Teacher Leader Corps (TLC) Final Report: 2013-14 through 2015-16

WAKE COUNTY PUBLIC SCHOOL SYSTEM

DATA, RESEARCH & ACCOUNTABILITY

Teacher Leader Corps (TLC) Final Report: 2013-14 through 2015-16

Abstract

The Teacher Leaders Corps had many strengths and was fairly successful in reaching its implementation and short-term goals. Central training quality was considered strong and attendance rates were high (especially in Years 1 and 2). Of those who began the TLC work in 2013-14, approximately 60% participated all three years. At the school level, about half of the intended dissemination events took place. Professional learning sessions emphasized use of various digital resources. Discovery Education resources were available to all schools and provided evidence that online resources were utilized by teachers and students. DE utilization was higher in Year 1 than in Year 2 or 3; and teachers utilized DE more than students. Decreased use of DE after Year 1 could reflect less interest or an increase in digital resources available to schools. TLC members utilized technology appropriately and in a variety of ways based on classroom observations. The school team model utilized in TLC provided a better opportunity for sustaining the effort than training sessions with no follow-up. Ways to further increase the likelihood of implementation, impact, and sustainability in schools include putting structures in place at the central and school level to facilitate and monitor teacher implementation and to provide more coaching for teachers.

TABLE OF CONTENTS

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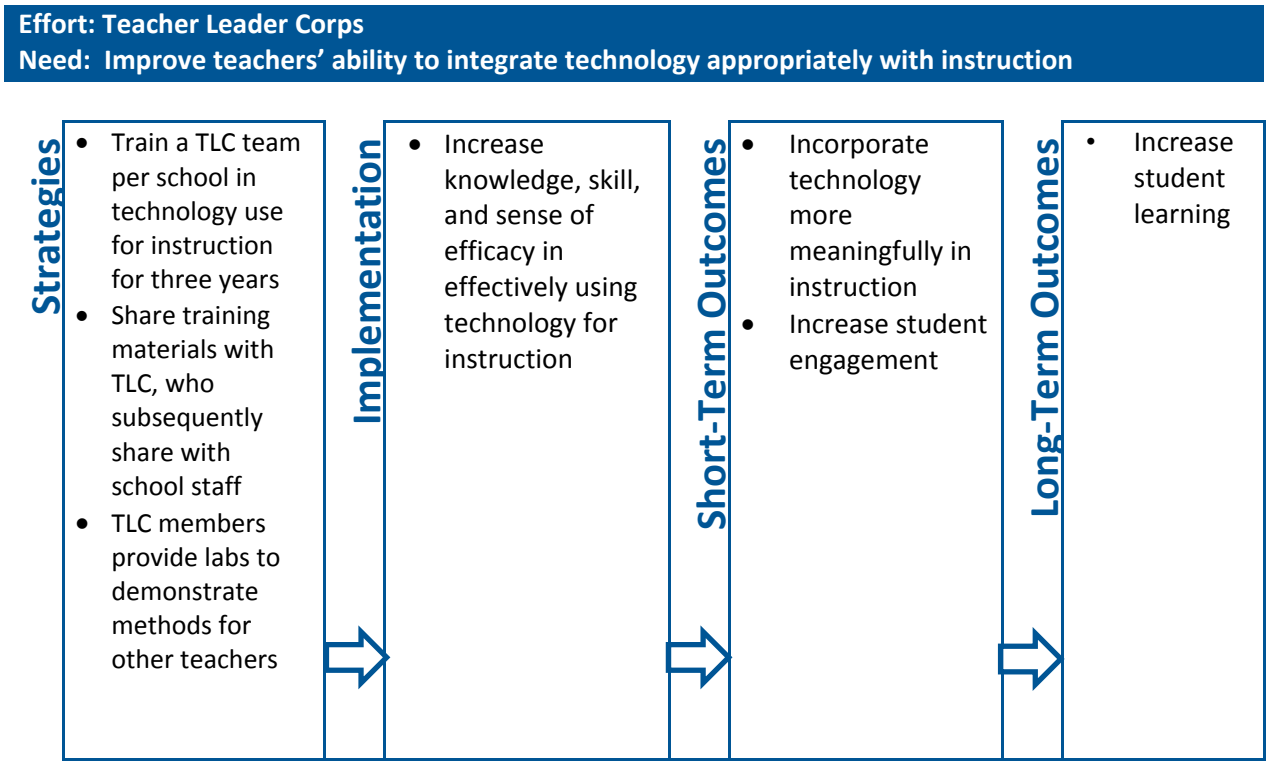
Summary

