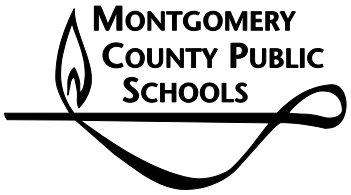

Evaluation of the Universal Design for Learning Projects

Office of Shared Accountability

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Executive Summary

At the request of the Office of Special Education and Student Services, the Office of Shared Accountability evaluated the Universal Design for Learning (UDL) projects during spring 2013. UDL is an instructional framework that seeks to give all students equal opportunities to learn, by providing multiple means of representation, of action and expression, and of engagement. As a pilot for implementing UDL within schools, Montgomery County Public Schools (MCPS) initiated the UDL Elementary School Project in 2010–2011 and the UDL Middle School Project in 2011–2012. Through these projects, a small team of staff at each selected school received customized professional development and consultation on UDL instructional practices.

To inform future implementation efforts within MCPS, this study examined four questions: 1) what was the extent of implementation of UDL instructional practices, 2) what was the impact of UDL implementation on student engagement, 3) what was the impact of UDL implementation on student's independence in learning, and 4) what was the impact of UDL implementation on teaching practices? The study included the first three elementary and three middle schools in the project and collected data through classroom observations, student surveys, and staff surveys.

Summary of Findings

Question 1: Implementation of UDL Practices

Based on observations at UDL project schools of 48 kindergarten–Grade 8 classes, just over one half of teachers consistently implemented UDL. They used at least four instructional practices that were 1) ways to present information other than verbally and with text or 2) ways for students to choose how to gain information or show what they know. This moderate level of implementation is reasonable given that the evaluation occurred two to three years into a five year project. More elementary (about two thirds) than middle school (just over one third) teachers had consistent implementation.

Questions 2 & 3: Impact on Student Processes

UDL implementation should positively impact two student processes: independence in learning (e.g., task initiation) and engagement. Three types of engagement were measured: academic (e.g., on task), affective (e.g., enthusiasm), and cognitive (e.g., self-regulation). Observations or surveys were used to measure these processes, depending on the grade level. There was evidence for positive impacts of UDL implementation on both student processes, with variations by grade level, type of process, and student subgroup.

In 11 kindergarten–Grade 2 classes at UDL project schools, observers collected data on student processes using a single indicator for each type of engagement and two indicators for independence in learning. Based on these indicators, all or almost all students in the majority of classes demonstrated academic engagement, cognitive engagement, and independence in learning, but not affective engagement.

Almost 1,500 students in Grades 3–8 at UDL project schools and at matched, comparison schools completed surveys on engagement; items on cognitive engagement also reflected independence in learning. The response rate was 93% for the student surveys. Five or six items were combined to form scales for each type of engagement; the scale ranged from 1–4 for academic and affective engagement and 1–5 for cognitive engagement. For Grade 3–5 students, affective engagement was significantly higher at UDL project schools (mean = 3.40) than at

comparison schools (mean = 3.28), but there were no differences for academic or cognitive engagement. These findings were largely the same for two student subgroups: English language learners and students with educational disabilities. For students in Grades 6–8, each type of engagement was significantly higher at project schools than at comparison schools: academic (mean = 3.15 vs. mean = 3.05), affective (mean = 2.94 vs. mean = 2.68), cognitive (mean = 3.50 vs. mean = 3.33). These findings were not the same as the findings for the two subgroups.

Question 4: Impact on Teacher Practices

Forty teachers and media specialists at project schools completed an online survey about teaching practices that are key to UDL implementation: lesson planning for accessibility and teacher collaboration. The response rate for this survey was 82%. There was evidence for positive impacts of UDL implementation on these teaching practices.

Lesson planning for accessibility requires front-loading, meaning the teacher incorporates UDL strategies during the creation of instruction and assessments, instead of adjusting lessons or assessments afterwards. Most survey respondents were front-loading their planning, as indicated by responses to two questions. First, since their involvement with the UDL project, about two thirds of respondents reported they had "completely changed" or "changed a lot" their use of individual planning time. Second, more than one half of respondents described these changes to their planning in terms of key UDL practices, such as building in student choices. Lesson planning for accessibility also requires building student choice throughout the school year. More than one half of respondents described a plan to build student choice, typically an informal plan.

Teacher collaboration to support UDL focuses on discussions with other teachers about students and student choice and on materials that enhance accessibility. Among survey respondents, more than one half had discussions with other teachers within their grade level at least a few times a month about student learning preferences and about building student choice. Most responding teachers shared responsibility for creating materials that enhance accessibility. About one half of respondents indicated that they frequently or regularly work with other teachers to create such materials and regularly add them to a shared electronic folder at their school. Further, the majority of respondents reported that they knew how to access this electronic folder and checked this folder for materials when planning a lesson. However, less than one half of respondents reported collaboration across content areas or grade levels.

Summary of Recommendations

Based on the findings, program staff should focus training, guidance, and other supports on the following suggestions to improve future implementation of the UDL projects:

- Increase the number of UDL practices implemented by encouraging more use of the following practices by all teachers: choices of products, choices of responses, variety of formats for handouts, and reflection about choice.
- Increase the number of UDL practices implemented by encouraging more middle school teachers to incorporate stations/centers and routines for making choices.
- Encourage teachers to create formal plans on how they will build students' abilities to make choices throughout the school year.
- Increase the sharing of materials that enhance accessibility with teachers in other content areas and across grade levels.

Evaluation of the Universal Design for Learning Projects

Elizabeth Cooper-Martin, Ph.D. and Natalie Wolanin

Background

Universal Design for Learning (UDL) is a set of principles for curriculum development that seeks to give all students equal opportunities to learn (National Center on UDL, 2012). UDL guides the creation of goals, methods, materials, and assessments so that these components of instruction can work for every student. Rather than being a "single, one-size-fits-all" approach, each component should be flexible with options for each learner in order to optimize every student's learning (Meyer & Rose, 2005).

The UDL framework is based on recent brain research that has identified three networks related to learning: recognition (what we learn), strategic (how we learn), and affective (why we learn) (Meyer & Rose, 2005). UDL's three guiding principles call for flexibility and multiple methods to address individual differences related to each network and its area of specialty, as follows:

- Principle I—Provide multiple means of representation to support the recognition networks for receiving and analyzing information.
- Principle II—Provide multiple means of action and expression to support the strategic networks for planning and executing actions.
- Principle III—Provide multiple means of engagement to support the affective networks for evaluating and setting priorities.

Three guidelines and multiple checkpoints support each UDL principle (Figure 1). By using these principles and guidelines to design curriculum and lessons, teachers can appropriately challenge, support, and engage all learners (Meyer & Rose, 2005). This framework was designed to meet the increased diversity of students in schools and to take advantage of the flexibility provided by computers and digital media. The latter can provide links for additional challenge or support, display content in various forms, and alter the presentation of content. However, there are many no-technology and low-technology ways to implement UDL principles (Maryland State Department of Education [MSDE], 2011).

To infuse UDL into school practice, the Office of Special Education and Student Services (OSESS) initiated the UDL Middle School Project in 2010–2011 and the UDL Elementary School Project the following school year. The purpose of both projects is to develop a more comprehensive knowledge base and scalable framework for school-level implementation of UDL within Montgomery County Public Schools (MCPS).

Both UDL projects support MCPS's mission that every student will have the academic, creative problem solving, and social emotional skills to be successful in college and career (MCPS, 2013).

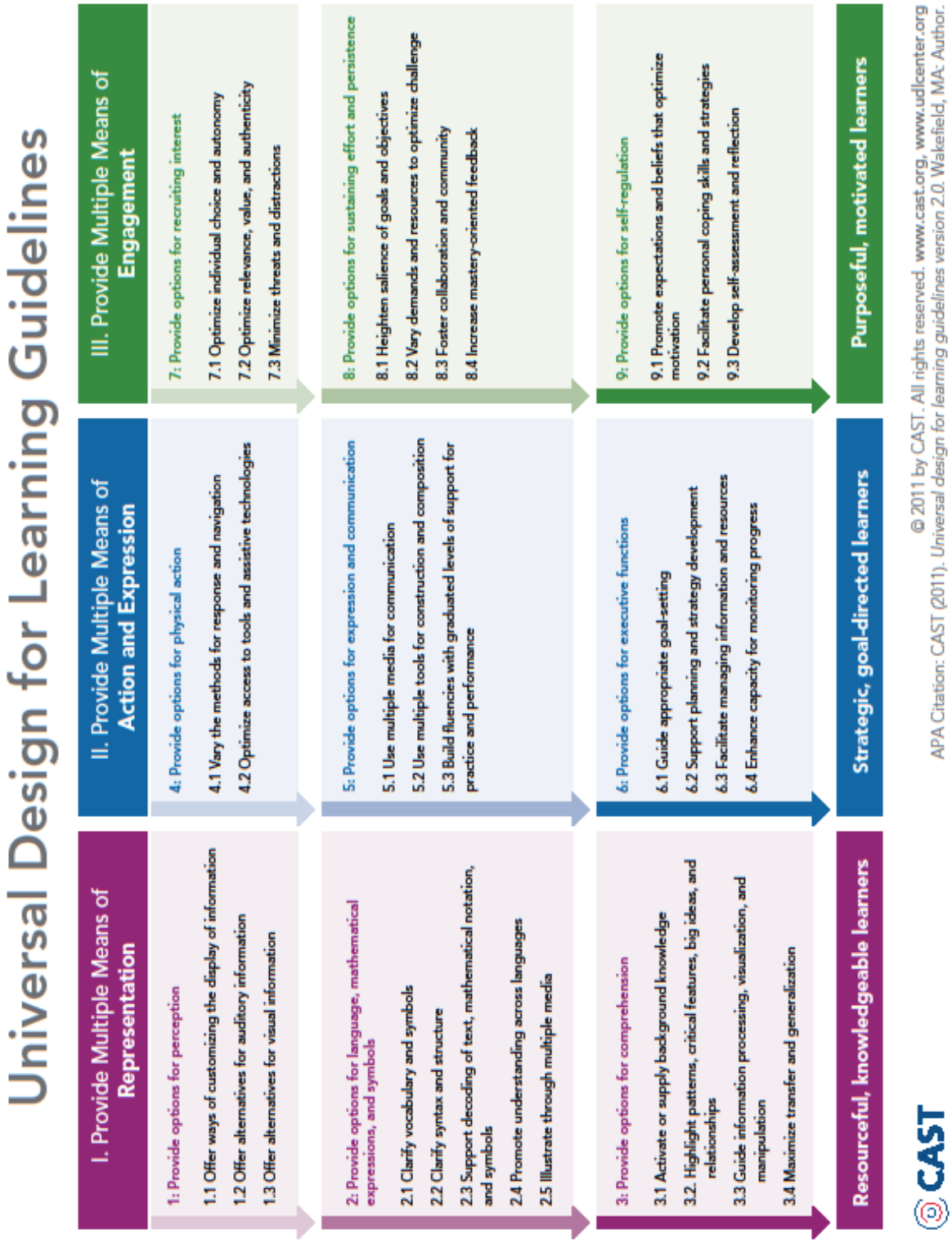

Figure 1. Universal Design for Learning Guidelines.

