PERSONALIZED LEARNING AND STUDENT ACHIEVEMENT

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In the following report, Hanover Research provides a review of the literature on personalized learning and its impact on student achievement. Specifically, the report addresses four key components of personalized learning: student choice, student engagement, flexible learning environments, and personal learning paths. In addition, this report includes profiles of personalized learning initiatives undertaken by two school districts.

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EXECUTIVE SUMMARY AND KEY FINDINGS

INTRODUCTION

Personalized learning may necessitate an array of changes to schools, both curricular and physical. Nevertheless, the outcomes associated with personalized learning suggest that this approach to education can be a powerful way to positively impact student achievement. This report presents a review of the learning outcomes associated with personalized learning in K-12 school districts, intended to support districts in their implementation and evaluation of personalized learning initiatives. The report proceeds in two sections:

- **Section I** reviews the literature on four components of personalized learning: student choice, student engagement, flexible learning environments, and personal learning paths.

- **Section II** profiles two school districts that are recognized in the literature as implementing exemplary personalized learning initiatives.

KEY FINDINGS

- **Research suggests that student choice relates to enhanced engagement in school and academic achievement.** The extant literature examining the impact of student choice on learning outcomes demonstrates a positive correlation between choice of assignments and motivation, engagement, and performance. Researchers attribute enhanced motivation to the greater sense of autonomy and competence that students feel when they are able to exert a choice

- **The literature points to a number of strategies for enhancing student choice in school.** For instance, a commonly-cited suggestion is to allow students to choose from multiple versions of assignments and assessments to demonstrate mastery. In addition, a number of innovative schools implement competency-based learning, which allows students to progress through a curriculum at their own pace. The degree of autonomy learners experience within schools implementing competency-based learning varies considerably.

- **The three facets of learner engagement – behavioral, cognitive, and emotional – are interrelated and relate significantly to academic achievement.** There is little evidence to support a causative link between student engagement and achievement. However, research demonstrates a correlation between the three types of engagement and students' academic outcomes. One study, conducted at the high school level, suggests that behavioral engagement may be the best predictor of academic achievement. Researchers also note that students in positive classroom environments – those characterized by high instructional quality, positive socioemotional climate, and low levels of student-teacher conflict – exhibit higher levels of engagement and academic achievement.

- **Limited research links the following components of school design to student achievement: freedom of movement, large group meeting places, natural light, and instructional neighborhoods.** One study finds that each of these design aspects is linked to enhanced student achievement, though a causal relationship has yet to be established. Particular design features that support flexible learning are computer banks for computer-based learning, collaborative work space for small group practice and projects, and seated space centered on the teacher for teacher-led small group work.

- **To facilitate student ownership of personalized learning paths, the literature suggests that learners engage in reflection, goal setting, planning, and progress monitoring.** Districts may require students to follow this process to create their own personal learning plans. This reflects the belief that students with ownership over their learning choices will be more engaged and successful in school. Teacher support and online tools for planning and tracking progress can aid students in the creation and implementation of their plans.

- **Districts implement a number of strategies in their effort to incorporate personalized learning into education.** Technology upgrades play a role in both of the districts profiled in this report. Specifically, the districts invested in technology upgrades in the classroom – such as computing devices and digital instruction tools – to enhance individualized instruction. In addition, the districts renovated physical space to promote student learning. In these instances, the districts focused on incorporating large spaces with function-specific zones into the design. These are intended to promote the flexible and multi-purpose use of classroom space.

SECTION I: OUTCOMES OF PERSONALIZED LEARNING

This section engages in an overview of the effects of personalized learning on student and school outcomes. To frame our analysis of the empirical literature on personalized learning, we refer to the definition put forth by the Bill & Melinda Gates Foundation, which describes personalized learning as "systems and approaches that accelerate and deepen student learning by tailoring instruction to each student's individual needs, skills, and interests."[1]

In order to assess the effects of personalized learning on student and school outcomes, Hanover Research will examine the following four aspects of personalized learning:

- Student Choice
- Student Engagement
- Flexible Learning Environments
- Personal Learning Paths

STUDENT CHOICE

An article published in *Adolescent Literacy in Perspective* defines student choice as the practice of giving learners the ability to make choices about what they are learning in the classroom with the intention of boosting student engagement and motivation.[2] By enhancing student engagement, educators hope that they will be able to influence student achievement and generate positive outcomes.[3] The extant research suggests that this approach may be effective. Studies indicate that allowing students a degree of autonomy in their learning experience may enhance their academic performance as well as their engagement in school (Figure 1.1).

For instance, an article published in the *Journal of Educational Psychology* in 2010 shows that allowing students to decide how to approach homework does have a positive effect on student motivation.[4] In this study, teachers assigned students randomly to one of two groups: homework choice or no homework choice. Those in the former could choose between two homework assignments, while learners in the latter had no choice in their assignments.[5] The results of the study determine that learners with a choice in their homework assignments exhibit increased interest in, enjoyment of, and competency in

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[1] "Early Progress: Interim Report on Personalized Learning." College Ready, November 2014. p. 2.
http://collegeready.gatesfoundation.org/learning/early-progress-interim-report-on-personalized-learning/

[2] Perks, K. "Crafting Effective Choices to Motivate Students." *Adolescent Literacy in Perspective*, April 2010. p. 2.
http://www.ohiorc.org/orc_documents/orc/adlit/inperspective/2010-03/in_perspective_2010-03.pdf

[3] Ibid.

