Assignment 3

Technology Implementation Plan for Mathematics

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Introduction

Mathematical literacy continues to be one of the most important goals for our students, not only district-wide but in the growing global society to which they belong. Success in mathematics prepares students for modern, complex challenges that will empower students to explain essential issues better and solve meaningful problems as they continue to nurture the potential for continued growth in mathematics literacy (PISA, 2015). Programme for International Student Assessment (PISA, 2015) describes mathematics literacy as:

> An individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to recognize the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective citizens.

According to a Pew Research Article (DeSilver, 2017) titled U.S. Students' Academic Achievement Still Lags That of Their Peers in Many Other Countries, students in the United States rank 38th out of 71 countries in mathematics. Students in the Amerman Public School District have tested below average in mathematics. It is imperative that we help our students succeed in this domain. We need to ensure that every student is performing at or above their ability. The role of success in mathematics remains increasingly important as our students grow and learn to become an integral part of a 21st-century global community. The connection to mathematics practices through the mastery of mathematics content and instruction is paramount in helping to increase standardized test score (Common Core State Standards Initiative, 2014).

"Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" (Berry, 2014). In order to make a positive impact on the students' achievement in the area of mathematics, a new Mathematics Technology Integration Plan will be introduced and put in place by a leadership team overseen by the technology department. This plan will look at two select technologies that they believe will support every learner, including English Language Learners (ELL), diverse learners, and the special education population. They will make recommendations based on the needs of students and staff as supported by a district-wide survey. After an initial pilot study of the recommended software, a plan for implementation (timing, faculty, staff, and administration training schedules, costs, assessments for success) will be outlined.

Background, Goals, and Objectives

The Amerman Public School District serves approximately 4,000 students from pre-kindergarten to twelfth grade. Students in grades kindergarten through eighth grade currently use Houghton Mifflin Go Math! Program and the high school uses Houghton Mifflin Harcourt for their algebra and geometry courses. For the past four years, the district has been equipped with one-to-one technology. Grades two through twelve use Chromebooks and grades kindergarten and first-grade use iPads. With this implementation, the district has seen a slight increase in overall standardized test scores. However, the students are still performing below average. The district and board of education have a goal of raising standardized mathematics scores significantly.

New Study Shows 1-to-1 Technology Improves Student Achievement in Math Over Time (Genota, 2018) indicates that improvement after the implementation of one-to-one technology

often does not increase until after the third year. While our district scores did see the most growth in year four, we are confident that with the addition of the appropriate software, the ubiquitous use of technology in all classrooms, regular professional development opportunities, and support for faculty, these select technologies will improve student standardized mathematics test scores in a more impactful way.

Choosing software that allows for personalized learning will support the educational needs of every student. Being able to differentiate instruction is especially crucial for our ELL, special education, and other various learners throughout the district. The ability of all students to have access to technology has given educators the opportunity to use technology to increase personalized learning opportunities which support the needs of the individual student by allowing for customization and flexibility of instruction (Berry, 2014). The careful and purposeful implementation of appropriate personalized software will complement existing programs while allowing for increased tailoring to individual student needs, interests, backgrounds and goals. Furthermore, attention to the flexibility of the delivery of instruction through the amount of time and where students engage in mathematics will allow students to develop 21st-century skills, such as creativity, critical thinking, technology literacy, flexibility (Berry, 2014). Students will as begin to focus on finding solutions to tasks and problems, using mathematical understanding to find answers, explaining how they are thinking mathematically, and supporting why or why not their solutions make sense (Common Core State Standards Initiative, 2014).

Amerman Public School District is committed to excellence for its almost 4,000 students. The one-to-one Chromebook initiative is well underway, and we believe that the addition of carefully selected mathematics personalized learning software will enhance education for all of

our diverse learners. Additionally, consistent and pedagogically appropriate use of technology in the classroom will be the focus of ongoing professional development for all mathematics teachers. Supporting faculty on a regular basis as the district incorporates these technologies will best meet the needs of all of our students (Cheung and Slavin, 2013). The customization and flexibility of instruction offered by the implementation of these new software technologies will help to improve student learning and increase achievement on district standardized mathematics testing.

Resource Recommendations

We recommend that the Amerman Public Schools implement two student-centered, personalized programs, Personal Math Trainer Powered by Knewton (PMT) and IXL Learning.

Personal Math Trainer (PMT)

While researching what programs would best support improved Mathematics scores within the district, we discovered that we have one program right at our fingertips. PMT is a resource that our district teachers already have access to, yet they were not using it because they did not know it existed in our district. It accompanies our existing Mathematics program, Go Math! by Houghton Mifflin and is available to students through Through Think Central. We suggest that this program is implemented immediately in kindergarten through sixth grade.