Program Description

The Teacher Leader Corps (TLC) professional learning initiative focused on building teachers' skills in the appropriate integration of technology into instruction. WCPSS Instructional Technology and Media Services (ITMS) staff contracted with Discovery Education (DE) to serve as trainers of four-member TLC teacher teams from each school. While some professional learning opportunities utilized DE materials, training also covered other technology resources. Costs for the three-year initiative exceeded one million dollars per year. DE trainers provided professional learning opportunities through multi-day training for each of the three years to the TLC members. TLC members subsequently shared TLC ideas and techniques through with other staff in their schools.

The primary goal of TLC was to build a sense of efficacy among teachers in knowing how to appropriately utilize technology for instruction (see Figure 1). The expectation was that teachers would then increase meaningful use of digital resources in instruction, which would lead to increased student engagement in their learning, and ultimately, increased student learning and achievement.

Figure 1
Pathway of Change



Multiple studies suggest that the adoption of technology and digital media provide many advantages to teachers, students, and school districts when implemented in a proper and sustainable manner. Instructional technology use gives students access to the tools that they will be expected to utilize effectively after graduation as well as increasing student achievement (Campuzano, Dynarski, Agodini, &

Rall, 2009; Shapley, Sheehan, Maloney, & Camikas-Walker, 2010; Suhr, Hernandez, Grimes, & Warschauer, 2010; Warschauer, 2006; Weston & Bain, 2010).

Implementation

Implementation of TLC sessions for teacher teams at the central level was strong. Planned full-day TLC trainings occurred for multiple cohorts each year. Attendance was 66% to 71% in Years 1 and 2, with some decline in Year 3 (47%). Participants had positive views of the sessions and considered them helpful. Of the original 695 Year 1 TLC members, 527 continued participation in Year 2, and 407 participated in Year 3 to complete their three-year commitment. Thus, over half (58.6%) stayed with TLC all three years. Replacement team members were added in most but not all cases. In some cases, TLC teams included fewer than the expected four members for an extended amount of time (i.e. several months to a whole school year).

At the school level, the expectation was that TLC members would share training modules and provide demonstrations in learning labs for their school colleagues. Completion was moderate with approximately 60% of the expected offerings made in Year 1 and a decline in Years 2 and 3 to 35% and 43% respectively. Time was the primary reason teachers gave for not disseminating the learning—most commonly time to share at staff meetings and/or time for other teachers to visit the learning labs. Some teachers mentioned that the school administration did not consider the TLC work as high in priority as other initiatives. Finally, some teachers also noted that they did not have enough time to prepare to share the material.

Teacher Outcomes

Teachers' sense of self-efficacy in utilizing digital resources for instruction increased for both the TLC teachers and non-TLC teachers. The TLC and non-TLC groups started out at about the same point in terms of their self-evaluations, and both groups improved over time. TLC members reached a higher level after the first year of TLC training and maintained this higher level across the three years. Teachers who were only members of TLC for one or two years had similar patterns of self-efficacy as those attending all three years.

DE usage data and TLC member observations provided indicators of teacher and student use of technology for instruction. While the TLC training was not specific to the utilization of DE, DE resources were the only digital resources available to all schools early on in the initiative, and DE records were the only software data available across the three-year period of TLC. Teachers accessed DE resources more often than students. Teacher usage averaged about three days per month in Year 1 and 2 but declined to about 1.5 times per month in Year 3. Other resources became available districtwide over time, which could explain some of the decline. DE use varied considerably across schools. Due to decreased use over time, costs per teacher increased from $39 in Year 1 to $65 per teacher in Year 3. The costs per student were about $8 each year.