[4] Patall, E., H. Cooper, and S. Wynn. "The Effectiveness and Relative Importance of Choice in the Classroom." *Journal of Educational Psychology*, November 2010. p. 910.
http://www.immagic.com/eLibrary/ARCHIVES/GENERAL/JOURNALS/E101100P.pdf

[5] Ibid., p. 903.

homework. Moreover, choice does have a measurable impact on student achievement as students perform better on end-of-unit tests when presented with options in completing homework.[6] A potential shortcoming that the study notes is the increased time burden on teachers to design, distribute, collect, and grade a variety of assignments.[7]

Another study published in *Psychological Bulletin* performs a meta-analysis of existing studies on student choice from 1974 through 2004.[8] In this synthesis, the authors find that student choice positively impacts a number of factors, including motivation, effort, task performance, competence, learning, and preferences for challenge. Researchers attribute enhanced motivation to the greater sense of autonomy and competence that students feel when they are able to exert a choice.[9] Notably, results from this analysis suggest that instructionally irrelevant choices – as opposed to choices affecting instruction such as activity and tasks options – have the biggest impact on learners' intrinsic motivation.[10]

Figure 1.1 : Student Choice and Academic Achievement

AUTHOR(S)	YEAR	SAMPLE SIZE	METHODS	OUTCOMES
Patall et al.	2010	207 students Grades 9-12	■ Students randomly assigned to two groups, one with a choice of two homework assignments and one without ■ At the end of each teaching unit, teachers administered Intrinsic Motivation Inventory ■ After students completed units, groups were switched (no-choice students became choice and vice-versa) ■ Teachers administered end-of-unit tests to assess achievement	■ Homework choice significant predictor of interest, enjoyment, competence, unit test scores ■ Homework choice has little effect on effort, pressure, tension, or value for homework

[6] Ibid., p. 910.

[7] Ibid.

[8] Patall, E., H. Cooper, and J. Robinson. "The Effects of Choice on Intrinsic Motivation and Related Outcomes: A Meta-Analysis of Research Findings." *Psychological Bulletin*, 134:2, April 2008. p. 270.
http://www.researchgate.net/publication/5554527_The_Effects_of_Choice_on_Intrinsic_Motivation_and_Related_Outcomes_A_Meta-Analysis_of_Research_Findings

[9] Ibid., p. 295.

[10] Ibid.

Author(s)	Year	Sample Size	Methods	Outcomes
Patall et al.	2008	41 studies from the years 1974-2004	■ Researchers looked through online journal databases for articles empirically testing the impact of student choice on motivation ■ Researchers integrated studies into one framework assessing effects, moderators of effects, and fixed/random error	■ Student choice positively correlates with motivation, effort, task performance, competence, learning, and preference for challenge ■ Student choice negatively correlates with pressure or tension

Source: *Journal of Educational Psychology* and *Psychological Bulletin*[11]

PROMOTING STUDENT CHOICE

Research submitted to academic journals such as the *Journal of Educational Psychology*, *The Science Teacher*, and the *English Journal* outline methods that teachers can use to promote student choice in the classroom. Figure 1.2 presents a sample of these activities as well as a brief explanation of their outcomes. Notably, the recommendations provided in these sources address student choice in homework and evaluations. When using tic-tac-toe choice boards, for example, students can make many decisions regarding which assignments they want to complete. Similarly, students completing summative projects are given a choice of what topics they want to research or write about.

Figure 1.2: Methods and Practices for Promoting Student Choice

Method	Outcome
Homework	Giving students a choice in selecting homework assignments boosts interest, enjoyment, perceived competence, and unit test scores.
Choice Boards	Using a tic-tac-toe board – a tool that allows students to select assignments on which they demonstrate mastery – builds skills, generates buy-in, and creates classroom community.
Summative Projects	By providing students with choice in selecting writing topics for a summative project, students engaged in close reading and other effective writing practices.

Sources: *National Science Teachers Association*, *English Journal*, *Adolescent Literacy in Perspective*, and *Journal of Educational Psychology*[12]

Another approach to student choice in their learning experience is competency-based learning. According to Next Generation Learning Challenges, an organization dedicated to

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[11] [1] Patall, Cooper, and Wynn, Op. cit., pp. 896-913. [2] Patall, Cooper, and Robinson, Op. cit., pp. 276–288.

[12] [1] Romano, M. "Tic-Tac-Toe: An Experiment in Student Choice." *The Science Teacher*, 81:4, May 2014. p. 1. Accessed via EbscoHost. [2] Falkner, S. "Signs of Life in the High School Classroom: Analyzing Popular Culture to Provide Student Choice in Analytical Writing." *English Journal, High School Edition*, 101:2, November 2011. pp. 47–48. http://www.ncte.org/library/NCTEFiles/Resources/Journals/EJ/1012-nov2011/EJ1012Signs.pdf [3] Patall, Cooper, and Wynn, Op. cit., p. 910. [4] Perks, Op. cit., p. 2.

enhancing college and career readiness through technological innovation, competency-based learning allows "students to move at their own optimal pace and receive credit when they demonstrate mastery of the material."[13] The organization reviewed its grant recipients in an attempt to document the approaches each takes to incorporating mastery into student progression through the curriculum. Below are the two primary strategies schools employ:[14]

- **In some schools, students move at their own pace within tightly specified boundaries**—within a specific activity, within a course curriculum, or perhaps within a grade level. The boundaries create a starting point and an ending point for self-pacing through a particular curriculum and set of standards, and students earn credit for making progress within that bounded set of competencies.

- **In other schools, students move at their own pace seemingly without boundaries**—there are no grade levels in the school, projects drive the learning and students master content as they work on projects, or students can choose how they will demonstrate mastery outside of any specific curriculum. Students must meet state standards and must demonstrate a predetermined level of mastery before they can move on. Some schools establish minimum requirements for self-pacing—so a student who doesn't like history, for example, can't avoid the subject and must continue to make progress toward mastery.

STUDENT ENGAGEMENT

The Glossary of Education Reform, a resource developed by the Great Schools Partnership, presents the following definition of student engagement:[15]

> In education, student engagement refers to the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught, which extends to the level of motivation they have to learn and progress in their education.

The extant literature asserts that student engagement plays a prominent role in preventing academic failure, promoting competence, and influencing a variety of outcomes for students.[16] Researchers also point to engagement as a significant predictor of academic achievement.[17] However, student engagement is not a singular entity. Over the past ten years, research on student engagement has shifted away from a unilateral construct to a multidimensional one.[18] For the purposes of this report, Hanover Research will examine

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[13] Vogt, K. "Competency-Based Learning in K-12 Schools." Next Generation Learning Challenges, February 11, 2014. http://nextgenlearning.org/blog/competency-based-learning-k-12-schools

[14] Bulleted text adapted from: Ibid.

[15] "Student Engagement Definition." The Glossary of Education Reform. http://edglossary.org/student-engagement/

[16] Li, Y. and R. Lerner. "Interrelations of Behavioral, Emotional, and Cognitive School Engagement in High School Students." *Journal of Youth & Adolescence*, 42:1, January 2013. p. 20. Accessed via ProQuest.