Utilizing PMT will enable the Amerman Public Schools to get an immediate jump start on implementing intervention strategies. PMT is a personalized solution for students, and it provides rigorous practice and instruction. It adapts to each students' learning level to give each student a customized learning path. Teachers can look at real-time data to see where students need help and where they excel (Houghton Mifflin Harcourt, 2015). Teachers will be able to use this data to pull small groups and give further individualized instruction.

To expedite the implementation of PMT, we recommend that the technology coordinator holds an after-school professional development session for the teachers in each building within the next month. We suggest that this training take place during a weekly faculty meeting. Utilizing a faculty meeting would be advantageous in order not to incur any additional costs for professional development. The overall implementation of this resource should not incur any fees for the district since this is a resource that we already have access to and we are going to utilize contracted time that the teachers are already required to be in the building.

IXL Learning

The next program that we recommend to help support student achievement in Mathematics is IXL Learning. We recommend implementing this program district-wide in grades kindergarten through twelfth grade. IXL Learning is a cloud-based, student-centered, personalized program that aligns with the Core Curriculum Content Standards, the New Jersey Student Learning Objectives, as well as our current mathematics program.

IXL Learning has won many awards, including the winning the 2018 CODiE Award for "Best Educational App for a Mobile Device" for the second year in a row (Accelerating Innovation in Technology, Data & Media, 2018). It is available across various devices. It is accessible via iOS and Android devices, as well as through its web-based interface. Another feature is that IXL Learning integrates easily with Google Classroom. Teachers can quickly and easily assign IXL skills to their students through Classroom. The Amerman Public Schools utilize G Suite for Education. Therefore, this is an attractive component because if the program is user-friendly for the teachers, we would expect to see greater participation.

Special Education, ELL, and other diverse learners have shown not only improved engagement but are enjoying mathematics as indicated by Annette Lutes, High School Special Education Teacher "IXL has revolutionized my classroom. Even my lowest-level students are able to be successful when working in IXL. And the skills they are mastering and the rate at which they are learning is truly amazing" (IXL, 2016). The ability of IXL to allow the teacher to personalize curriculum so that students are working at their level allows for success for each student each time they use the program.

We are confidently optimistic that IXL Learning will meet the needs of the Amerman Public School District. Numerous research studies back up its effectiveness and show that using IXL Learning helps to improve student achievement significantly (Empirical Education, 2013). One local study in New Jersey examined student achievement in schools across the state. Researchers analyzed results from the 2014 New Jersey Assessment of Skills Knowledge (NJ ASK) and the scores from the 2016 Partnership for Assessment of Readiness for College and Careers (PARCC). They looked at schools that use IXL and schools that do not. The results showed that IXL schools outperformed schools that did not use IXL by four percentile points in math (IXL, 2015). The amount of time that students were using IXL varied per student, from as little as one minute per week to seventy minutes per week.

A study done in California involved 4th graders. Through a Title 1 grant, students had the opportunity to come to school early and spend time in the math lab working on IXL. The math lab took place for four months (January to April) for two years in a row. During its implementation, the math scores on the state assessment rose higher each year. At the end of year two, test scores went up an average of 24 points (Donawerth, 2013).

One high school in Kentucky saw dramatic results after implementing IXL Learning. Based on state assessments, the school was ranked in the bottom five percent of the schools throughout the state and then designated as a school in need of improvement. They used IXL to implement robust, targeted intervention strategies. Over the two year period, the school made successful strides and reached the 97th percentile and became noted as a "School of Distinction" (Stobaugh, Chandler, and White, 2015).

Because IXL Learning is an adaptive, personalized program, it provides differentiated instruction and will meet the needs of the diverse population of learners throughout our district. Teachers can run reports and use the descriptive, individualized data to drive their instruction. IXL Learning uses MicroSkills for targeted improvement. Honing in on precise concepts makes it easier for students to learn and understand the various math concepts. The program also provides excellent support for teachers by making immediate, detailed feedback available, as well as detailed instructions on how to help students will skills. IXL analytics provides ongoing data so that teachers can see which students are struggling with concepts and how students are progressing with their academic growth ("How to Use IXL to Support Diverse Learners," 2016). All of this valuable data is important and helpful when trying to document student progress, especially for students with IEPs.

Another valuable aspect of IXL Learning is that administrators have access to powerful reports that can track any number of results. They can identify top performing students in each grade, evaluate usage, and monitor student data. They will be encouraged to use this data to hold the teachers accountable for usage, make public affirmations over the school-wide public address (PA) system, and to create rewards and incentives.