Observations of TLC members in a representative sample of schools revealed that teachers utilized technology in a variety of ways and at different levels of sophistication to enhance instruction. Teachers

most often played a facilitative role (i.e., through coaching and interactive direction of students) rather than a lecturing role. Student engagement was also reasonably high.

Recommendations

Districtwide professional learning initiatives must be seen as programs designed to impact teachers' practices and ultimately student achievement (Killion, 2008). TLC can inform future district efforts based on both strengths and areas for improvement. In terms of strengths, training was of high quality with multiple sessions over time, teacher teams were trained together over several years, and data were collected on progress made over time. Areas for improvement include:

- **Increasing the chances for strong school implementation** by building stronger support from the central level (e.g., having an in-house implementation team), reducing the number of simultaneous central initiatives, increasing team sizes for larger schools, and including an administrator and perhaps an instructional resource teacher on school implementation teams.

- **Monitoring school implementation more closely** by providing checklists of "look fors" for school observers and considering a teacher-leader role for team members to allocate some of their time (e.g., 25%) to coaching and monitoring implementation. Central staff could provide guidance on how to manage scheduling so that teachers can visit learning labs or provide alternate delivery vehicles for disseminating learning labs (e.g., online video library).

- **Building the likelihood of sustainability** with increased coaching as teachers try new practices, providing principals with guidance on replacement of team members as needed, and providing materials to orient new team members to the effort and its importance.

Background

Evaluation Study

This is the final report from Data, Research, and Accountability (DRA) on the Teacher Leaders Corps initiative (see blue chevron below).

The study assessed both implementation and outcomes of TLC. Because TLC was rolled out to all schools simultaneously, it was not possible to compare technology use and student outcomes over time due to the lack of a comparison group. As such, data provided are descriptive in nature (see Table 1). Specific conclusions cannot be drawn about TLC's specific program effectiveness separate from other initiatives in the district. Data sources utilized included measures developed by Discovery Education and WCPSS. DRA staff utilized training attendance, implementation monitoring surveys, digital integration surveys, usage data, interviews, and observations as data sources for the study. Appendix A provides an overview of data sources and methods, with additional detail in additional appendices specific to each data source.

Table 1

Study Design and Supported Conclusions

Research Design	Conclusions that can be Drawn
☐ Experimental	We can conclude that the program or policy caused changes in outcomes because the research design used random assignment.
☐ Quasi-Experimental	We can reasonably conclude that the program or policy caused changes in outcomes because an appropriate comparison strategy was used.
☑ Descriptive ☑ Quantitative ☑ Qualitative	These designs provide outcome data for the program or policy, but differences cannot be attributed directly to it due to lack of a comparative control group.

Sources: List, Sadoff, & Wagner (2011) and What Works Clearinghouse (2014).

Program Description

Beginning in 2013, WCPSS Instructional Technology staff contracted with Discovery Education (DE) to develop the Teacher Leader Corps (TLC) professional learning initiative. TLC focused on general concepts of integration of technology into instruction and was designed to better leverage technology for learning. Academics leadership staff chose DE as the training partner because of their expertise and capacity to train teams of teachers from all schools simultaneously. Schools were given access to DE's

library of online instructional resources as part of the overall initiative. The training, however, focused on general technology integration strategies (i.e., not specifically DE resources). Prior to the start of Year 1 of TLC (2013-14 school year), principals and other key Central Office staff were introduced to Discovery Education, told about the overall goals and expectations of the TLC program, and asked for their support. Principals were also required to create a Teacher Leader Corps (TLC) team of four teachers per school. Additional information on the history of the initiative is available in a previous report (Simmons & Baenen, 2016).