[17] Dotterer, A. and K. Lowe. "Classroom Context, School Engagement, and Academic Achievement in Early Adolescence." *Journal of Youth & Adolescence*, 40:12, December 2011. p. 1649. Accessed via EbscoHost.

[18] Li and Lerner, Op. cit., p. 21.

student engagement through the tripartite understanding commonly endorsed in the literature.[19] These facets are:[20]

- Cognitive Engagement: Pertains to students' thoughts in relation to learning and education.

- Behavioral Engagement: Refers to students' active participation in school-related activities.

- Emotional Engagement: Refers to students' affective reactions in the classroom and towards school.

Hanover Research identified four empirical studies that assess the impact of cognitive, behavioral, and emotional engagement on learners' academic achievement. Figure 1.3 presents an overview of these studies and their findings.

Figure 1.3: Student Engagement and Academic Achievement

AUTHOR(S)	YEAR	SAMPLE SIZE	METHODS	OUTCOMES
Li and Lerner	2013	1,029 students Grades 9-11	■ Used data from the Head, Heart, Hands, and Health (4-H) study of Positive Youth Development (PYD) ■ Examined interrelationships among behavioral, emotional, and cognitive engagement over time	■ Positive emotions and motivational thoughts intensify participation ■ Positive feelings broaden cognitive capacity ■ Positive feelings could lead to enhanced participation
Conner	2011	93 students in elementary, middle, and high school	■ Mixed-methods approach ■ Used the National Survey for School Engagement to assess the three dimensions ■ Used focus groups to interview groups of students ■ Assessed self-reported engagement at each school level	■ Elementary school students more emotionally engaged ■ All three levels report similar behavioral engagement rates

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[19] Ibid.

[20] [1] Finn, J. "School Engagement and Students at Risk." National Center for Education Statistics, 1993. http://nces.ed.gov/pubs93/93470a.pdf [2] Connell, J. and J. Wellborn. "Competence, Autonomy and Relatedness: A Motivational Analysis of Self-System Processes." *Minnesota Symposium on Child Psychology*, University of Chicago Press, 1991. [3] Marks, H.M. "Student Engagement in Instructional Activity: Patterns in the Elementary, Middle, and High School Years." *American Educational Research Journal*, 37:1, 2000. Cited by Li and Lerner, Op. cit., p. 21.

AUTHOR(S)	YEAR	SAMPLE SIZE	METHODS	OUTCOMES
Dotterer and Lowe	2011	1,014 students Grade 5	▪ Used standardized assessments, observations, and self-reporting ▪ Rated classroom factors, psychological engagement, behavioral engagement, and academic achievement ▪ Tested if classroom factors predict student engagement as well	▪ Positive classroom factors relate to psychological and behavioral engagement ▪ Psychological and behavioral engagement positively affect achievement ▪ Struggling students benefit most from positive classroom factors
Chase et al.	2014	710 students Grades 10-12	▪ Used data from the Head, Heart, Hands, and Health (4-H) study of Positive Youth Development (PYD) ▪ Self-reported GPA measured achievement	▪ Behavioral student engagement at Grade 10 strongest predictor of GPA in Grade 12 ▪ Emotional engagement in Grade 10 predicts GPA in Grade 11 ▪ Behavior strongest predictor of GPA overall

Source: Journal of Youth Adolescence[21], Review of Higher Education and Self-Learning[22]

Research suggests that school engagement positively relates to students' academic outcomes. For instance, in their study of high school students, Chase et. al. determine that there is "a bidirectional, reciprocal relationship between school engagement and academic achievement."[23] In other words, engagement levels can predict a learner's academic achievement. Conversely, student achievement (as measured by grade point average) can predict a student's level of engagement in school.[24] Some evidence from this study suggests that, of the three types of engagement – cognitive, behavioral, and emotional – behavioral engagement is the strongest predictor of academic achievement in students' high school years.[25] In particular, Chase et al. note that even if students are cognitively engaged – that is, "if students think that school is important" – they may not succeed academically if they do not know the proper behaviors to engage in schoolwork.[26]

However, changes in one type of engagement may also impact other types of engagement. Learner and Li's research indicates that feedback loops exist between the different types of

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[21] [1] Li and Lerner, Op. cit., pp. 23–29. [2] Conner, T. "Academic Engagement Ratings and Instructional Preferences: Comparing Behavioral, Cognitive, and Emotional Engagement Among Three School-Age Student Cohort." *Review of Higher Education & Self-Learning*, 4:13, December 15, 2011. pp. 58–62. Accessed via EbscoHost. [3] Dotterer and Lowe, Op. cit., pp. 1652–1656. [4] Chase, P.A. et al. "Academic Achievement in the High School Years: The Changing Role of School Engagement." *Journal of Youth and Adolescence*, 43:6, June 2014. pp. 886–894. Accessed via EbscoHost.

[22] Conner, Op. cit., pp. 58–63.

[23] Chase et al., Op. cit., p. 891.

[24] Ibid.

[25] Ibid.

[26] Ibid.

engagement.[27] For instance, the researchers find a significant, positive relationship between emotional engagement in Grade 9 and behavioral engagement in Grade 10. Likewise, emotional engagement in Grade 10 predicts cognitive engagement in Grade 11.[28] The research also asserts the need for more studies in order to understand the nature of the relationships between the various forms of engagement.[29]

The studies by Li, Lerner, Chase, and others show that grade level and classroom context may impact the type of engagement supports students need. While Connor's study is limited in its sample size, its cross-grade level nature demonstrates the shift away from emotional engagement in school as students progress out of elementary school.[30] Dotterer and Lowe, on the other hand, examine the impact of classroom context on student engagement. Classroom factors considered in their study include:[31]

- Social/Emotional Climate
  - Classroom over-control
  - Chaos
  - Teacher detachment
  - Positive climate
  - Negative climate
  - Teacher sensitivity
- Instructional Quality
  - Richness of methods
  - Productive use of instructional time
  - Evaluative feedback
- Teacher-Student Conflict

In their study, the researchers determine that students in positive classroom environments – those characterized by high instructional quality, positive socioemotional climate, and low levels of student-teacher conflict – demonstrate higher behavioral and psychological engagement.[32] Moreover the researchers note that psychological engagement, which is a combination of emotional and cognitive engagement, and behavioral engagement are both predictors of academic achievement.[33]

FLEXIBLE LEARNING ENVIRONMENTS

Creating an effective learning environment, according to a paper published by the Organization for Economic Co-operation and Development (OECD), requires districts to subscribe to *practice theory* and link that to *responsive commissioning*.[34] Practice theory "describes the interaction between learner and environment," whereas responsive commissioning "explores the nature of the interaction between the social and physical

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[27] Li and Lerner, Op. cit., p. 29.

