have data on successful implementation models. The missing piece is the resources and time needed to build capacity in our teachers. A deeper look may reveal that it would be a very fruitful investment.

Appendix A

MLG Survey Questionnaire

Survey Participation Disclaimer:

Participation in this survey is strictly voluntary. Your answers will be used for research purposes. This research is in no way affiliated with your school or school district. Please do not share any identifying information or confidential data about students or employees at your school site. No identifying information will be collected by the researcher about you the participant. By selecting "Yes, I agree to participate in this survey" below, you agree to the terms outlined above. Thank you for your participation.

* Required

1. Do you agree to participate in this survey? *

Mark only one oval.

- Yes, I agree to participate in this survey and have read the terms outlined above.
 No, I do not wish to participate in this survey at this time. Stop filling out this form.

Teaching experience:

2. How long have you been teaching? *
3. What is the highest level of education achieved? *
4. Do you hold any special credentials (NBC, etc.)? *

Experience with Mastery Learning:

5. What is your experience with Mastery Learning and Grading (MLG)? *
6. Have you used/considered using Mastery Learning practices in your classroom? *

Mark only one oval.

- Yes
 No (Stop filling out this form.)

Evaluation of MLG practices:

7. In your opinion, do MLG practices enhance student learning? Explain. *
8. Did you find that implementing Mastery Learning takes added time to plan and manage when compared to a more traditional approach to teaching might? Explain. *
9. Is time an obstacle for teachers interested in adopting MLG practices? *

Mark only one oval.

- Yes (Skip to question 12.)
 No

Implementation of MLG:

10. Some teachers do cite time as an obstacle to implementing MLG in their classroom. What helped you get around this obstacle (tools, curriculum, management, etc)? *

Technology and MLG:

11. Is/was technology a support that helped you save time in implementing MLG? *

Mark only one oval.

- Yes
 No

MLG and Personalized Learning Systems:

12. Does your school site have a personalized learning system (PLS) platform? (Schoology, Google Classroom, etc.) *

Mark only one oval.

- Yes
- No (Stop filling out this form.)

Using PLS in the classroom:

13. Have you used a PLS platform to design course instruction? *

Mark only one oval.

- Yes Skip to question 15.
- No

Using PLS:

14. Why might you not have used the PLS? * (Skip to question 16.)

PLS and student learning:

15. Did you find using the PLS helped support meeting the diversity of academic needs in your classroom? Why or why not? *

MLG, PLS, and time management

16. Do you feel that a PLS saves teachers time when implementing mastery learning practices?

Mark only one oval.

- Yes
- No

17. In your opinion, how could your school build capacity in teachers so that they would make daily use of a PLS (Schoology, Google Classroom, etc.) to support customized learning for students?

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