Figure 1 provides the Pathway of Change for the TLC effort (see Appendix B for a more detailed logic model). The DE trainers provided professional learning opportunities through multi-day training in each of the three years to the TLC members. TLC members subsequently shared TLC ideas and techniques and provided labs to demonstrate lessons in practice with other staff in their schools. Thus, both the TLC team members and other teachers in the school were provided with opportunities to learn how to incorporate technology more meaningfully into instruction. An increase in appropriate use of technology for instruction was then to occur, which would lead to increased student engagement and learning. Another goal of the Teacher Leader Corps was to develop leadership skills in members as they provided professional learning experiences to their colleagues.

Costs

The TLC initiative was a three-year agreement between WCPSS and DE to provide five full days of training per year to four-member teams from each WCPSS school during each academic year. Because WCPSS' schools operate on several different academic calendars, four cohorts were established: traditional (elementary), traditional (secondary), modified/single-track year round, and multi-track year-round.

Table 2 provides a yearly breakdown of costs related to the TLC initiative and for Discovery Education software licenses. Initially, central school district funds paid for the trainings, substitute teachers, and teacher stipends, while schools paid for their individual Discovery Education content licenses. Schools' content licenses were calculated based on the grade span and size of the school. Starting in year 2, central school district funds covered all costs related to the TLC initiative including school site licenses. Table 3 provides average yearly costs for schools by grade span. As shown in Table 3, prices for licenses increased only slightly for elementary and high schools across the years, with an increase at middle schools of $577 over time. By year 3 of the initiative, central funds covered the school licenses.

Table 2
WCPSS Three-Year Costs for TLC and Discovery Education Initiative

	Year 1 2013-14	Year 2 2014-15	Year 3 2015-16	Overall
Discovery Education School Licenses	$391,373	$412,020	$420,640	$1,224,033
Discovery Education Trainings	$447,500	$447,500	$447,500	$1,342,500
Teachers' Substitutes	$202,760	$221,041	$245,323	$669,124
Teacher Stipends	$8,960	$11,694	$1,520	$22,174
TLC Evaluation by DE	$10,000	$10,000	$10,000	$30,000
Total	**$1,060,593**	**$1,102,255**	**$1,124,983**	**$3,287,831**

Note: End-of-year figures.

Table 3
Average Costs per School for DE Content Licenses

	Year 1	Year 2	Year 3
Elementary	$2,313	$2,360	$2,391
Middle	$2,313	$2,848	$2,890
High	$2,785	$2,848	$2,890

Note: Smaller schools paid a reduced rate.

Research Supporting TLC Initiative

Technology Adoption

The adoption of technology and digital media provides many advantages to teachers, students, and school districts. Benefits include access to current and timely content, increased interactivity to promote student engagement, adaptability to individual student needs, alignment to state and local curricular standards, integrated formative assessments, and lower costs over time compared to traditional learning modalities (Fletcher, Schaffhauser, & Levin 2012; Johnston 2011; Mardis, Everhart, Smith, Newsum, & Baker 2010).

Instructional technology initiatives, when implemented in a proper and sustainable manner, give students access to the tools that they will be expected to utilize effectively after graduating from high school. When instructional technology initiatives are properly implemented, research shows significant increases in student achievement. A large number of research studies have found student benefits within K-12 technology initiatives (Bebell, 2005; Campuzano, Dynarski, Agodini, & Rall, 2009; Goldberg, Russell, & Cook, 2003; Hunter & Greever-Rice, 2007; Jeroski, 2003; Lowther, Ross, & Morrison, 2003; Shapley, Sheehan, Maloney, & Camikas-Walker, 2010; Suhr, Hernandez, Grimes, & Warschauer, 2010; Warschauer, 2006; Weston & Bain, 2010).

The benefits of instructional technology integration cannot occur if teachers are not comfortable using technology or applying it to their lesson planning and instruction. Over time, when teachers begin to master available technology, they more consistently implement more media into their lessons. The role of the classroom teacher then switches from a lecturer to more of a facilitator role where the teacher guides students through learning (Edwards, 2013; Corn, 2009).