[28] Ibid.

[29] Ibid.

[30] Conner, Op. cit., pp. 60–62.

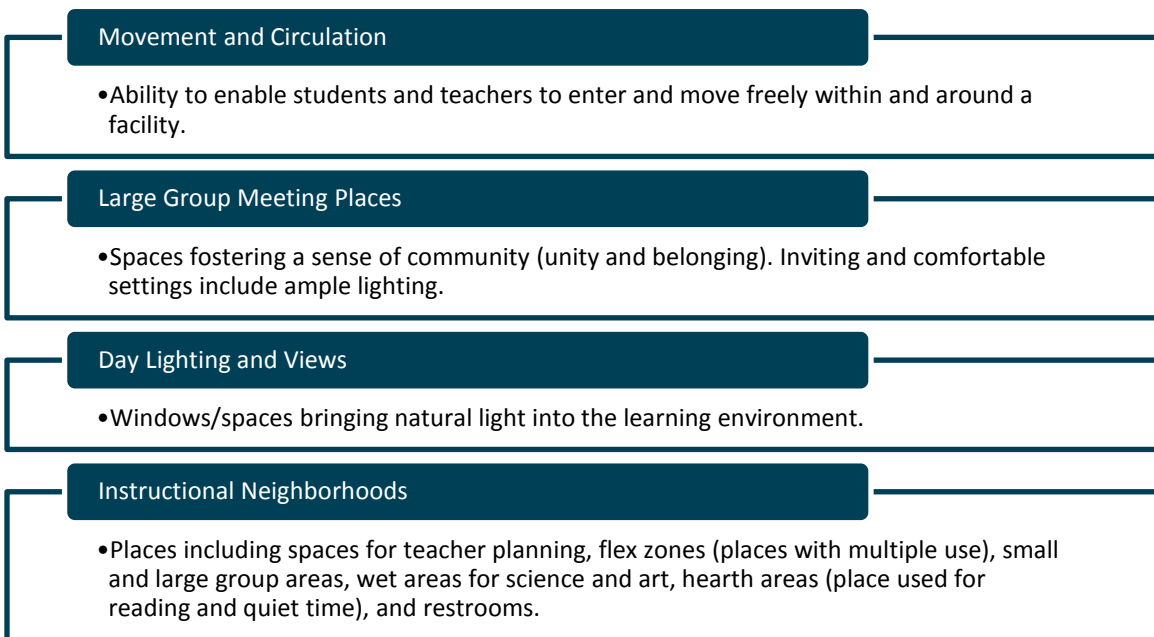[31] Dotterer and Lowe, Op. cit., p. 1653.

[32] Ibid., p. 1656.

[33] Ibid.

[34] Lippman, P. "Can the Physical Environment Have an Impact on the Learning Environment?" *CELE Exchange*, 2010. p. 1. http://www.oecd.org/edu/innovation-education/centreforeffectivelearningenvironmentscele/46413458.pdf

aspects of the learning environment."[35] In other words, to create an effective learning environment districts not only need to understand how students function in the classroom, but also how students interact with both the teacher and other students within that space. With regards to how this interacts with personalized learning, the OECD study states that modern learning environments "are envisioned as places where the learner is engaged in self-directed and cooperative learning activities" and so the learning environment plays a direct role in personalized learning.[36]

Some research indicates that specific physical environments are positively correlated with student achievement, even after controlling for potentially mediating variables. To measure the impact of environment on learning, one 2008 study published in the *Journal of Advanced Academics* analyzes the effects of four different design aspects on student achievement. These design aspects, along with their key features, are presented in Figure 1.4.

Figure 1.4: Aspects of Classroom Design

Movement and Circulation
- Ability to enable students and teachers to enter and move freely within and around a facility.

Large Group Meeting Places
- Spaces fostering a sense of community (unity and belonging). Inviting and comfortable settings include ample lighting.

Day Lighting and Views
- Windows/spaces bringing natural light into the learning environment.

Instructional Neighborhoods
- Places including spaces for teacher planning, flex zones (places with multiple use), small and large group areas, wet areas for science and art, hearth areas (place used for reading and quiet time), and restrooms.

Source: *Journal of Advanced Academics*[37]

The study finds positive correlations between academic achievement and environments promoting movement and circulation, large group meeting places, lighting, and instructional neighborhoods.[38] The study controlled for socio-economic status (SES) and found that,

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[35] Ibid.
[36] Ibid.
[37] Figure contents adapted from: Tanner, C.K. "Explaining Relationships Among Student Outcomes and the School's Physical Environment." *Journal of Advanced Academics*, 19:3, Spring 2008. pp. 452–453. Accessed via EbscoHost.
[38] Ibid., p. 465.

while SES negatively correlates with student achievement, overall environment correlates with improved student performance. It should be noted, however, that the study did not control for a number of mediating factors (e.g., quality of instruction, school funding) and therefore cannot draw strong causal relationships between design and achievement. An overview of the study is presented in Figure 1.5.