Programs that produce desired results, engage students and produce copious amounts of useable data are can be incompatible with school budgets however we feel that the cost is commensurate with the product. The twelve-month, 4,000 students, Mathematics license, will cost the district $9.50 per student, for a total of $38,000. This expense will come from the budget of the Supervisor of Mathematics and Title 1 funds.

Implementation

In accordance with recommendations from the New Jersey Mathematics Curriculum Framework, the Amerman Public School District Technology Plan for Mathematics will be implemented in the areas of content, instruction, and assessment. The plan will consist of the following steps:

1. Establish a committee which includes at least one teacher from each school in the district and one Mathematics teacher from each middle school and high school.
2. The committee will conduct a survey to identify issues, develop timelines, focus on determined goals and produce professional development plan.
3. Create an inventory of the existing technological resources used for teaching and learning mathematics.
4. Develop vision and goals for enhancing the area of mathematics with the use of technology.
5. Produce a draft outlining the gaps in the inventory of existing resources and the vision and goals as well as recommendations for integrating technology for minimizing those gaps.
6. Disseminate the draft to other stakeholders, such as school and district administration, teachers, and parent connection organization.

7. Request feedback and offer the opportunity for the open forum on the suggested implementation.
8. Continue the dialog until the consensus is reached.
9. Seek internal and external budget for supporting the integrations, incorporate the projected cost into a five-year district technology plan.
10. Start solid professional development program before purchasing any new software or hardware.
11. Provide additional training opportunities as/after the new technological resources are being acquired.
12. Evaluate the software paying special attention to the balance of promoting higher-level thinking skills and allowing for drill and practice.
13. Plan courses and instructional programs to incorporate the technology.
14. Decide on maintenance and licensing of the purchased software and hardware.
15. Plan for continuous evaluation and upgrading of the resources, as necessary.

The plan correlates to the School Technology Needs Assessment (Corn, 2007), with its focus on incorporating the teachers' feedback into decision making on incorporating technology into Mathematics curriculum. The teachers' contribution to the planning and implementation of the products is invaluable.

As the above-stated plan provides a general set of recommendations for approaching technology implementation in the area of Mathematics, the earlier sections of this paper already discussed establishing the vision and goals specific to the district. It is important to take inventory of the technology that is currently in use and support mathematics instruction as well as

understand the deficiencies. The STNA online survey will be used to assess mathematics technology needs for the school from all faculty and staff in order to recommend the best tools (Corn, 2007).

The overall success of the implementation plan relies heavily on several critical components. Poole (2009) refers to them as pillars of successful technology implementation. One of such pillars refers to "ongoing training" (Poole, 2009). The teachers at the Amerman Public School district will receive professional development of both, Personal Math Trainer Powered by Knewton (PMT) and IXL Learning.

In preparation for the integration and use of both programs in the next academic year, the district will schedule two distinct professional opportunities (one for each program) and invite trainers from Knewton and IXL Learning for conducting those. These initial training sessions will be scheduled during the current academic year to provide all Mathematics instructors with adequate lead time for practice and lesson plan updates.

Both content providing companies, Knewton and IXL Learning, will be informed of the district's vision and goals as well as the budgetary restrictions. The teachers will be educated on how to incorporate PMT and IXL Learning content into their existing curriculum and lessons, how to use the real-time diagnostic data analysis tools, and how to meet the needs of every student at their level. These introductory sessions will inspire and empower the teachers with the educational toolsets to further investigate and invest time into incorporating the programs into their curricula.

In addition, the district will generate a list of additional professional development opportunities (both online and in-person) available for enrolling over the summer. The list will be

shared with all Mathematics instructors in the district. All instructors will be strongly encouraged to take advantage of the training opportunities available during the summer months. Those instructors who will be able to take advantage of the summer training opportunities will serve as PMT and IXL Learning ambassadors during the next academic year and provide peer-to-peer assistance to other teachers at their schools.

During the summer months, the district administrators and the discipline supervisors will receive just-in-time training on the reporting sides of PMT and IXL Learning. Training consultants from both companies will conduct webinars and face-to-face training sessions (if needed) on how to produce aggregate data from the learning systems and follow student progress on various levels, such as individual level, class level, grade level, school level, and the district level. Additional benchmarking tools, based on the comparative analysis to other districts in the state, will be explored.

Just in time for the new academic year, a coaching session for all Mathematics teachers and discipline supervisors will be scheduled to alleviate the stress from incorporating the new programs into the curriculum. Program ambassadors who benefited from the summer professional development opportunities will provide just-in-time support to their fellow peers. The technical support team from Information Technology Services will be available to address any installation and usage related concerns and answers any questions.