Professional Learning

Regardless of content focus, effective professional learning that impacts student achievement must utilize a research-based model. Joyce and Showers (2002) and Cooper (n.d.) provide excellent summaries that point to the following critical components for effective professional development, especially for complex efforts:

1. Developing knowledge through exploring theory and concepts,
2. Demonstrating or modeling the strategy or skill,
3. Providing time for initial practice in the workshop to build knowledge and skill,

4. Providing coaching, usually by a peer, to build knowledge, skill, and transfer of learning. Peer coaching not only contributes to the transfer of training; it involves collaborative planning and facilitates the development of new school norms of collegiality and experimentation.

Of these, the component with the most impact was coaching (Joyce & Showers, 2002). Effective professional development is based on a comprehensive overall plan at the district level, occurs in multiple sessions over time, and meets the standards for effective professional development (Cooper, n.d.).

TLC Implementation

District-Level Efforts

Planned full-day trainings occurred for multiple cohorts. Attendance was strong (66% to 71%) in Years 1 and 2, with some decline in Year 3 (47%). Participants considered the sessions helpful, and 59% of team members participated all three years.

Did all district-level trainings occur? Was attendance at TLC sessions strong?

Yes, all district-level trainings occurred with the exception of one cohort of TLC members during Year 2 who had to complete one of their training days via self-paced virtual modules due to inclement weather (i.e., snow). Each of the three years, over 600 members of school-based teams participated in several cohort groups.

Attendance was fairly strong, especially in Years 1 and 2. Appendix C provides more detail.

- About two-thirds (65.9%) of TLC members attended all trainings in Year 1, and close to three-fourths (70.6%) attended all trainings in Year 2.
- The percentage of TLC attending all five days of training *declined* in Year 3 (47.2%).

Table 4
TLC Session Attendance Rates by Year

Year	Attended at all	Attended all training days		# attended 3-4 days		# attended 1-2 days		Average Hours of PD completed
		#	%	#	%	#	%	
2013-14	695	459	(66.0%)	189	(27.2%)	44	(6.3%)	29.78
2014-15	660	466	(70.6%)	139	(21.1%)	55	(8.3%)	30.81
2015-16	643	303	(47.2%)	294	(45.8%)	45	(6.9%)	29.21

Source: WCPSS eSchools Databases
Note: 2014-15 counts for participants attending all days includes participants who did not complete the 5th day of training due to inclement weather.

What was the attrition rate on TLC teams across years?

Of the original 695 Year 1 TLC members, 527 continued participation in Year 2, and 407 participated in Year 3 to complete their three-year commitment. Thus, over half (58.6%) stayed with TLC all three years, but over 40% did not. While program staff felt this was strong, no standard was available for expected attrition. These results can serve as a useful benchmark for similar multi-year training models.

Table 5
TLC Session Attendance Rates by Year

	2013-14	Still There in 2014-15	Still There in 2015-16
Started in 2013-14	**695**	**527**	**407**
% of 2013-14		**75.8%**	**58.6%**

Source: WCPSS eSchools Databases

Did TLC members fit the guidelines?

Leadership staff in Academics asked principals to select four classroom teachers to become members of the Teacher Leader Corps. Expectations were that teachers would:

1. attend five days of training each of the three years,
2. integrate technology and develop learning labs within their own classroom,
3. work with administrative staff to identify the instructional needs of school staff,
4. train other teachers to empower them to use technology within their lessons, and
5. coach peers around using this model to improve student learning.

Principals were expected to provide structured time for the TLC participants to deliver effective school wide training to teachers, promote the use of digital resources to support common core learning and teaching, and provide consistent and on-going feedback to all TLC participants to help improve their skills as teacher leaders.

As shown below, nearly all participants were teachers (as requested). Other sections of this report address training attendance, school training and labs, and administrative support.