Further, UDL supports the following actions that MCPS staff are expected to deliver, in order to support the district's mission (MCPS, 2013):

- Differentiate instruction to meet the needs of all students.
- Evaluate what students know and are able to do through multiple and diverse measures.
- Engage students in active learning of relevant and challenging content.
- Create an environment that fosters student learning in a variety of ways and settings.
- Empower students to take ownership of learning.

Program Description

Background, Goals, and Participants

The UDL Elementary School and Middle School projects are based on the premise that implementation is more effective when initiated by a small, focused group within a school and then disseminated schoolwide (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005; McREL, 2008). Therefore, the project focus is on building a group of leaders, known as the Instructional Technology Leadership Team (ITLT). At each school, the ITLT includes 7 to 12 staff members. They are expected to become mentors and coaches on UDL strategies and technology for the benefit of all staff and students at their school (Collette & Richardson, 2010, 2011).

The UDL Elementary School and Middle School Projects share the same goals, as follows:

- Identify models for schools to develop leadership teams focused on schoolwide implementation of UDL over a three- to five-year period.
- Identify scalable models to guide the professional learning of UDL leadership teams across multiple schools.
- Clarify qualitative and quantitative data collection tools to measure changes in instructional practices related to UDL, guide professional learning needs assessment, and measure schoolwide changes.
- Develop school- and district-level models for teachers to share UDL practices, materials, and technology tools, and how UDL impacts student learning.
- Support curriculum development, purchase of instructional materials, and technology integration to best support UDL countywide.
- Create web-based, on-demand resources for teachers and administrators in MCPS and throughout the country to support school-level UDL implementation.

Schools had to apply to participate in each project (Collette & Richardson, 2010, 2011). Based on their applications, three elementary schools, Forest Knolls, Great Seneca Creek, and Sargent Shriver, were chosen for the UDL Elementary School Project, and both Lakelands Park and Rosa M. Parks middle schools were selected for the UDL Middle School Project. Because MCPS had identified Tilden Middle School as the site of the Middle School Special Education Institute, Tilden was selected as the third school for the UDL Middle School Project.

Supports Provided

At each school, ITLT members received customized training and support on UDL and instructional technology. Each ITLT member who was a classroom teacher received a digital camera to enhance instruction and capture classroom implementation examples. To enhance the development of lesson plans, participating schools also received equipment such as computing devices (e.g., netbooks), headsets, audio splitters, and digital cameras.

Program staff members, who support both projects, are members of the High Incidence Accessible Technology (HIAT) team, within the Physical Disabilities Program unit of OSESS. HIAT is a collaborative team that applies the principles of UDL to support school teams to meet the needs of all students (HIAT, 2012).

Middle School Project

The project for middle schools started in school year 2010–2011. During the first year, each ITLT member completed a one-credit, 15-hour course, taught by MCPS staff members, in summer or fall 2010. The ITLT met every two weeks for 60–90 minutes during the school year. The meetings focused on implementing UDL, using technology and no-technology supports to implement UDL, and defining processes to develop the ITLT as a professional learning community. A program staff member facilitated the meetings and visited each school at least weekly to assist with the development of lesson plans by visiting classes or attending teachers' planning periods.

During the second year, 2011–2012, the ITLT focused on providing professional development and supports to other instructional staff members (including paraeducators) at their school and improving their own skills at implementing UDL. Each pilot school also hosted seventh grade co-teaching teams from other schools who came to observe UDL implementation. During school year 2012–2013, ITLT members continued activities as a professional learning community.

Elementary School Project

Likewise, during the first year of the project at elementary schools, 2011–2012, ITLT members participated in professional development including a three-credit (45 hour) online Continuing Professional Development course. The course, which was developed by MCPS, focused on technology for implementing UDL and on leadership and coaching to support the use of UDL throughout the school. Additionally, the ITLT met monthly; members planned the meetings in consultation with program staff members as needed. HIAT staff members visited each school monthly to assist with the development of lesson plans and observe classes. During school year 2012–2013, each ITLT continued activities as a professional learning community.

Methods of Intervention

As a result of professional development trainings and opportunities provided through the UDL projects, ITLT members at both elementary and middle schools are expected to implement UDL in their instruction. Program staff identified instructional practices that embody the principles of UDL and, based on initial work with ITLTs, represented changes from existing practices for

teachers. Therefore, each of their lessons should include at least some of the following instructional practices, centered on student choice and flexibility in teacher presentation.

Student Choice

To support and challenge the diverse learning styles of students, a teacher should provide them with choices in how they gain information and show what they know. These choices would be in one or more of the following areas:

1. *Products*. The teacher provides students with choices for responses and products that demonstrate their skill and knowledge (e.g., verbal, written, drawing, physical demonstration, technology).
2. *Tools*. The teacher provides students with choices for types of tools to generate products that demonstrate their skill and knowledge (e.g., paper-pencil, computer, Promethean Board, alternatives to handwriting, calculator).
3. *Stations/centers/groups*. The teacher provides a variety of choices in methods to learn information that align with diverse learning styles (e.g., technology, readings at varied levels).
4. *Routines*. The teacher establishes expectations, procedures, and routines that allow students to be reasonably independent with respect to choices or options in learning tools, materials, or methods (e.g., transition to stations, use of technology).

Flexibility in Teacher Presentations

The teacher should present information using multiple methods to complement text and verbal presentations in order to support and challenge diverse learning styles. These methods would be in one or more of the following areas:

1. *Curriculum materials*. The teacher presents materials in additional formats beyond viewable text and a teacher speaking (e.g., text in digital files that could be read aloud, online resources, audio, video, pictures, charts).
2. *Explanatory devices*. The teacher uses multiple types of explanatory devices (e.g., concept maps, graphic organizers, demonstration, pictures, audio/video, written, diagrams, charts, models, manipulatives).
3. *Drawings or images*. The teacher uses drawings or images in paper handouts, digital materials, and presentations to complement text and a teacher speaking.

Project Outcomes for Teachers

Lesson Planning for Accessibility

To create instructional materials and strategies that reflect UDL guidelines, teachers are expected to incorporate UDL strategies during development of curriculum, instruction, and assessments, instead of adjusting them afterwards to meet the needs of individual students (Delaware Department of Education [DDE], 2004; MSDE, 2011). In other words, teachers are expected to "front-load" lesson planning rather than retrofit. Further, because UDL practices encourage

students to select materials, tools, and products, teachers need to develop skills and routines that build each student's ability to make choices that best support his/her learning (MSDE, 2011).

Teacher Collaboration

Collaboration among teachers can reduce the need for each one to create instructional materials and strategies that incorporate UDL principles (MSDE, 2011). Therefore, teachers involved in the UDL projects are expected to share responsibility for creating materials and share digital materials and other resources. There should be a consistent, understandable, and schoolwide organization of electronic folders, and all staff should know where to look for resources. Along with the logistical setup, both dialogue and problem solving needs to happen to encourage the spread of sharing practices within and across content areas or grade levels. Additionally, teachers should discuss student learning profiles to ensure access to all students. Lastly, teachers should work together to build students' capacity for making choices (i.e., learning tools, tasks, or products) throughout the school year and across grades.

Project Outcomes for Students

As a framework for curriculum design, instructional processes, and assessment, UDL strives to provide equal opportunities for every student to access the curriculum and to demonstrate what he/she has learned (MSDE, 2011). Therefore, all students benefit from implementation of UDL—including those who are gifted and talented; English language learners; students without disabilities; as well as students with physical, cognitive, or emotional disabilities.

Engagement

One way that students benefit from UDL is higher levels of engagement with school. When teachers provide multiple means of engagement, students are expected to be more involved and invested in learning. When students are challenged and also receive support to reach those challenges, school is more rewarding (DDE, 2004). Implementation of UDL frequently includes technology to provide choices to students and support their learning; an additional benefit of such technology is that many students are more engaged in schoolwork when they can use technology (DDE, 2004).

Independence in Learning

To take advantage of the flexibility and choice offered by UDL, students must make choices. For example, a teacher may use digital text to offer options for perception, but the student needs to select the options that best support his/her learning, such as font size, sound, images, or highlighting of main ideas (Meyer & Rose, 2005). Therefore, students need to develop the ability to make choices among materials, tools, and products (MSDE, 2011). Thus, another expected benefit of UDL is that students will become more independent in their learning.