Figure 1.5 : School Design and Academic Achievement

AUTHOR(S)	YEAR	SAMPLE SIZE	METHODS	OUTCOMES
Tanner	2008	11,500 students in 24 elementary schools	- Used literature review to identify elements for evaluation - Conducted site visits to assess facilities and learning environments - Used Iowa Tests of Basic Skills (ITBS) to measure student achievement - Used SES as a control variable due to its significance	- Presence of all design aspects correlates positively with student achievement - Causal relationship not established, however - SES still has significant effect on student achievement

Source: *Journal of Advanced Academics*[39]

By analyzing the effects of certain design aspects, the study shows possible ways for schools to design their physical space to promote student achievement. To improve movement and circulation, districts can take into consideration personal and social distance, how students flow from classroom to classroom, and access to facilities.[40] With large group meeting places, districts can build larger facilities for media centers, dining areas, amphitheaters, and auditoriums and design them to be "inviting and comfortable," with ample lighting.[41]

Finally, instructional neighborhoods can promote a flexible learning environment. Building classrooms to resemble studios with cooperative learning spaces and quiet private areas allow students to engage in personalized learning.[42] Folding partitions, large-group lecture rooms, small group spaces, staff offices, and incorporated technology represent other ways districts can use space to promote personalized learning and drive achievement.[43]

The typical classroom, where the focal point of the room is the blackboard and all desks are organized into neat rows, may not support personalized or student-centered learning.[44] According to an article published by the OECD's Centre for Effective Learning Environments,

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[39] Ibid., pp. 457–466.
[40] Ibid., pp. 449–452.
[41] Ibid., pp. 451–454.
[42] Ibid., p. 457.
[43] Ibid., pp. 453, 457.
[44] Lippman, Op. cit., p. 2.

personalized learning classrooms should be structured differently than traditional classrooms in order to better reflect the new roles of teachers and curricula in personalized learning environments. Below, Figure 1.6 compares and contrasts the traditional classroom structure with a modified classroom structured around personalized learning.

Figure 1.6: Differences in Adapting Learning Environments to Technology

Traditional Classroom with SMART Board
- SMART Board replaces blackboardis focal point of room
- Structure reinforces teacher-centered learning environment

Classroom with Modified Learning Environment
- Environment changed to enable students to engage in personalized learning
- Teacher acts as facilitator, guiding students, the learning process, and subjects to learn.

Source: *CELE Exchange*[45]

In addition, integrating modern technology like computers, tablets, and SMART boards is another way to enhance flexibility and adaptiveness of the learning environment. A recent report released by the American Institutes for Research (AIR) makes this claim, naming blended learning environments as one possible way to introduce flexibility into the classroom.[46] The AIR report also outlines the efforts that one district, the Metropolitan School District of Warren Township in Indiana (Warren), is taking to shape classrooms to emphasize personalized learning. Profiled later in this report in Section II, Warren is building wireless lounges, increasing laptop availability, and renovating classrooms to include spaces such as:[47]

- A **simultaneous instruction computer lab** with 34 workstations, each possessing two monitors;

- Two **collaborative learning studios** for collaboration and project-based work;

- A **digital viewing room** set up to resemble a theater with seating and a podium for a teacher, with students able to interact directly with the project image on the wall; and

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[45] Figure content adapted from: Ibid., pp. 2–3.
[46] Tanenbaum, C., K. Le Floch, and A. Boyle. "Are Personalized Learning Environments the Next Wave of K-12 Education Reform?" American Institutes for Research, August 2013. p. 3.
http://www.air.org/sites/default/files/AIR_Personalized_Learning_Issue_Paper_2013.pdf
[47] Ibid., pp. 3–4.

- A **creative thought gallery** that has dry-erase boards for walls.

These actions fall in line with recommendations that other states are making to promote personalized learning within the classroom. In Delaware, for example, the Rodel Foundation Teacher Council—a group of teacher-leaders focused on improving personalized learning throughout the state—recommends that classrooms have three distinct areas to promote a blended learning atmosphere.[48] These distinct areas include a bank of computers for computer-based learning, clusters of stations grouped together for small group practice and projects, and seats around the teacher for teacher-led small group work.[49]

PERSONAL LEARNING PATHS

A personal learning path or plan is defined by the Glossary of Education Reform as a plan developed by students in collaboration with teachers, counselors, and parents in order to help them achieve short- and long-term learning goals. Typically based on the belief that students with ownership over their learning choices will be more engaged and successful in schools, students compiling personal learning plans may be required to complete all or some of the following activities:[50]

- Think about and describe their personal life aspirations, particularly their collegiate and career goals.

- Self-assess their individual learning strengths and weaknesses, or reflect on what they have academically achieved, excelled at, or struggled with in the past.

- Identify specific learning gaps or skill deficiencies that should be addressed in their education, or specific knowledge, skills, and character traits they would like to acquire.

- List or describe their personal interests, passions, pursuits, and hobbies, and identify ways to integrate those interests into their education.

- Chart a personal educational program that will allow them to achieve their educational and aspirational goals while also fulfilling school requirements, such as particular learning standards or credit and course requirements for graduation.

- Document major learning accomplishments or milestones.

The publically available empirical research directly examining the impact of developing personal learning paths on measures of student achievement and engagement is limited. However, the results of a seminal research study conducted on the role of student self-efficacy and personal goal setting in 1992 indicate that student self-efficacy and goal setting are intertwined: "the higher the perceived self-efficacy, the higher the goals students set for themselves," the researchers explain after gathering and analyzing data from 102 secondary

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[48] "Blueprint for Personalized Learning in Delaware." Rodel Foundation, 2014. p. 15.
   http://www.rodelfoundationde.org/blueprint/pdf/blueprint-2014.pdf
[49] Ibid.
[50] Bulleted text taken verbatim from "Personal Learning Plan." Glossary of Education Reform, March 3, 2014.
   http://edglossary.org/personal-learning-plan/

school students in a large Eastern city over the course of year.[51] "Self-efficacy influenced not only students' setting of academic goals for themselves, but also their achievement of those goals."[52]

Researchers also propose that educators can help students gain more control over their learning paths in three central ways: by providing organizational autonomy support, procedural autonomy support, and cognitive autonomy support. Below, Figure 1.7 displays several instructional strategies that characterize each type of support as conceptualized by researchers Stefanou et al. in *Educational Psychologist*.