Table 6
Job Classification of TLC Members (School-Based Only)

Job Classification	Year 1		Year 2		Year 3	
	N	%	N	%	N	%
Elementary Teachers	248	41.8%	241	44.2%	342	56.6%
Secondary Teachers	223	37.6%	204	37.4%	175	29.1%
Teachers (non-grade level specific)	101	17.0%	93	17.1%	84	13.9%
Media Coordinators	2	**0.3%**	2	**0.4%**	3	**0.5%**
School Administrators	8	**1.3%**	1	**0.2%**	0	**0.0%**
Other Professional Staff	11	**1.8%**	4	**0.7%**	0	**0.0%**
Total	593		545		604	

Note: School-Based Positions Only

Lead Trainer Interviews

At the end of the three-year initiative, DRA staff interviewed five of the lead trainers from Discovery Education who had worked with different cohorts of schools for at least two of the three years. The semi-structured interview gathered descriptive and perceptive data about the initiative. Overall, the DE trainers thought that the training efforts went well. Some of the specific factors that served to facilitate the success of the initiative included the visibility of the Central Office staff at trainings, the ability to work consistently with a cohort throughout the initiative, and the opportunity that the TLC members had to collaborate with their peers.

The trainers also discussed some barriers to implementation and offered some recommendations for the future. These included a lack of sufficient administrative support for providing time for TLC members' training, labs, and coaching to other school staff. Trainers thought the limited coaching they were able to do in schools was a valuable aspect of their work. They indicated that future DE work with school districts would include more coaching as well as talking with principals while in the schools to maintain or build support. The Lead Trainer Interview Appendix (Appendix D) provides more detail.

"I think Wake has … [had more] central office level presence and they've had more of the teachers [who] understood the importance of TLC and that their role was truly important in the district and within their school."

"I saw in Wake County that my schools who had the full support of their administrators were more successful than the schools that did not.

Lead Trainer

School Level Efforts

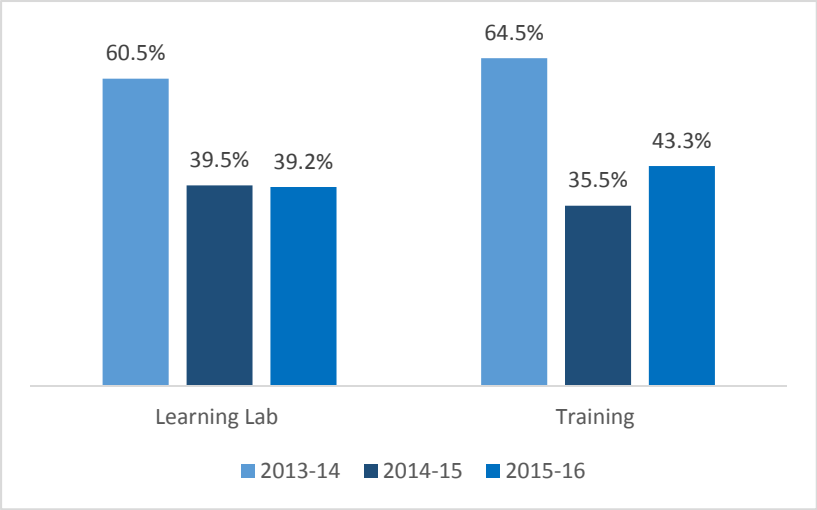
During Year 1, approximately 60% of all TLC members had the opportunity to share their training modules and demonstrate learning labs for their colleagues at their school. These percentages dropped sharply in Years 2 and 3 (36% to 43%).

Did TLC Members Share Training Materials in their Schools?

During the first year, DE provided TLC members with turnkey training materials following the professional learning days, which TLC members could then share with school staff. Subsequently, TLC members were given time to develop a presentation during the professional learning days. TLC members were sent a survey after each training day to indicate what they were able to share at their school and provide feedback; return rates were reasonably strong in Years 1 and 3 (56.6% and 50.2%), but lower in Year 2 (36.3%). DRA staff calculated the percentage of training or learning lab events (i.e., dissemination events) that TLC members reported delivering compared to those they were expected to deliver. See Appendix E for more details on methods and results.

- The percentage of TLC member dissemination events delivered compared to those expected was higher in Year 1 (over 60%) than in Years 2 or 3 (36% to 43%).
- The percentage of TLC member-led trainings delivered to those expected was slightly higher in Year 3 compared to Year 2.