Student Learning

UDL's ultimate goal is to improve student learning. To achieve this outcome, teachers must consistently implement UDL with fidelity, and that implementation must have the expected impact of increased student engagement and greater independence in learning. If students are more engaged and more independent in their learning, their learning is expected to increase.

Evaluation Questions

This evaluation examined the fidelity and extent of implementation of UDL and its impact on the attitudes and behaviors of students and on teaching practices. It was important to confirm that teachers are implementing UDL and that such implementation is having the expected impact on students and teachers, prior to determining UDL's effect on student learning. The goal was to provide feedback to the program staff to support development of an effective model of classroom and school-level implementation of UDL that is scalable to a large district.

1. Do teachers who received UDL professional development and consultation consistently implement UDL? Areas to examine include the following:
    a. Student choices
        i. Products: To what extent do teachers provide choices to students for responding and products that demonstrate their skill and knowledge?
        ii. Tools: To what extent do teachers provide choices for types of tools to generate products that demonstrate students' skill and knowledge?
        iii. Stations/centers/groups: To what extent do teachers provide choices in methods to learn information that tap into diverse learning styles?
        iv. Routines: To what extent do teachers establish expectations, procedures, and routines related to student choices and options in learning tools, materials, and methods?

    b. Flexibility in teacher presentations
        i. Curriculum materials: To what extent do teachers present materials in additional formats beyond viewable text and the teacher speaking?
        ii. Explanatory devices: To what extent do teachers use multiple types of explanatory devices?
        iii. Drawings or images: To what extent do teachers use drawings or images in paper handouts, digital materials, and presentations to complement text and the teacher speaking?

2. What is the impact of UDL implementation on student engagement? Areas to examine include the following:
    a. What is the impact of UDL implementation on the following forms of engagement?
        i. Academic, defined as time on task during class and homework completion
        ii. Affective, defined as enthusiasm, excitement, and enjoyment of class
        iii. Cognitive, defined as self-regulation and being strategic about class work
    b. Is the impact of UDL implementation on student engagement consistent for each of the following student groups?
        i. English language learners
        ii. Students with educational disabilities

3. What is the impact of UDL implementation on student independence in learning processes? Areas to investigate include the following:
    a. What is the impact of UDL implementation on learning processes, such as the following?
        i. Task initiation
        ii. Self-selection of learning tools, tasks, or products
        iii. Independence in completing activities
        iv. Self-monitoring of task completion

    b. Is the impact of UDL implementation on student independence in learning processes consistent for each of the following student groups?
        i. English language learners
        ii. Students with educational disabilities

4. What is the impact of UDL implementation on lesson planning for accessibility and teacher collaboration? Areas to investigate include the following:
    a. Lesson planning for accessibility
        i. Front-loading lesson planning
        ii. Planning for building student choice throughout the school year

    b. Teacher collaboration practices
        i. Discussion of student learning profiles
        ii. Discussion of building student choice across grades
        iii. Sharing of responsibility to create materials that enhance accessibility
        iv. Knowledge to access already-created materials that enhance accessibility
        v. Sharing materials across content areas or grade levels

Methodology

To answer all evaluation questions, this study utilized a multimethod data collection strategy, including classroom observations, student surveys, and staff surveys. Based on program materials and previous research studies, the evaluators, in collaboration with staff members from the Physical Disabilities Program and the HIAT team, developed instruments for these activities.

This study included the three middle schools that joined the UDL project in 2010–2011: Lakelands Park, Rosa M. Parks, and Tilden, plus the three elementary schools that joined the UDL project in 2011–2012: Forest Knolls, Great Seneca Creek, and Sargent Shriver. To accommodate this age range, different methods were used to collect data on the same construct.

Data Collection Activities

Classroom Observations

Instrument. Program staff members had developed an observation protocol for classroom visits which included the four categories of student choices and the three categories of teacher flexibility listed in Evaluation Question 1. Through discussions between evaluators and program staff and pilot observations, the protocol was refined and some categories were changed to insure reliable reporting. The final observation protocol included nine indicators, as listed and defined in Table 1. Each indicator had multiple options for observers to document the extent of evidence; options varied by indicator (see detail in Table 1).

Table 1
UDL Protocol Indicators, Definitions, and Options for Extent of Evidence

Indicators of student choices	Definition	Options for extent of evidence
Choices of responses	Teacher provides students (in whole group or a small group) with choices for responses when called on.	None, evident. Not applicable.
Choices of products	Teacher provides students with choices for products (e.g., student work, informal assessments) that demonstrate their skill & knowledge.	None, minimal, evident. Not applicable.
Choices of tools for production	Teacher provides students with choices for types of tools that they can use to produce/generate products, responses, or informal assessments that demonstrate their skill and knowledge.	None, evident. Not applicable.
Choices of methods to learn information	Teacher provides students with choices of methods of learning that tap into diverse learning styles or offer different learning experiences.	None, minimal, evident.
Stations/centers	Teacher provides stations or centers.	None, minimal, evident, evident with emphasis.
Routines for making choices	Teacher establishes expectations, procedures, and routines related to student choices of products, tools, or methods.	None, minimal, evident, evident with emphasis. Not applicable.
Reflection about choice	Teacher asks students to reflect on their choice.	None, evident.
Indicators of teacher flexibility	**Definition**	**Options for extent of evidence**
Variety of presentation formats	Teacher uses additional formats beyond viewable text and a teacher speaking, when presenting to students as a whole group or a small group.	None, minimal, evident, evident with emphasis. Not applicable.
Variety of formats for handouts	Teacher provides additional formats beyond hard copy with only text.	None, minimal, evident. Not applicable.

Options for extent of evidence were defined as follows. Minimal meant that there was some evidence of the practice, but that the teacher did not fully implement it as expected by the program staff. Evident meant that the teacher implemented the practice as expected. Evident with emphasis meant that the teacher implemented the practice to a degree that was distinctly better than the expected level, as defined by program staff.

In kindergarten–Grade 2 classes, observers also collected data on student processes. If the teacher assigned a task to the students, observers collected data on students' independence in learning processes, using two indicators: 1) Students start work promptly without prodding by teacher; and 2) Students work independently (without consulting teacher) to complete the activity.

Observers collected data on engagement two times during each kindergarten–Grade 2 class, using a single indicator for each type of engagement, as follows:

- Academic: Students are on task.
- Affective: Students show enthusiasm.
- Cognitive: Students are self-regulated.

Observable evidence for each of the indicators was as follows. For academic engagement, two types of evidence were required: 1) students do the assigned work and 2) students do not engage in off-task behavior (e.g., get out of seat without permission, have off-topic conversation, gaze out window). For affective engagement, at least one of the following types of evidence was required: 1) students vocalize/express excitement about content/activities (e.g., "oohs & aahs"); 2) students want to take a turn; 3) students eagerly raise their hands; or 4) students want to participate. For cognitive engagement, there was one type of evidence: that students avoid disciplinary encounters.

For each indicator of engagement and independence in learning in kindergarten–Grade 2 classes, the observer recorded how many students demonstrated the indicator using the following categories: all, almost all, most, some, few, none.

Sample. The observation sample included all teachers and media specialists on the ITLT team at each UDL project school in the sample. The total was 25 teachers and media specialists at elementary schools and 25 teachers and media specialists at middle schools.

Data Collection. Four staff members from the Office of Shared Accountability (OSA) were trained in using the protocol, with support from staff members from the Physical Disabilities Program and the HIAT team. Each observer visited only elementary or only middle schools. The observation was one class period (about 45 minutes) for each middle school teacher or media specialist and a comparable length of time (i.e., 40–45 minutes) for each elementary school teacher or media specialist. Observations occurred between April 15 and May 2, 2013. All 25 elementary observations were completed. Observations of two middle school teachers could not be scheduled; thus 23 (92%) middle school observations were completed.

Student Surveys

Sample. The student survey sample included all students in observed classes in Grades 3–8. To provide a comparison group of students, six comparison schools were selected based on similarity to UDL project schools. Schools eligible to be a comparison school included those that were not participating in and had not applied to participate in the UDL project, had not received extensive UDL training from MCPS program staff, and did not mention UDL in their School Improvement Plan. Advanced statistical analysis identified the three eligible schools most similar to each UDL project school in the study, based on the following variables:

1. Percentage of Black or African American students
2. Percentage of Asian American students
3. Percentage of Hispanic/Latino students
4. Percentage of White students
5. Percentage of students receiving English for Speakers of Other Languages (ESOL) services
6. Percentage of students receiving Free and Reduced-price Meal System (FARMS) services
7. Percentage of students receiving special education services
8. Percentage of special education students who spend 80% or more of their instructional time in general education classes
9. Percentage of special education students who spend at least 40% but less than 80% of their instructional time in general education classes
10. Percentage of special education students who spend less than 40% of their instructional time in general education classes
11. Average class size (i.e., for Grades 4–5 in elementary schools, for English class in middle schools, and for all classes other than English in middle schools)

Program staff used their knowledge and experience with schools to make the final selection of one comparison school for each UDL project school in the sample. Next, within each comparison school, one of the authors selected a comparable classroom to match each observed class, in terms of grade level and subject area. The comparable classroom had to be the same grade level as the observed classroom. Therefore, the sample excluded students of media specialists, due to the difficulty of identifying a class receiving instruction in the media center at the comparison school at the same grade level as the observed class during the survey administration window. The final sample of students included 661 in Grades 3–5 and 934 in Grades 6–8.

Instrument. The student survey items concerned three types of engagement: academic, affective, and cognitive. All engagement items referred to the specific class that the student was attending at the time of the survey. The items for cognitive engagement also reflected independence in learning processes; these items concerned self-regulation and being strategic about class work. Items on academic engagement referred to time on task during class and homework completion, and those about affective engagement concerned enthusiasm, excitement, and enjoyment of the class. The authors modified items used in previous surveys on engagement of elementary or middle school students for this study (Appleton, Christenson, Kim, & Reschly, 2006; National Center for School Engagement, 2006; Skinner, Kindermann, & Furrer, 2009). Items and response options for all three types of engagement are in Table 2.