Figure 1.7: Strategies Associated with the Different Features of Autonomy Support

ORGANIZATIONAL AUTONOMY SUPPORT	PROCEDURAL AUTONOMY SUPPORT	COGNITIVE AUTONOMY SUPPORT
Students are given opportunities to: ▪ Choose group members; ▪ Choose evaluation procedures; ▪ Take responsibility of due dates for assignments; ▪ Participate in creating and implementing classroom rules; and ▪ Choose seating arrangement.	Students are given opportunities to: ▪ Choose materials to use in class projects; ▪ Choose the way competence will be demonstrated; ▪ Display work in an individual manner; ▪ Discuss their wants; and ▪ Handle materials.	Students are given opportunities to: ▪ Discuss multiple approaches and strategies; ▪ Find multiple solutions to problems; ▪ Justify solutions for the purpose of sharing expertise; ▪ Have ample time for decision making; ▪ Be independent problem solvers with scaffolding; ▪ Re-evaluate errors ▪ Receive informational feedback; ▪ Formulate personal goals or re-align task to correspond with interest; ▪ Debate ideas freely; ▪ Have less teacher talk time and more teacher listening time; and ▪ Ask questions

Source: *Educational Psychologist*[53]

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[51] Zimmerman, B., M. Martinez-Pons, and A. Bandura. "Self-Motivation for Academic Attainment: The Role of Self-Efficacy Beliefs and Personal Goal Settting." *American Educational Research Journal*, 29:3, Fall 1992. pp. 666–668, 673. http://www.researchgate.net/profile/Manuel_Martinez-Pons/publication/233896457_Self-motivation_for_academic_attainment_The_role_of_self-efficacy_beliefs_and_personal_goal_setting/links/0deec53caef30dfbb2000000.pdf

[52] Ibid., p. 673.

[53] Figure contents taken verbatim from: Stefanou et al. "Supporting Autonomy in the Classroom: Ways Teachers Encourage Student Decision Making and Ownership." *Educational Psychologist*, 39:2, 2004. p. 101. http://faculty.washington.edu/sunolen/562/old%20562%20files/Stefanou.pdf

CASE STUDY: DALLAS INDEPENDENT SCHOOL DISTRICT, TX

For Dallas Independent School District (DISD), personalized learning—a "one size fits one education experience"—is a crucial instructional priority.[54] Moreover, the district believes that a true personalized learning environment depends on the use of personal learning paths. "A personal learning path," DISD notes, "describes how a student will master a concept or skill – what lessons and activities she will engage in to become an expert in rigorous content." Notably, successful personal learning path implementation requires both teacher and student involvement. Teachers need to collaborate with parents, students, and other teachers to help build learning paths and use data to understand student needs, whereas students need to know their own goals, take ownership over their learning processes, and help to create their own personal learning paths.[55]

Student agency is key to implementing personal learning paths. Below, Figure 1.8 demonstrates the student agency rubric shared in DISD's "Personalized Learning Playbook."

Figure 1.8: Student Agency Rubric for Personalized Learning

BEGINNING	PRACTICING	DEVELOPING	ACHIEVING
Teacher sets students' academic goals and tracks progress against those goals.	Teacher sets students' academic and non-academic goals, tracks progress against those goals, and reflects on students' strengths and areas for growth.	Teacher and students co-set personal academic and non-academic goals, track progress against those goals, and reflect on areas for growth.	Students set personal academic and non-academic goals, track progress against those goals, and reflect on strengths and areas for growth.

Source: Dallas Independent School District[56]

To help facilitate the development of personal learning paths, students at DISD can access their online "Learner Profiles" through the district website. Learner Profiles contain up-to-date information on student grades, test scores, assignments, and learning styles. The profiles also contain spaces for students to set their own goals for the future.[57]

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[54] "Personalized Learning in Dallas ISD." Dallas Independent School District. http://www.dallasisd.org/Page/35469

[55] "Personalized Learning: Meet." Dallas Independent School District. http://www.dallasisd.org/Page/34683

[56] Figure contents taken verbatim from: "Personalized Learning Playbook." Dallas Independent School District. p. 9. http://www.dallasisd.org/cms/lib/TX01001475/Centricity/Domain/13594/PL%20Handbook8.2015.pdf

[57] "Personalized Learning in Dallas ISD," Op. cit.

SECTION II: DISTRICT PROFILES

In the following section, Hanover Research examines how two districts, Fulton County Schools (FCS) and Metropolitan School District of Warren Township (Warren), implement personalized learning programs within their schools. To select these districts, Hanover Research relied on the extant literature on personalized learning programs. Each profile details several different aspects of personalized learning, including increasing student choice, implementing technology, and created improved physical learning environments.

FULTON COUNTY SCHOOLS, GA

In Georgia, FCS is focused on making every school in the district a personalized learning environment by 2019.[58] To that end, FCS published a comprehensive "Personalized Learning Roadmap" in March of 2014 that details the district's vision of personalized learning, how personalized learning aligns with the district's strategic plan, and the concrete steps—such as curricular changes, technology implementation, and physical renovations—the district needs to take to enhance personalized learning.[59]

Overall, the district's adoption of personalized learning is intended to help FCS achieve long-term goals such as a 90 percent graduation rate, an 85 percent college eligibility rate, and a 100 percent career readiness rate. According to a press release published by Education Elements, the company working to support FCS in its transition to personalized learning, "the district believes that with a one-size-fits-all model it will not be able to realize these goals but that by focusing on creating personalized learning models in each of its schools, student needs will be met and its goals achieved."[60]

ENHANCING TECHNOLOGY

Innovative instructional technology is a key aspect of FCS's personalized learning adoption. The following excerpt from the district's personalized learning roadmap presents what FCS calls a "snapshot of the [district's] future" and demonstrates how closely technology is intertwined with FCS' vision of personalized learning:[61]

> Eleven year old Myra in East Point glances at her tablet to review her personal dashboard with her progress report and schedule of activities for the day before getting on the bus. The previous evening she watched a video lecture her teacher created for the day's lab in science and took a quick quiz on the lab procedures.
>
> Upon arriving at school, she looks at her tablet to see the schedule of rotations planned for the day which include individual instruction, a whole group science lab,

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[58] "Personalized Learning Roadmap." Fulton County Schools, March 2014. p. 18.
https://www.fultonschools.org/en/divisions/acd/Documents/FCS%20Personalized%20Learning%20Roadmap%20Final%2v03102014.pdf

[59] See "Personalized Learning Roadmap," Op. cit.

[60] "Education Elements to Support Fulton County Schools in Personalized Learning Implementation." PR Web, April 23, 2015. http://www.prweb.com/releases/2015/04/prweb12672693.htm

[61] "Personalized Learning Roadmap," Op. cit., p. 2.

small group work on a social studies project that her group designed, and independent work using online resources. In mathematics she is learning to solve linear equations using an online tool which provides formative feedback. The results of her progress throughout the day are instantly fed into her personal dashboard.