As the school year progresses, the teachers will continue having ongoing professional opportunities on a regular basis. They will be able to report the results of these training sessions as part of the ongoing assessment of the overall implementation plan. The assessment of the

overall professional development and the individual training sessions will be incorporated in the general assessment of the ongoing technology implementation plan.

Assessment of Implementation

Ongoing assessment is essential not only during the implementation phase of any new program but should be considered a dynamic process. We began this process by analyzing our available resources and curriculum need in order to support and address issues that would improve standardized mathematics scores throughout the district. Careful determination of which programs would supplement and support current district software was completed, and the recommendation was made to purchase IXL and PMT. After the pilot of the new software is completed the implementation phase (as outlined above) will be modified and actualized. The dynamic nature of continued and consistent evaluation of these new programs will include all stakeholders in order to work with our students to achieve excellence in mathematics (ADDIE Model, 2016).

Planning for regular data collection and assessments helps to support the integration of the new software is essential for all stakeholders. When faculty, staff, and students are aware of regular and scheduled evaluations, everyone is aware of what the expectations are as they continue to work towards a unified goal. The use of a Logic Model (Frazier and Hearrington, 2017) along with employing a regular schedule for its delivery, will help keep the focus on the district vision, to support all students success in mathematics and increasing standardized mathematics test scores.

Successful implementation for students can be measured in a number of ways. A decrease in math anxiety, an increase in self-efficacy as it relates to solving challenging math problems,

increased engagement and enjoyment when doing math, and finally, coming to school and staying in school (Frazier and Hearrington, 2017). An example of a Logic Model (Table 1) outlines specific inputs, activities, outputs, outcomes, and impacts that can be collected for the assessment of the implementation of the new programs. Regular assessments give administration and faculty the opportunity to adjust and revise the implementation of the new software as issues may surface. Expectations of regular evaluations help to assist faculty to support students throughout the implementation of this new program.

Table 1. Logic model for mathematics achievement (Frazier and Hearrington, 2017, p. 67-68)

Resources/Inputs ➡	**Activities ➡**	**Outputs ➡**	**Outcomes ➡**	**Impacts**
Hardware, Software, & Infrastructure	IXL/PMT is pushed out to Chromebooks	Teachers gain an understanding of how IXL/PMT can enhance learning	Student scores on basic math operations increase 20%	Reduced student math anxiety
Trainers and PD planned bi-weekly	Teachers, principals, and coaches trained on IXL/PMT implementation		Student scores on word problems increase by 15%	Increased student math self-efficacy
Administrative expectation to use IXL/PMT at least 10 minutes each day	Teachers implement IXL/PMT for at least 10 minutes daily (in class or HW)	Teachers can integrate IXL/PMT at least five ways into mathematics instruction	Student scores on fractions, ratios, and percentage increase by 15%	Increased student engagement in mathematics
Scheduled weekly teacher team planning & discussion of IXL/PMT	Teachers meet weekly for IXL/PMT discussion as a team lead by a coach.	Teachers comfort level integrating IXL/PMT in the five ways increases.	Student scores on pre-algebra problems increase by 15%.	Increased student enjoyment of mathematics.

Weekly IXL/PMT coaching per teacher	Teachers meet each week individually with the assigned IXL/PMT coach.	Teacher lessons show increasing sophistication with IXL/PMT	Student scores on mathematics vocabulary increase by 20%.	Reduced student rate Increased average daily attendance
Assessment Data to Collect				
Deployment schedules PD schedules Memeo from principals to teachers Meeting schedules Baseline Math scores	IXL/PMT usage rates from the central management software *Records of meetings (notes, agendas, teacher reflections)* Pre-implementation (baseline)student math anxiety, self-efficacy, engagement and enjoyment scores	Teacher reports and coaches observations of teaching practice Teacher comfort measurements results Collected teacher lesson plans	Student test scores	Post-implementation student math anxiety, self-efficacy, engagement and enjoyment scores Retention rates Daily attendance rates

Conclusion

As our society becomes digitally enhanced and rapidly moves in the direction of data-driven decision making, the mathematical literacy and mathematical fluency become essential skills for the modern day students. Developing mathematical skills enhances students ability to solve problems and incorporate critical thinking strategies to create applied solutions in multiple fields and areas (PISA, 2015). Using technological approach towards the development of the mathematical skill set provides students with a competitive edge not only in this country

but also on the international arena. Success in mathematics awards students with an opportunity to grow as smart and responsible citizens of the 21st century.

The Mathematics Technology Integration Plan puts in place a plan that will add two carefully selected technologies that will support all diverse learners, including ELL and the special education population. A district-wide survey and initial pilot study was conducted before implementation commenced. The addition of these two strong mathematics programs along with regular professional development and evaluation will support students improvement in standardized test scores throughout the Amerman School District.

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