Table 2
Engagement Items on Student Survey, Response Options, and Cronbach's Alpha Values

Engagement items	Response options (value for scale)	Cronbach's alpha[a] Grades 3–5	Cronbach's alpha[a] Grades 6–8
Academic		.76	.82
• When I'm in this class, I think about other things. (reverse coded) • In this class, I work as hard as I can. • When I'm in this class, I listen very carefully. • When I'm in this class, I just act like I'm working, even though I'm not. (reverse coded) • I try very hard to do well on my homework for this class. • I pay attention in this class.	Very true (4) Sort of true (3) Not very true (2) Not at all true (1)		
Affective		.87	.90
• When I'm in this class, I feel good. • When we work on something in this class, I feel interested. • I feel excited by the work in this class. • I enjoy the work I do in this class. • This class is fun. • I enjoy learning new things in this class.	Very true (4) Sort of true (3) Not very true (2) Not at all true (1)		
Cognitive		.72	.76
• When I read something for this class, I ask myself questions to make sure I understand what it is about. • I check my classwork for mistakes. • If I don't understand what I read for this class, I go back and read it over again. • After I do homework for this class, I look it over to see if it's correct. • If I don't know what a word means when I am reading for this class, I try to find out.	Always (5) Often (4) Sometimes (3) Seldom (2) Never (1)		

[a]Cronbach's alpha measures the scale's internal reliability; values ≥.70 are considered acceptable (Nunnaly, 1978).

Scales. For better reliability, a scale of multiple items, rather than a single item, was used to measure each type of engagement, as shown in Table 2. The internal consistency or reliability of each scale was calculated and examined in this study using Cronbach's alpha (Nunnaly, 1978). The internal reliability was considered satisfactory because Cronbach's alpha was at least .70 for each scale (Table 2).

Administration. An OSA staff member administered the survey to students in their classrooms between May 1 and May 23, 2013. Students completed a hard copy of the survey. The survey administrator read the directions, which stated that students' responses would be confidential, that their teachers would not see their responses, and that information would be reported only at the aggregate level. The survey administrator also read each item and each response option out loud. Survey administrators read information out loud to ensure student understanding and to provide another presentation format. The overall response rate was 93%, including 626 respondents in Grades 3–5 for a 95% response rate, plus 862 respondents in Grades 6–8 for a 92% response rate.

Staff Surveys

Sample. The sample for the staff survey was the same as the observation sample; it included all teachers and media specialists on the ITLT team at each UDL project school. The total was 25 at elementary schools and 25 at middle schools.

Instrument. The staff survey was online and focused on lesson planning for accessibility and collaboration with other teachers. It included questions on individual and team lesson planning; planning for building student choice throughout the school year individually and with other teachers; accessing, creating, and sharing materials that enhance accessibility; and discussion of student learning profiles.

Administration. On May 28, 2013, one of the authors sent an e-mail with a link to the survey to each member of the sample, followed by three e-mail reminders during June. E-mails went to 49 staff members; due to an oversight, one middle school teacher did not receive the e-mails. Forty staff members completed the survey for an overall response rate of 83%. The response rate among elementary school staff members was 88% (22 of 25) and among middle school staff members was 75% (18 of 24).

Analytical Procedures

Evaluation Questions 1 and 4

Descriptive statistics were used to analyze the findings for Evaluation Question 1 on teacher's implementation of UDL practices and for Evaluation Question 4 on teacher's lesson planning for accessibility and collaboration with other teachers. To test for significant differences in teaching practices between elementary and middle school students, χ^2 tests were used.

Evaluation Questions 2 and 3

Evaluation Questions 2a and 3a concern the impact of UDL implementation on student engagement and independence in learning processes, respectively. Stepwise regression analysis was used for these questions, to test whether students in classrooms with UDL implementation had higher levels of engagement and independence in learning processes than students in classrooms at comparison schools. The measure of engagement equaled the mean value across all scale items (using the scale values in Table 2) for each student who answered all items or all but one item in the scale. The regression analyses controlled for differences in the following student characteristics: grade level, course subject, gender, race and ethnicity, receipt of FARMS services, receipt of special education services, receipt of ESOL services, number of tardies, number of suspensions, and grade point average (only for students in Grades 6–8). There were separate analyses for each type of engagement and elementary versus middle school students.

To answer Evaluation Questions 2b and 3b, on whether the impact of implementation of UDL is consistent for different student groups, the regressions for Questions 2a and 3a were repeated to include only English language learners and only students with educational disabilities. English language learners were defined as students currently receiving ESOL services plus students who had recently exited from these services. For Grades 3–5, English language learners included students who were currently receiving or had ever received ESOL services. For Grades 6–8,

English language learners included students currently receiving ESOL services plus those who had exited ESOL within the last two years. For all grades, students with educational disabilities included students currently receiving special education services. If the number of students in a subgroup was too small (i.e., < 100) for regression analysis, t-tests were used. Unlike regression, t-tests cannot control for differences between students.

For all analyses, tests of statistical significance were calculated to judge whether the observed relationship between UDL implementation and student processes (e.g., engagement) occurred by chance. Also, tests of practical significance were calculated to judge whether the observed relationships were large enough to be useful to program staff (American Psychological Association, 2001). Effect sizes were used as tests of practical significance.

For regression analyses, standardized regression coefficients (β values) were used as an effect size measure (Kline, 2005). To interpret the magnitude of β values, the following guidelines from Cohen (1988) were used: .10, .30, and .50 which correspond to small, medium, and large effect sizes, respectively.

For t-tests, Cohen's *d* was used to measure the effect size. Cohen (1988) proposed the following guidelines for *d*: .20, .50, and .80 correspond to small, medium, and large effect sizes, respectively. Cohen's *d* was calculated as follows: $(Mean_{UDL} - Mean_{C})/SD_{ALL}$ (Vacha-Hasse & Thompson, 2004). In this equation, $Mean_{UDL}$ was the mean of the responses from students at UDL project schools, $Mean_{C}$ was the mean of the responses from the students at comparison schools, and SD_{ALL} was the standard deviation of the responses from students at all schools.

Strengths and Limitations of the Methodology

One strength of this study is that all schools involved in the first year of both the elementary and middle school UDL projects participated in the evaluation. Further, to measure the extent of implementation of UDL practices, classroom observations were conducted to capture teacher behavior. An additional strength was not specifying to the observed teacher which day or time the observer would arrive; this approach lessened the possibility that the observed teacher would change behaviors to meet the observer's expectations. Also, the observation protocol was developed by working closely with program staff members who are experts on UDL implementation. Lastly, the high response rates to the student surveys (93%) and staff survey (82%) suggest that the survey responses reflect the experiences of most students and staff members in the samples.

One limitation of this study is the use of self-reports from staff surveys to evaluate certain aspects of UDL implementation; it is possible that these responses were self-serving. Another limitation was the use of observations to measure student engagement and independence in learning processes for students in kindergarten–Grade 2. These processes are best measured by asking the student questions because these processes are internal to the student. However, this approach was not possible for these students; they were too young to reliably complete written surveys and the sample size was too large for individual interviews. Additionally, observers could not distinguish which students were English language learners or which ones had educational disabilities; therefore, it was not possible to analyze whether the findings about engagement and independence in learning processes were consistent for these subgroups among students in kindergarten–Grade 2.

Results

Findings for Question 1

Do teachers who received UDL professional development and consultation consistently implement UDL?

Level of Implementation

Data from classroom observations were used to evaluate implementation of UDL by project teachers, including media specialists, at all grade levels. The observation protocol included nine UDL instructional practices. Program staff members agreed that evidence of at least four UDL practices during an observed class was consistent (i.e., adequate) implementation. Two approaches to measuring the evidence were used.

Noncompensatory. The first approach was noncompensatory; it required that each practice had to be at the evident or evident with emphasis level. (Evident meant that the teacher implemented the practice as expected and evident with emphasis meant that the teacher implemented the practice to a degree that was distinctly better than the expected level, as defined by program staff.) With this approach, consistent implementation of UDL was at a low level across all project schools; only 15 teachers, just under one third of those observed (31%), demonstrated four or more UDL practices (Table 3). This total of 15 included 9 elementary teachers (36%) and 6 middle school teachers (26%)

Table 3
Number of Observed UDL Instructional Practices for All Teachers, by School Level

	All (N = 48)		Elementary school (n = 25)		Middle school (n = 23)	
	n	%	*n*	%	*n*	%
# UDL practices noncompensatory[a]						
0 to 3	33	69	16	64	17	74
4 to 7	15	31	9	36	6	26
# UDL practices compensatory[b]						
0 to 3	23	48	9	36	14	61
4+/- to 7	25	52	16	64	9	39

[a]All practices were at the evident or evident with emphasis level.
[b]4+/- could include two practices at the evident level, one practice at the evident with emphasis level, and one practice at the minimal level.

Compensatory. The second approach to measuring the evidence was compensatory; teachers that met the standard of four practices included those with two practices at the evident level, one practice at the evident with emphasis level, and one practice at the minimal level. (Minimal meant that there was some evidence of the practice, but that the teacher did not fully implement it as expected.) With this approach, the practice at the evident with emphasis level compensated for the practice at the minimal level. This level was labeled 4+/- to indicate that one practice could be at the "evident with emphasis level" (+) and one at the "minimal level" (-). With this approach, consistent implementation of UDL was at a moderate level across all project schools; about one half of all observed teachers (52%) demonstrated consistent implementation (Table 3). This total included nearly two thirds (64%) of the observed elementary teachers and more than one third of the observed middle school teachers (39%).