Myra's teachers have access to her dashboard and use the data on her progress and interests to suggest resources to help her make the right instructional choices. Myra and her parents are able to view her past work as well as her trajectory of future learning as aligned to standards and her own personal learning plan.

However, FCS has several challenges to overcome in order to build that future. The district is aware, for example, that FCS stakeholders want to use more web-based tools focused on student learning and that both teachers and administrators lack "cutting edge tools" to improve teaching and learning in all schools.[62] Furthermore, an analysis of the district's infrastructure and technology capabilities in 2013 revealed that the district's structure was only partially aligned with the following personalized learning "success criteria":[63]

- An IT strategy is in place to use technology for developing Personalized Learning applications, creating and delivering [Personalized Learning] instruction material;

- Integrated data of student demographics, instructional, etc., should be easily accessible by the educators that can guide instruction and personalized the experience;

- Fast and uninterrupted broadband network connectivity at home and school. Recommended specifications: 100 kilobytes per second or faster per student for Internet connection, and 1000 kbps or faster for internal school network; and

- One-to-one or max one-to-two device (computer/tablet) to student ratio.

To increase the district's structural alignment with technological success criteria, FCS plans on updating the Technology Strategic Plan, creating a long-term budget plan, and building the district's capacities for "real-time operation of tools."[64]

RENOVATING PHYSICAL SPACES

To help improve students' personalized learning experiences, FCS is considering renovating several physical spaces in the district, as the 2013 analysis of the district's infrastructure and technology capabilities found that FCS' "design requirements and facilities may need to be updated to better support personalized learning."[65]

The district outlines the following personalized learning success criteria, intended to guide its approach to facility design:[66]

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[62] "Personalized Learning Business Case Development and Roadmap, Phase Two."
http://www.boarddocs.com/ga/fcss/Board.nsf/files/9H4S4F5C9F05/$file/FCS_Phase%20II_%20PL%20Current%20State%20_3-11-14.pdf. Gartner Consulting for Fulton County Schools, 2013. pp. 2, 5.
[63] Bulleted text taken with minor edits from: Ibid., p. 32.
[64] "Personalized Learning Roadmap," Op. cit., p. 14.
[65] "Personalized Learning Business Case Development and Roadmap, Phase Two," Op. cit., p. 13.
[66] Bulleted text adapted from: Ibid., p. 33.

- The facilities design process is collaborative and reflects input from a variety of stakeholders;
- Classrooms and learning spaces tend to reflect the following characteristics:
  o Align with educational goals and student demographic needs
  o Large and flexible
  o Easily reconfigurable (i.e. movable furniture, movable walls)
  o "Zones" to facilitate different types of learning as applicable
  o Technology enabled
  o Light controlled
- Group spaces—libraries and computer labs—are available to encourage and accommodate collaboration (laptop/tablet charging ports, discussion tables, etc.)

CONSIDERING STUDENT CHOICE

For FCS, increased student choice is an important benefit of personalized learning. The district believes that students should have choices regarding curricula, learning resources, learning materials, and learning environments.[67] After an analysis of the district's offerings that found content offerings varied between and within schools, for instance, FCS began focusing on increasing student choice by improving the in-person and online class options available to students. Specifically, the district was concerned that course variations could lead to "inequitable access to curricular options… and limited usage of multiple learning pathways and varied learning environments."[68] Figure 2.1 presents some of the district's objectives, deliverables, and activities for enabling choice through curricula.

Figure 2.1: Curating Curricular Options and Offerings to Enable Choice

ELEMENT	DESCRIPTION
Purpose	■ Ensure equity and variety within schools and across the district's offerings of curricular options
Objectives	■ Enhance and manage district's portfolio of college and career-oriented options (e.g., signature programs, magnets, internships, early college, etc.) ■ Within classes, expand curricular options. Facilitate choice in terms of how students achieve standards and how that learning is assessed within classes; as well as choice of classes/programs
Key Deliverables	■ Options made available to FCS students: --Magnet schools or academies opened --Program created --Internships offered ■ Web-based tool for students to browse and explore existing options ■ Training/communications for teachers

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[67] "Personalized Learning Roadmap," Op. cit., p. 3.
[68] Ibid., p. 14.

ELEMENT	DESCRIPTION
Key Activities	▪ Continue to explore, and open theme-based schools (magnets) and other programs ▪ Work with schools and partners to offer students a more comprehensive offering of (examples) online courses, independent study and honors challenges, seminars, courses at nearby high schools and higher education institutions, internships, career and technical programs, after-school programs, summer school, co-teaching, peer tutoring, advisory services, course-embedded supplemental instruction, academic-support and extended-learning options ▪ Provide planning/support to school-based teams undertaking new programs or opening new schools ▪ Manage portfolio of offerings in a central location

Source: Fulton County Schools[69]

PERSONAL LEARNING PATHS

FCS plans on providing every student with the ability to craft their own learning plan within a large framework of options. Ideally, students will be provided with the process, supports, and technology to support independent goal-setting that can be measured and tracked over time. To support this plan, the district aims to create an inventory of current tools and processes that could support the creation of learning plans, reinforcing existing career and counseling services, evaluating current tools and processes, and, if necessary, implementing new tools and processes.[70]

METROPOLITAN SCHOOL DISTRICT OF WARREN TOWNSHIP, IN

In Indiana, Warren is using Race to the Top funds to support personalized learning for students. The district's path to promoting personalized learning is focused on four central components:[71]

- Enhancing technology to engage students and to allow anytime, anywhere learning;

- Shifting the teachers' roles to support student-centered learning;

- Renovating physical spaces to better meet students' learning needs; and

- Using data and assessments to inform instruction.

In the following sub-section, Hanover Research focuses on two of the components listed above—enhancing technology and renovating existing physical space—and discusses how each component works to promote personalize learning and increase student engagement and collaboration.

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[69] Figure contents adapted from: Ibid., p. 26.

[70] Ibid., p. 30.