Figure 2
Percentage of TLC Expected Dissemination Events that Occurred by School Year



Source: PD Monitoring Tool data from each school year
Responses: 2013-14: N=2003 (57.5%, 696 teachers); 2014-15: N=1198 (36.3%, 660 teachers); 2015-16: N=1613 (50.2%, 643 teachers) (5 data collections after each training day)

In open-ended responses, the predominant reason TLC members provided for not conducting the training was time—not having time on staff meeting agendas because of multiple competing priorities and TLC members not having time to prepare a presentation or lab. Table 7 provides additional reasons, including "newness" on the team.

Table 7
Year 3 TLC Responses to PD Monitoring Question: What prevented you from implementing any of the training modules with other teachers at your school?

Category	Frequency	Percent
Time	498	90.9
New TLC Member	15	2.7
TLC Member felt unprepared	14	2.5
Lack of support/interest	11	2.0

Source: PD Monitoring Tool data from Year 3
Note: Percentage of 548 comments made. Due to rounding percentages may not equal 100%. Comments made in less than 2% of the comments are not shown.

Did TLCs provide learning labs in their classroom?

In Year 1 (2013-14), 61% of TLC members were able to conduct learning labs at their school sites; however, by Years 2 and 3, that percentage dropped to 39%. Table 8 provides reasons given for not conducting learning labs. Within the time category, the following barriers to implementing learning labs were identified:

- administration (9%),
- testing and/or curriculum mandates (8%),
- scheduling conflicts (6%),
- other professional development initiatives (6%),
- track out (5%),
- inclement weather/vacation (3%),
- TLC member absences (2%), and
- too little time between trainings (1%).

"We are on a strict curriculum which has us teaching lessons as written by CMAPP or Caulkins,"

"School-wide professional development has been focused on MTSS Tier 2 plans, as we are a cohort school"

Teacher comments

A related reason from another 5% of teachers was a lack of interest/participation. This could also relate to time if teachers did not have time or coverage to go to the learning labs. Some school administrators provided a substitute to facilitate this. Other common reasons from 4% to 5% of respondents related to a lack of technology resources or the TLC member feeling unprepared.

Table 8
Year 3 TLC Responses to PD Monitoring Question: If no, why have you not been able to conduct a learning lab?

Category	Frequency	Percent
Time	**430**	**74.5**
Lack of interest/participation	29	5.0
Lack of technology resources	27	4.7
No coverage for teachers	25	4.3
TLC Member not prepared/lack of training	24	4.1
New TLC Member	18	3.1
TLC Member not aware of expectations	10	1.7
Used other method	7	1.2

Source: PD Monitoring Tool data from Year 3.
Note: Percentages are of the 577 comments; Comments made in less than 1% of the comments are not shown.

Teacher Outcomes

Did teachers increase their knowledge and self-efficacy in terms of integrating technology into instruction?