Implementation of Specific Practices

All Teachers. Among all observed teachers, about one half had evidence of two indicators: variety of presentation formats (56%) and choice of tools for production (48%) (Table 4). Although one half of observed elementary teachers provided choices of methods to learn information (52%) and had established routines for making choices (52%), less than one third of observed middle school teachers showed evidence of these two practices. Further, although no middle school teachers used stations/centers, about one half (48%) of all elementary teachers did, including 50% of kindergarten–Grade 2 teachers and 45% of Grades 3–5 teachers. Close to one half of all middle school teachers (44%) used a variety of formats for handouts, but only one elementary teacher did so. Less than one quarter of all observed teachers, of elementary school teachers, and of middle school teachers were observed using the remaining practices: variety of formats for handouts, choices of products, choices of responses, and reflection about choice.

Table 4
Frequency of Specific UDL Instructional Practices Among All Teachers by School Level

	All (N = 48)		Elementary school (n = 25)		Middle school (n = 23)	
UDL practice	*n*	%	*n*	%	*n*	%
Variety of presentation formats	27	56	11	44	16	70
Choices of tools for production	23	48	12	48	11	48
Choices of methods to learn information	20	42	13	52	7	30
Routines for making choices	18	38	13	52	5	22
Stations/centers	12	25	12	48	0	0
Variety of formats for hand outs	11	23	1	4	10	44
Choices of products	10	21	6	24	4	17
Choices of responses	9	19	5	20	4	17
Reflection about choice	4	8	3	12	1	4

Note. Teachers used more than one instructional practice.

Teachers with 4+/- Implementation. Among the 25 teachers with implementation at the 4+/- level or higher, the majority had evidence of four indicators: routines for making choices (17, 68%), choice of methods to learn information (16, 64%), variety of presentation formats (16, 64%), and choice of tools for production (14, 56%) (Table 5).

Table 5
Frequency of Specific UDL Instructional Practices Among Teachers with UDL Implementation at the 4+/- level or Higher, by School Level

	All (N = 25)		Elementary school (n = 16)		Middle school (n = 9)	
UDL practice	*n*	%	*n*	%	*n*	%
Routines for making choices	17	68	13	81	4	44
Choices of methods to learn information	16	64	11	69	5	56
Variety of presentation formats	16	64	8	50	8	89
Choices of tools for production	14	56	8	50	6	67
Stations/centers	11	44	11	69	0	0
Choices of products	7	28	4	25	3	33
Choices of responses	6	24	4	25	2	22
Variety of formats for hand outs	5	20	1	6	4	44
Reflection about choice	4	16	3	19	1	11

Note. Teachers used more than one instructional practice.

There were differences between school levels among teachers with implementation at the 4+/- level or higher (see Table 5 above). Evidence of routines for making choices was more common among elementary (13, 81%) than among middle school teachers (4, 44%). Similarly, the majority of elementary teachers with implementation at the 4+/- level or higher used stations/centers (13, 81%), but no middle school teachers did. However, while almost all middle school teachers with implementation at the 4+/- level or higher used a variety of presentation formats (8 of 9), only one half of the elementary teachers with implementation at the same level (8 of 16) did so.

As with all observed teachers, there was evidence of the last four practices in Table 5 among relatively few teachers with implementation at the 4+/- level or higher.

Findings for Questions 2 and 3

What is the impact of UDL implementation on student engagement and on student independence in learning processes?

The findings on the relationship between UDL implementation and the student processes of engagement and independence in learning are presented by grade level, because the evaluation methods varied by grade level. Academic engagement was defined as time on task and homework completion. Affective engagement was defined as enthusiasm, excitement, and enjoyment. Cognitive engagement was defined as self-regulation and being strategic. Independence in learning was defined as task initiation, independence in completing activities, and self-monitoring of learning. The expectation was that UDL implementation would have a positive effect on student engagement and independence in learning processes.

Kindergarten–Grade 2

For kindergarten–Grade 2, data on engagement and independence in learning came from 11 classroom observations at UDL project schools. For each indicator of engagement and independence in learning, the observer recorded how many students demonstrated the indicator using the following categories: all, almost all, most, some, few, none.

Engagement. Observers collected data on each type of student engagement twice for each class. The level of engagement varied by type of engagement (Table 6).

Table 6
Evidence for Student Engagement by Type of Engagement for Kindergarten–Grade 2

	# classes (N = 11)		
All or almost all students engaged	Academic	Affective	Cognitive
Observed both times	6	2	10
Observed one time	3	3	0
Not observed	2	6	1

Academic engagement was fairly high in the kindergarten–Grade 2 classes. Out of 11 classes, there were 6 in which all or almost all students were academically engaged at both observation times. There were three additional classes in which all or almost all students were academically

engaged at one of the observation times. There were only two classes in which observers did not see all or almost all students academically engaged at either observation time.

Affective engagement was not consistently high in the observed classes. There were only two classes in which all or almost all students demonstrated affective engagement at both observed times and three additional classes in which all or almost all students demonstrated affective engagement at one of the observation times.

Cognitive engagement was high in the observed classes. In 10 classes, all or almost all students demonstrated the indicator for cognitive engagement at both observation times.

Independence in Learning Processes. For kindergarten–Grade 2, observers collected data on student independence in learning processes, using two indicators, whenever the teacher assigned a task for students to do on their own. Teachers assigned such a task in 8 of the 11 classes.

Student independence in learning processes was high in the majority of classes (Table 7). All or almost all students demonstrated both indicators of independence in learning processes in five of the eight classes. In one additional class, all or almost all students demonstrated one indicator.

Table 7
Evidence for Student Independence in Learning for Kindergarten–Grade 2

All or almost all students demonstrated	# classes (N = 8)
Both indicators	5
One indicator	1
None of the indicators	2

Student subgroups. Observers could not determine which students were English language learners or had educational disabilities. Therefore, it was not possible to analyze whether student processes were consistent for these subgroups of kindergarten–Grade 2 students.

Grades 3–5

Students in Grades 3–5 at both project and comparison schools completed surveys about their levels of engagement (see Table 2). Survey items on cognitive engagement also measured independence in learning.

Regression analysis was used to test for a significant relationship between UDL implementation and student engagement. If there were fewer than 100 responding students, t-tests were used instead of regression analysis. For all analyses, tests of practical significance were calculated to judge whether the observed relationships were large enough to be useful to program staff; effect sizes were used as tests of practical significance.

Engagement. Among responding students, academic and cognitive engagement did not differ between UDL project and comparison schools, but affective engagement was higher at project schools (Table 8).

Table 8
Mean and Standard Deviation of Engagement Scales for Grades 3–5 by School Group

	Project schools			Comparison schools		
Type of engagement (range)	*n*	Mean	Standard deviation	*n*	Mean	Standard deviation
Academic (1.0–4.0)	278	3.42	0.51	287	3.43	0.46
Affective (1.0–4.0)	279	3.40	0.56	287	3.28	0.62
Cognitive (1.0–5.0)	256	3.80	0.76	267	3.82	0.77

The relationship for affective engagement was statistically significant ($\beta = .13$, $p < .01$) (Table 9). This relationship also was practically significant with a small effect size ($\beta > .10$), meaning that the difference in affective engagement between the two school groups was small, but large enough to be useful to program staff. The relationships for academic and cognitive engagement were not statistically or practically significant.

Table 9
The Relationship between UDL Implementation and Student Engagement, by Type of Engagement for Students in Grades 3–5

	Academic ($N = 553$)	Affective ($N = 554$)	Cognitive ($N = 572$)
Project school: *B (SE)*	-0.03 (0.04)	0.15 (0.05)	-0.04 (0.07)
Project school: β	-0.04	0.13**	-0.03
Model fit: F (df)	9.86***(6)	9.61***(5)	5.76***(4)
Model fit: adjusted R^2	.09	.07	.04

*$p < .05$, **$p < .01$, ***$p < .001$.

Student subgroups. Among responding students who were English language learners, academic and cognitive engagement did not differ between UDL project and comparison schools, but there was a small difference for affective engagement (Table 10).

Table 10
Mean and Standard Deviation of Engagement Scales for English Language Learners in Grades 3–5 by School Group

Type of engagement (range)	Project schools			Comparison schools		
	n	Mean	Standard deviation	n	Mean	Standard deviation
Academic (1.0–4.0)	115	3.40	0.52	121	3.40	0.47
Affective (1.0–4.0)	116	3.42	0.55	121	3.28	0.63
Cognitive (1.0–5.0)	107	3.81	0.70	117	3.84	0.79

For English language learners, the relationship for affective engagement was statistically significant ($\beta = .16$, $p < .05$) and practically significant with a small effect size ($\beta > .10$) (Table 11).

Table 11
The Relationship between UDL Implementation and Student Engagement, by Type of Engagement for English Language Learners in Grades 3–5

	Academic (*N* = 231)	Affective (*N* = 232)	Cognitive (*N* = 223)
Project school: *B (SE)*	-0.03 (0.06)	0.19 (0.08)	0.00 (0.10)
Project school: β	-0.03	0.16*	0.00
Model fit: F (df)	6.01***(5)	4.42**(4)	4.22*(2)
Model fit: adjusted R^2	.10	.06	.03

*$p < .05$, **$p < .01$, ***$p < .001$.

Because there were fewer than 100 responding students with educational disabilities, t-tests were used instead of regression analysis. For these students, academic engagement did not differ between project and comparison schools, nor did cognitive engagement (Table 12). Affective engagement was higher at project schools than at comparison schools. This difference was not statistically significant at conventional levels ($t(58) = 1.38$, $p = .10$), but was practically significant ($d = 0.45$), with a small effect size ($d > 0.20$).