[71] Bulleted text adapted from: "Personalized Learning in Progress: Case Studies of Four Race to the Top District Grantees' Early Implementation." District Reform Support Newtwork, November 2014. pp. 6, 8. https://rttd.grads360.org/services/PDCService.svc/GetPDCDocumentFile?fileId=7452

ENHANCING TECHNOLOGY

In order to support personalized learning with technology, Warren distributed laptops to every student in Grades 1-12, trained teachers on the use of technology in the classroom, and asked teachers to set goals for how they would have students use the devices.[72] These teacher-set goals typically included objectives such as:[73]

- Have the students use the devices a certain number of times per week;
- Have a paperless classroom; and
- Use a flipped classroom approach.

To increase personalized technology use throughout the district, Warren also provides teachers with several quick-reference resources, including a guide addressing how digital resources and activities can best be used and a chart listing all available digital tools and technology. Suggested activities described by the resource guide include discussing technology preparedness with colleagues or a grade-level team, talking with administrators about the support necessary to implement technology, and identifying the types of student data that can be generated by current technological resources.[74] Below, Figure 2.2 displays a sample of the digital tools and technology available to teachers at Warren.

Figure 2.2: Digital Tool Options at Warren

SUBJECT	GRADES K-5 DIGITAL TOOLS	GRADES 6-12 DIGITAL TOOLS
Math	- ALEKS (Grades 3-12) - Dreambox (Grades K-8) - I-Ready Math (Grades K-8) - ST Math (Grades K-5) - TenMarks (Grades 2-12)	- ALEKS (Grades 3-12) - Dreambox (Grades K-8) - I-Ready Math (Grades K-8) - TenMarks (Grades 2-12)
English Language Arts (ELA)	- Achieve3000 (Grades 3-12) - Curriculet (Grades 3-12) - Imagine Learning (Grades K-6) - i-Ready Reading (Grades K-8) - Lexia (Grades PK-5) - MyOn (Grades PK-8) - Newsela (Grades 3-12) - NoRedInk (Grades 3-12)	- Achieve3000 (Grades 3-12) - Curriculet (Grades 3-12) - i-Ready Reading (Grades K-8) - MyOn (Grades PK-8) - Newsela (Grades 3-12) - NoRedInk (Grades 3-12)

Source: Metropolitan School District of Warren Township[75]

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[72] Ibid.., pp. 28-29.
[73] Bulleted text adapted from: Ibid., p. 29.
[74] "Personalized Learning Teacher Playlist." Metropolitan School District of Warren Township. pp. 3–4. https://docs.google.com/document/d/1QJ3qe4B6xFnH9wMO5FQqqgJWOSrLNJAGLCaJObD1c5k/edit
[75] "Warren Personalized Learning Digital Tools and Technology." Metropolitan School District of Warren Township. pp. 1–2. https://docs.google.com/document/d/1IDJ8ROgS6kFdoNgAi9YgbZ28dNsTZXWyBlMiGI7yfOA/edit

RENOVATING PHYSICAL SPACES

Physical renovations represent one of Warren's more ambitious measures to support personalized learning throughout the district. In addition to renovating existing classrooms to better accommodate the flipped learning approach, the district renovated all three middle school libraries, known as "Mediaplexes," within a six month span (Figure 2.3).[76] Each Mediaplex contains a number of sheltered, flexible work spaces, including:[77]

- **Simultaneous instruction computer labs** with 34 workstations, each possessing two monitors: one monitor displays what the teacher is presenting, while the other allows the student to replicate what the teacher is doing.

- **Collaborative Learning Studios** containing several computer tables with dry erase boards as surfaces to encourage student collaboration and creativity, as well as equipment allowing students to use Skype to talk to teachers and peers.

- **Digital viewing rooms** set up to resemble a theater with seating and a podium for a teacher, with students able to interact directly with the project image on the wall.

- **Creative thought galleries** containing computers and dry-erase walls to encourage writing, design, and interaction between students and teachers.

Figure 2.3: Warren Township Mediaplex
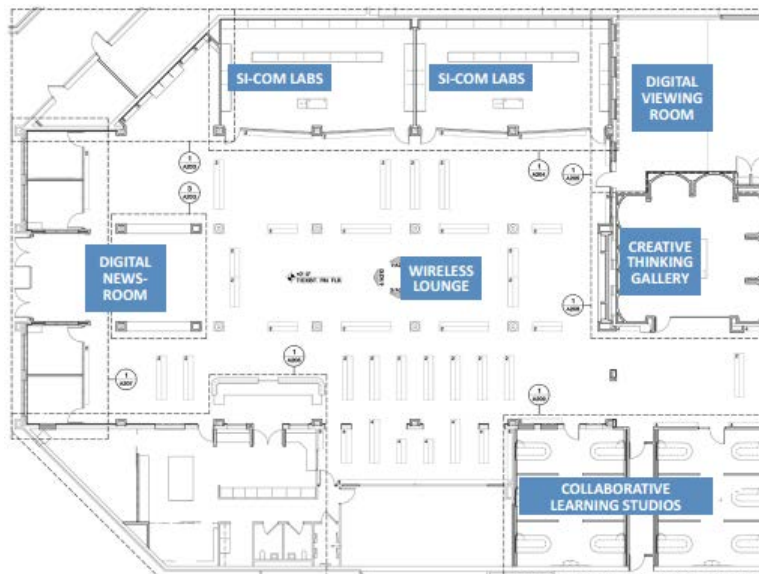
Source: The District Reform Support Network[78]

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[76] "Personalized Learning in Progress: Case Studies of Four Race to the Top District Grantees' Early Implementation," Op. cit., pp. 29–30.

[77] Bulleted text adapted from: [1] "Personalized Learning in Progress: Case Studies of Four Race to the Top District Grantees' Early Implementation," Op. cit., p. 29. [2] Tanenbaum, Le Floch, and Boyle, Op. cit., p. 4.

[78] "Personalized Learning in Progress: Case Studies of Four Race to the Top District Grantees' Early Implementation," Op. cit., p. 29.

Notably, physical renovations at Warren were accompanied by professional development for teachers. Instructional staff throughout the district received support regarding how to use the new and renovated spaces from school-based media specialists who provided clear directions regarding "the best ways to incorporate the remodeled spaces and new technology into lessons."[79] The district believes that media specialist ownership and collaboration will lead to more use and better use of upgraded space.[80]

[79] Ibid., p. 30.
[80] Ibid.

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