Table 12
Mean and Standard Deviation of Engagement Scales for Students with Educational Disabilities in Grades 3–5 by School Group

Type of engagement (range)	Project schools			Comparison schools		
	n	Mean	Standard deviation	*n*	Mean	Standard deviation
Academic (1.0–4.0)	19	3.05	0.76	41	3.19	0.48
Affective (1.0–4.0)	19	3.41	0.67	41	3.07	0.77
Cognitive (1.0–5.0)	18	3.54	0.88	38	3.47	0.84

Consistency. Among responding students in Grades 3–5, the relationships between UDL implementation and student engagement for all students were very consistent with the relationships among English language learners and students with educational disabilities (Table 13). For all students, as for both subgroups, only affective engagement differed significantly between UDL project schools and comparison schools. This relationship was practically significant for all students and both subgroups and statistically significant for all students and English language learners.

Table 13
Summary of Significant Relationships between UDL Implementation and Student Engagement for All Students and Student Subgroups in Grades 3–5 by Type of Engagement

	All students		Student subgroup			
			English language learners		Students with educational disabilities	
Type of engagement	Statistically significant	Practically significant	Statistically significant	Practically significant	Statistically significant	Practically significant
Academic	No	No	No	No	No	No
Affective	Yes**	Small	Yes*	Small	No	Small
Cognitive	No	No	No	No	No	No

*$p < .05$, **$p < .01$, ***$p < .001$.

Independence in Learning Processes. The survey items about cognitive engagement also reflected independence in learning processes (see Table 2). The above findings indicated that there was not a relationship between UDL implementation and these processes for all students, for English language learners, or for students with educational disabilities (Table 13).

Grades 6–8

Data collection and analytical procedures for Grades 6–8 were the same as those described above for Grades 3–5. The results for middle school students follow.

Engagement. Among responding middle school students, each type of engagement was higher at UDL project schools than at comparison schools (Table 14).

Table 14
Mean and Standard Deviation of Engagement Scales for Grades 6–8 by School Group

	Project schools			Comparison schools		
Type of engagement (range)	n	Mean	Standard deviation	n	Mean	Standard deviation
Academic (1.0–4.0)	436	3.15	0.53	375	3.05	0.60
Affective (1.0–4.0)	437	2.94	0.67	374	2.68	0.72
Cognitive (1.0–5.0)	436	3.50	0.82	374	3.33	0.82

There was a statistically significant relationship for each type of engagement (Table 15): academic ($\beta = .09$, $p < .001$), affective ($\beta = .11$, $p < .01$), cognitive ($\beta = .16$, $p < .001$). The relationship also was practically significant for affective and cognitive engagement with small effect sizes ($\beta > .10$).

Table 15
The Relationship between UDL Implementation and Student Engagement, by Type of Engagement for Students in Grades 6–8

	Academic (*N* = 763)	Affective (*N* = 762)	Cognitive (*N* = 763)
Project school: *B (SE)*	0.10 (0.04)	0. (0.0)	0. (0.0)
Project school: β	0.09***	0.16***	0.11**
Model fit: F (df)	10.98***(6)	8.23***(8)	8.24***(7)
Model fit: adjusted R^2	.07	.08	.06

*p < .05, **p < .01, ***p < .001.

Student Subgroups. Among English language learners in middle schools, each type of engagement was somewhat higher at UDL project schools than at comparison schools (Table 16). Because there were fewer than 100 responding students who were English language learners, t-tests were used instead of regression analysis. For academic engagement, the difference was not statistically significant (t(56) = 1.57, p > .05), but was practically significant (d = 0.42), with a small effect size (d > 0.20). Likewise, for affective engagement, the difference between project and comparison schools was not statistically significant (t(56) = 1.26, p > .05), but was practically significant (d = 0.34), with a small effect size (d > 0.20). Lastly, the difference for cognitive engagement was both statistically (t(56) = 1.99, p = .05) and practically significant (d = 0.53), with a medium effect size (d > 0.50).

Table 16
Mean and Standard Deviation of Engagement Scales for English Language Learners in Grades 6–8 by School Group

	Project schools			Comparison schools		
Type of engagement (range)	n	Mean	Standard deviation	*n*	Mean	Standard deviation
Academic (1.0–4.0)	37	3.29	0.59	21	3.05	0.67
Affective (1.0–4.0)	37	3.28	0.50	21	3.07	0.78
Cognitive (1.0–5.0)	37	3.81	0.76	21	3.36	0.91

Among students with educational disabilities, academic and affective engagement were somewhat higher at UDL project schools than at comparison schools, but cognitive engagement did not differ (Table 17).

Table 17
Mean and Standard Deviation of Engagement Scales for Students with Educational Disabilities in Grades 6–8 by School Group

	Project schools			Comparison schools		
Type of engagement (range)	*n*	Mean	Standard deviation	n	Mean	Standard deviation
Academic (1.0–4.0)	73	3.19	0.45	72	3.14	0.60
Affective (1.0–4.0)	73	2.94	0.71	71	2.78	0.80
Cognitive (1.0–5.0)	73	3.43	0.80	71	3.40	0.89

None of the relationships between UDL implementation and student engagement were statistically significant for middle school students with educational disabilities, but those for academic and affective engagement were practically significant, with a small effect size ($\beta \geq .10$) (Table 18).

Table 18
The Relationship between UDL Implementation and Student Engagement, by Type of Engagement for Students with Educational Disabilities in Grades 6–8

	Academic (N =134)	Affective (N = 138)	Cognitive (N = 138)
Project school: B (SE)	0.10 (0.08)	0.16 (0.12)	-0.04 (0.13)
Project school: β	0.10	0.11	-0.02
Model fit: F (df)	3.11*(3)	3.76*(3)	5.18** (2)
Model fit: adjusted R2	.26	.06	.06

*p < .05, **p < .01, ***p < .001.

Consistency. The findings about UDL implementation and engagement for all middle school students were not consistent with the findings for each student subgroup (Table 19). The relationship between UDL implementation and engagement was statistically significant for all students for each type of engagement, but the only statistically significant relationship for a student subgroup was for cognitive engagement, among English language learners. It is worth noting that sample sizes influence significant testing, such that differences among smaller samples, like the student subgroups, are less likely to be statistically significant.

Table 19
Summary of Significant Relationships between UDL Implementation and Student Engagement for All Students and Student Subgroups in Grades 6–8, by Type of Engagement

	All students		Student subgroup			
			English language learners		Students with educational disabilities	
Type of engagement	Statistically significant	Practically significant	Statistically significant	Practically significant	Statistically significant	Practically significant
Academic	Yes***	No	No	Small	No	Small
Affective	Yes***	Small	No	Small	No	Small
Cognitive	Yes**	Small	Yes*	Medium	No	No

*p < .05, **p < .01, ***p < .001.

With respect to practical significance, only the relationship for affective engagement was consistent; it was significant with a small effect size for all students and also for each subgroup. For academic engagement the relationship was not practically significant for all students, but it was, with a small effect size, for both subgroups. Lastly, the relationship for cognitive engagement was practically significant for all students, with a small effect size and for one subgroup, English language learners, with a medium effect size.

Independence in Learning Processes. The survey items about cognitive engagement also reflected independence in learning processes (see Table 2). The above findings indicate that independence in learning processes were significantly higher, both statistically and practically, at project schools for all students and also for English language learners, but not for students with educational disabilities.

Summary

There was evidence for positive impacts from implementation of UDL practices on student processes, with variations by grade level, type of student process, and student subgroup.

Based on classroom observations at UDL project schools, academic engagement, cognitive engagement, and independence in learning were all high for students in kindergarten–Grade 2, but affective engagement was not. Due to the limitations of observations (as noted above), it was not possible to analyze whether the findings were consistent for student subgroups.

Students in Grades 3–8 at both UDL project and comparison schools completed surveys about their levels of engagement; the items on cognitive engagement also reflected independence in learning. For all students in Grades 3–5, affective engagement was significantly higher at UDL project schools than at comparison schools, but there were no differences for academic or cognitive engagement. Further, these findings were the same for both subgroups of students: English language learners and students with educational disabilities. For students in Grades 6–8, all three forms of engagement were significantly higher at UDL project schools than at comparison schools. These findings for all students were not the same as the findings for the two subgroups.

Findings for Question 4

What is the impact of UDL implementation on lesson planning for accessibility and teacher collaboration?

To evaluate the impact of UDL implementation on teaching practices, data were collected through a staff survey of teachers (including media specialists). The results are based on responses from 40 staff members in 22 elementary and 18 middle schools. The results from the two school levels were similar and therefore were combined, with a note for any significant differences.

Lesson Planning for Accessibility

As discussed above, lesson planning for accessibility requires that teachers front-load and build the abilities of their students to make choices related to learning. Front-loading means that the teacher incorporates UDL strategies during the creation of instruction and assessments, instead of adjusting them afterwards. Further, because UDL practices encourage students to select materials, tools, and products, teachers need to develop skills and routines that build each student's ability to make choices that best support his/her learning.

Front-loading. To evaluate whether teachers at project schools were front-loading, survey responses about the use of individual planning time were analyzed. Respondents reported to what extent they had changed the way they use their individual planning time in four areas, since their involvement with the UDL project (Table 20). For each area, about two thirds or more (63–73%) of the 40 respondents indicated that they completed changed or changed a lot.

Table 20
Extent of Changes to Individual Planning Time by Area (N = 40)

Since your involvement with the UDL project, to what extent have you changed the way you use your individual planning time to:	Completely changed		Changed a lot		Changed a moderate amount		Changed a little		No change at all	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Plan your presentation to students	2	5	23	58	11	28	4	10	0	0
Plan materials for students	4	10	22	55	14	35	0	0	0	0
Plan for student learning needs	4	10	22	55	11	28	2	5	1	3
Plan student assignments	5	13	24	60	8	20	0	0	3	8

Further, in open ended questions, respondents described the ways that their individual planning time had changed for each of the four areas: presentation to students, materials for students, student learning needs, and student assignments. Responses across all four areas were analyzed for evidence that teachers incorporated UDL strategies during their planning time (Table 21). About two thirds of the respondents said that in their individual planning time they now build in student choices (26 of 40, 65%) and incorporate more visuals, images, and graphic organizers (25 of 40, 63%). Furthermore, at least one half of the respondents stated they now consider student barriers and learning styles (23 of 40, 58%), incorporate digital media and technology (22 of 40, 55%), and provide a variety of formats beyond text and speaking (20 of 40, 50%). Examples of these UDL-related changes are found in the Appendix.

Table 21
UDL Related Changes to Individual Planning Time for Presentations, Materials, Learning Needs, and Assignments (N = 40)

Changes to planning time (open-ended)	*n*	%
Build in student choices	26	65
Incorporate (more) visuals/images/graphic organizers	25	63
Consider predictable student barriers/student needs/learning styles/successful options	23	58
Incorporate digital media/technology	22	55
Provide additional formats beyond viewable text plus teacher speaking/variety of ways/multiple explanatory devices	20	50
Options where students can demonstrate understanding	16	40
More interactive/hands-on/less worksheets	10	25
Reflective/have students think about choice	3	8
Different ways to assess	3	8
Other UDL comments	10	25
No comment	1	3

Note. Each respondent's answer could include more than one category.

Significant differences, shown in Table 22, were found between school levels for two changes. More elementary (12 of 22, 55%) than middle school (4 of 18, 22%) respondents indicated options where students can demonstrate understanding (χ^2 (df = 1) = 24. 1, $p < .05$). Also, more elementary (9 of 22, 41%) than middle school respondents (1 of 18, 6%) included other UDL comments (χ^2 (df = 1) = 24. 1, $p < .05$).

Table 22
Selected UDL Related Changes to Individual Planning Time by School Level

	School level			
	Elementary (n = 22)		Middle (n = 18)	
Changes to planning time (open-ended)	*n*	%	*n*	%
Options where students can demonstrate understanding	12	55	4	22
Other UDL comments	9	41	1	6

Note. Each respondent's answer could include more than one category.

Most teachers were front-loading, as indicated by the above responses. First, about two thirds of respondents completely changed or changed a lot their use of individual planning time, since involvement with the UDL project. Second, more than one half of respondents described these changes in terms of key UDL strategies: building in student choices, considering student barriers and learning styles, or providing a variety of formats beyond text and speaking.

Building Student Choice. As described above, UDL principles emphasize providing choices to students in how they gain information and show what they know. Therefore, teachers reported on whether they had a plan to build students' ability to make choices throughout this school year (Table 23). Almost three fourths of the participants (29 of 40, 73%) replied that they have an informal plan. Only 4 of 40 (10%) teachers indicated that they have a formal plan, and 7 (17%) replied that they have no plan or did not respond.

Table 23
Types of Plans to Build Students' Ability to Make Choices (N = 40)

Did you have a plan to build students' ability to make choices throughout this school year?	*n*	%
Yes, an informal plan	29	73
Yes, a formal plan	4	10
No plan	6	15
No answer	1	2

Additionally, teachers were asked to describe their plan for building student choice throughout the school year in an open-ended question. However, 10 of the 33 teachers (30%) with a plan did not give a description (Table 24). Among the 23 respondents who did describe their plan, about one half (11 of 23, 48%) indicated that students choose their best way to learn; examples of these plans are in the Appendix.

Table 24
Description of Plan for Building Student Choice Throughout the School Year

Plan for building student choice throughout this school year (open-ended)	Respondents with a plan (N = 33)[a]		Respondents who described their plan (N = 23)[b]	
	n	%	*n*	%
Students choose their best way to learn	11	33	11	48
Students reflect on choices	5	15	5	22
Model choices	4	12	4	17
Gradually introduce choices	4	12	4	17
Other choice comments	4	12	4	17
Other comments	2	6	2	9
No comment	10	30	NA	NA

Note. Respondent's answers could include more than one category.
[a]Includes 29 respondents with an informal plan and 4 respondents with a formal plan.
[b]Includes 19 respondents with an informal plan and 4 respondents with a formal plan.

Teacher Collaboration

As discussed above, teachers involved in the UDL projects should collaborate in several ways. They should discuss student learning profiles with colleagues to better understand how to ensure access to each student. Also, given the important role of student choice (i.e., among learning tools, tasks, or products) within UDL, teachers should work together to build students' capacity for making choices throughout the school year and across grades. Lastly, given the need to create accessible materials as part of UDL practices, teachers are expected to share responsibility for creating and sharing them.

Discussion of Student Learning and Building Student Choice. Teachers reported how often they discussed student learning preferences with other teachers during this school year. The majority, (24 of 40, 61%), said a few times a week or a few times a month (Table 25). Further, teachers reported on their collaboration to build students' capacity for making choices. About one half of respondents (21 of 40, 53%) said they discussed building student choice with other teachers of the same grade level a few times a month or a few times a week. However, discussions with other teachers across grade levels were less frequent; only one fifth (8 of 40, 20%) of respondents reported doing so a few times a month or a few times a week.

Table 25
Frequency of Discussing Student Learning and Student Choice (N = 40)

During this school year, how often did you discuss…	A few times a week		A few times a month		About once a month		3–4 times a year		1–2 times a year		Never or no answer	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Student learning preferences with other teachers	5	13	19	48	5	13	4	10	1	2	6	15
Building student choice with other teachers for the same grade level	8	20	13	33	6	15	5	13	1	2	7	17
Building student choice with other teachers across grade levels	1	2	7	18	9	23	8	20	8	20	7	17

Additional survey items about discussions regarding students concerned team planning time; teachers reported on changes in using that time to discuss students, since their involvement with the UDL project (Table 26). No one indicated a complete change and almost one fourth (8 of 33, 24%) reported no change. However, just over one half (18 of 33, 54%) replied that their team planning time has changed a lot or a moderate amount in this aspect. Similarly, among the 11 teachers that reported planning with a second team, just over one half (6 of 11, 54%) replied that their time has changed a lot or a moderate amount with respect to discussing students.

Table 26
Extent of Changes to Team Planning Time to Discuss Students

Since your involvement with the UDL project, to what extent have you changed the way you use your team planning time…	Completely changed		Changed a lot		Changed a moderate amount		Changed a little		No change at all	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
To discuss students. ($N = 33$)[a]	0	0	8	24	10	30	7	21	8	24
With a second team to discuss students. ($N = 11$)[b]	0	0	2	18	4	36	0	0	5	46

[a]Includes only the 33 respondents who answered this question.
[b]Includes only the 11 respondents who answered this question.

When asked in an open-ended question, to describe changes to their team planning time to discuss students, more than one third (9 of 25, 36%) of those who responded mentioned that they discuss different learning styles or how all students can access the curriculum (Table 27).

Table 27
Description of Changes to Team Planning Time to Discuss Students ($N = 25$)

Change (open-ended)	*n*	%
Discuss different learning/all students access to curriculum /how to address barriers	9	36
Discuss various ways to present	3	12
Plan choices	3	12
Plan to increase student engagement	2	8
Discuss strategies and interventions	2	8
Other changes	4	16
Not much change	2	8
Other comments	2	8

Note. Includes only respondents who indicated they had changed their team planning time for discussing students. Each respondent's answer could include more than one category.

Materials That Enhance Accessibility. Survey respondents described in their own words to what extent they did each of the following: work with other teachers to create materials that enhance accessibility, share materials with teachers in other content areas, and share materials with teachers in other grade levels. Their responses were classified into one of three categories: frequently/regularly, somewhat, rarely/not often.

About one half (23 of 40, 57%) of the respondents indicated that they frequently or regularly work with other teachers to create materials that enhance accessibility (Table 28). Close to one half (18 of 40, 45%) indicated that they frequently or regularly share materials with teachers in other content areas. Only one fifth (8 of 40, 20%) indicated that they frequently or regularly share materials with teachers in other grade levels; close to one third share with teachers in other grade levels either somewhat (13 of 40, 32%) or rarely (12 of 40, 30%). In an open-ended

question, respondents described their work with other teachers on materials that enhance accessibility; examples of verbatim comments from those who regularly work with other teachers are in the Appendix.

Table 28
Extent of Working with Other Teachers to Create or Share Materials that Enhance Accessibility (N = 40)

	Frequently/ regularly		Somewhat		Rarely/not often/ not applicable		No answer	
To what extent do you…	*n*	%	*n*	%	*n*	%	*n*	%
Work with other teachers to create materials	23	57	7	18	4	10	6	15
Share materials with teachers in other content areas	18	45	7	18	9	22	6	15
Share materials with teachers in other grade levels	8	20	13	32	12	30	7	18

Note. Responses were classified into frequency categories.

To share materials that enhance accessibility, schools should have electronic folders with these materials. Survey respondents reported on whether already-created materials that enhance accessibility for students are available electronically at their school. The majority of respondents (28 of 40, 70%) replied that these materials are available and that they know how to get them (Table 29).

Table 29
Availability of Electronic Already-created Materials (N = 40)

At your school, are already-created materials that enhance accessibility for students available electronically?	*n*	%
Yes, and I know how to get these materials.	28	70
Yes, but I don't know how to get these materials.	1	2
No, my school does not have these materials available electronically.	3	8
I don't know whether these materials are available electronically at my school.	2	5
No answer.	6	15

Among the 28 respondents who said materials were available electronically and who knew how to access them, more than three fourths (22 of 28, 79%) strongly agreed or agreed that they check for these materials when planning a lesson (Table 30). Close to two thirds (18 of 28, 64%) strongly agreed or agreed that they regularly add to the materials that are available electronically.

Table 30
Usage of Already-created Materials That Enhance Accessibility (N = 28)

	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree	
Survey item	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
When planning a lesson, I always check for already-created materials that enhance accessibility for students and are available electronically at my school.	5	18	17	61	4	14	2	7	0	0
I regularly add to the materials that enhance accessibility for students and that are available electronically at my school.	4	14	14	50	3	11	7	25	0	0

Note: Includes only the 28 respondents who said materials were available electronically and who knew how to access them.

Summary. The teacher practices that are key to UDL implementation are lesson planning for accessibility and teacher collaboration. Overall, there was evidence for positive impacts of UDL implementation on these teacher practices.

Lesson planning for accessibility requires front-loading, which means that the teacher incorporates UDL strategies during the creation of instruction and assessments. Most survey respondents were front-loading, as indicated by the following. First, since their involvement with the UDL project, about two thirds of respondents reported they had "completely changed" or "changed a lot" their use of individual planning time. Second, more than one half of respondents described these changes to their planning time in terms of key UDL strategies: building in student choices, considering student barriers and learning styles, or providing a variety of formats beyond text and speaking.

Lesson planning for accessibility also requires building student choice throughout the school year. Most survey participants made plans to build student choice throughout the school year. More than one half of the respondents described such a plan, typically an informal one.

Teacher collaboration focuses on discussions with other teachers about students and student choice and on materials that enhance accessibility. Among survey respondents, more than one half had discussions with other teachers at least a few times a month about student learning preferences and about building student choice within their grade level. Most responding teachers shared responsibility for creating materials that enhance accessibility. About one half of respondents indicated that they frequently or regularly work with other teachers to create such materials that enhance accessibility and regularly add them to a shared electronic folder at their school. Further, the majority of respondents reported that they knew how to access this electronic folder and checked this folder for materials when planning a lesson.

However, teacher collaboration across content areas or grade levels was less frequent. Less than one half of survey respondents frequently or regularly shared materials that enhance accessibility with teachers in other content areas. Only one fifth of respondents frequently or regularly discussed students or shared materials that enhance accessibility across grade levels.

Discussion

The goals of the UDL projects include the following: to identify models for schools to develop leadership teams focused on schoolwide implementation of UDL over a three- to five-year period and to identify scalable models to guide the professional learning of UDL leadership teams across multiple schools. The findings from this evaluation suggest that the model used in the UDL pilot projects was successful; there was evidence for positive impact on teachers' implementation of UDL practices, on the student processes of engagement and independence in learning, and on teacher practices of lesson planning for accessibility and collaboration. At least one half of teachers consistently implemented UDL or reported using the key teacher practices; this moderate level of implementation across all teachers is reasonable, given that the evaluation occurred two to three years into a five year project.

The purpose of the observations was not to evaluate individual teachers (because only one class was observed) but to evaluate the implementation level of UDL instructional practices within project schools. Given that implementation was at a moderate level for the project, it was assumed that project teachers used UDL practices more frequently than teachers at comparison schools. Therefore, the above analyses of student engagement included students of all project teachers.

However, it is possible that the project teachers with inconsistent implementation of UDL did not increase the engagement of their students and thus should be excluded from analysis. Therefore, the analyses of student engagement were redone using *only* the students of project teachers with consistent implementation (along with their comparison classrooms). The results were very similar to those presented above, in terms of higher engagement among students in project schools. Re-analysis of subgroups was not possible, due to the very small sizes of these groups.

As noted above, consistent implementation of UDL practices was lower among middle school than elementary school teachers. However, the apparent impact of UDL on student processes was greater among the older students. While each type of engagement differed significantly between project and comparison schools for Grades 6–8, only affective engagement differed significantly for students in Grade 3–5. A possible explanation is that the engagement level was so high among all the younger students, that differences between the two groups of schools were less likely. The mean value of each type of engagement was closer to the scale's maximum for the younger students than for the older ones (across all schools) (Table 31). For academic engagement, the mean for Grades 3–5 was 3.43, which is closer to the scale's maximum value of 4.0, than the mean of 3.10 for Grades 6–8. Likewise, for affective engagement, the mean of 3.34 for Grades 3–5 was closer to the scale's maximum value of 4.0, than the mean of 2.81for the older students. Finally, for cognitive engagement, the mean of 3.81 for the younger students was closer to the scale's maximum of 5.0, than the mean of 3.42 for Grades 6–8.

Table 31
Mean and Standard Deviation of Engagement Scales by School Level

	Grades 3–5			Grades 6–8		
Type of engagement (range)	*n*	Mean	Standard deviation	*n*	Mean	Standard deviation
Academic (1.0–4.0)	565	3.43	0.48	811	3.10	0.56
Affective (1.0–4.0)	566	3.34	0.60	811	2.81	0.70
Cognitive (1.0–5.0)	523	3.81	0.76	810	3.42	0.82

Recommendations

Based on findings from the evaluation, we recommend that program staff focus training, guidance, and other supports on the following suggestions for improving future implementation of UDL:

- Encourage leadership at all schools to increase the number of UDL practices implemented by providing additional training, Professional Learning Communities, and collaborative planning to promote use of the following practices: choices of products, choices of responses, variety of formats for handouts, and reflection about choice.
    - Just over one half of teachers had consistent implementation, which meant using at least four of the nine UDL practices.
- Encourage leadership at middle schools to increase the number of UDL practices implemented by providing additional training, Professional Learning Communities, and collaborative planning to promote use of stations/centers and routines for making choices.
    - Consistent implementation of UDL practices was lower among middle school teachers than among elementary school teaches.
- Consider encouraging teachers to formally plan how they will build students' abilities to make choices throughout the school year; provide specific models and templates that teachers can use.
    - Most teachers indicated that they had an informal plan to build students' abilities to make choices, but not a formal plan.
- Increase the sharing of materials that enhance accessibility with teachers in other content areas and across grade levels; provide specific ways and examples for teachers to use.
    - Less than one half of respondents regularly shared materials with teachers in other content areas and only one fifth shared materials across grade levels.

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Appendix: Detailed Responses from Staff Survey

Table A1
Examples of Changes to Individual Planning Time

Category	Examples
Build in student choices	• I try to make sure there are more materials for student choice. • Embedding choice into how to learn and how to demonstrate knowledge • I try to build in choices for students whenever I can. This will be an on-going process. • I now, more often, give students several options for responding to assignments. For example, in my reading class, students show mastery of vocabulary by drawing, acting it out, or writing sentences.
Incorporate (more) visuals/images/graphic organizers	• Consistently adding visuals to flipcharts embedding videos • I look for more visuals and more interesting ways to present through visuals and video clips • Much of the multiple modes of presenting information include visuals, so much of my planning time is spent creating these.
Consider predictable student barriers/student needs/learning styles/successful options	• Before I present, I take into consideration the different ways students learn information. I don't present the same way all the time. • More consciously thought about "who is being left out?" and "what can provide to help those students overcome their barriers to learning?" • I've spent a lot more time thinking and planning for specific student challenges. I've found that when I design the lesson thinking of these students from the beginning, the entire lesson works better for all students.
Incorporate digital media/technology	• Presentations have change to consistently provide various ways to present information to students. This includes utilizing various components of Flipcharts and embedding videos, images and sound to present the information. • I am always looking for digitized text so that the students can have a copy that was properly manipulated. • Offering students choice as far as the way they would like to present their learning both through the use of technology or without technology. Also, different ways to incorporate technology (i.e. Word Q and Natural Reader) to provide accommodations.
Provide additional formats beyond viewable text plus teacher speaking/variety of ways/multiple explanatory devices	• Making sure that there are a variety of ways for the students to understand the information... verbal, visual, hands on, small group, large group, student discussions, etc. • I look for many different modalities- using the promethean flipcharts, music, kinesthetic learning etc. • Simply taking additional time to incorporate a variety of learning approaches, particularly in math and reading. Always plan for rotations in math and reading (almost daily).

Table A2
Examples of Plans to Build Students' Ability to Make Choices

Category	Examples
Students choose their best way to learn	• Students have the opportunity to complete written assignments on the computer, variety of paper styles, pens, colored pencils, markers, etc. At the beginning of the year I explained to all students that we are an UDL classroom and they have choices to decide on their own the best way they learn and to show what they know. • I explain to students that I give them choices. They are to choose according to their likes, strengths, and opportunities for challenge. What they choose should have an end product that will show their best effort. • Students were taught how to recognize their own learning strengths and needs. They were then encouraged to think about the choices they were given so they could make the correct choice. Often, if they didn't do well, I would encourage them to make a different choice next time so they could find the method that worked best for them.

Table A3
Examples of Collaboration to Create or Share Materials That Enhance Accessibility

Category	Examples
Frequently/regularly work with other teachers to create materials that enhance accessibility	• I work with teammates on a weekly basis to plan lessons with accessibility in mind. Sometimes we will take materials and resources from the online curriculum and modify it to meet the needs of our learners. Other times, we will take materials from previous years to do the same or create materials ourselves that attempts to account for student barriers to learning. • There was lots of collaboration among teammates and members of the UDL team. Teammates met regularly each week, and UDL members met each month to share and create materials. • I attended team meetings at each grade level on a regular basis and sparked many conversations about how to make lessons more UDL. I created graphic organizers, flipcharts, project choices for various teams. I meet with teams/teachers informally everyday but formally about every 2 weeks.
Frequently/regularly share materials with teachers in other content areas	• We use t-share and a calendar with hyperlinks daily. • Very often, send emails to grade level team and specialists frequently to share created organizers, flipcharts, etc. occasionally uploaded resources to county websites. • Every day. Whatever I make and find each day is either emailed directly to my team or put in Teacher Shared for others to use.
Frequently/regularly share materials with teachers in other grade levels	• Weekly and as needed • Regularly with entire school • Materials created go into the teacher shared folder