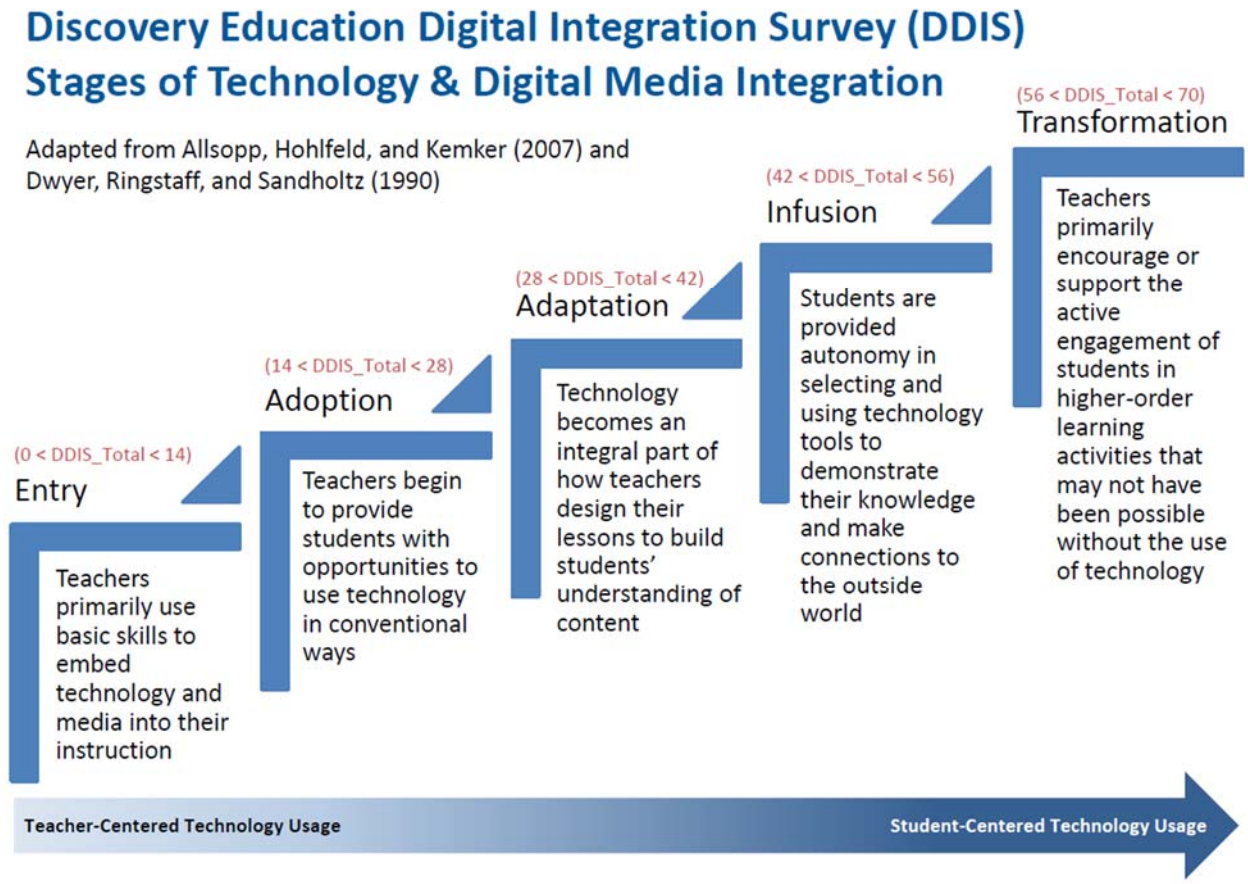
Teachers' sense of self-efficacy in utilizing digital resources for instruction increased for both the TLC teachers and non-TLC teachers in the school. The two groups started out at about the same point, with TLC members reaching a higher level after the first year of TLC training and maintaining the higher level across the three years. Teachers who were only members of TLC for one or two years had similar patterns for self-efficacy as those attending all three years. Some slippage in teachers' sense of self-efficacy occurred over the summer months.

A major short-term goal was for TLC members and later other staff members to increase their sense of self-efficacy in appropriately utilizing technology for instruction. Self-efficacy is defined as the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations (Bandura, 1986). The Discovery Education Digital Integration Survey (DDIS) assesses this in ways consistent with the stages of technology integration identified by Dwyer, Ringstaff, and Sandholtz (1990). See Figure 3 and Appendix F for more details.

Both TLC and non-TLC WCPSS teachers responded to 10 different self-efficacy questions in a DE pre- and post-survey. Response rates for TLC members were higher than for non-TLC members given that the district has over 10,000 teachers, which may mean that responses were not fully representative of teachers districtwide. In fact, the number of responses received from non-TLC members was too low to be used in spring of 2014.

Figure 3

Stages of Technology Integration



Note 1: Reprinted from Discovery Education (n.d.). Reprinted with permission.
Note 2: Discovery Education totals self-rating scores (10 questions with a scale of 1-7) to categorize respondents into implementation stages. The ranges above each stage specify the scores assigned to each level.

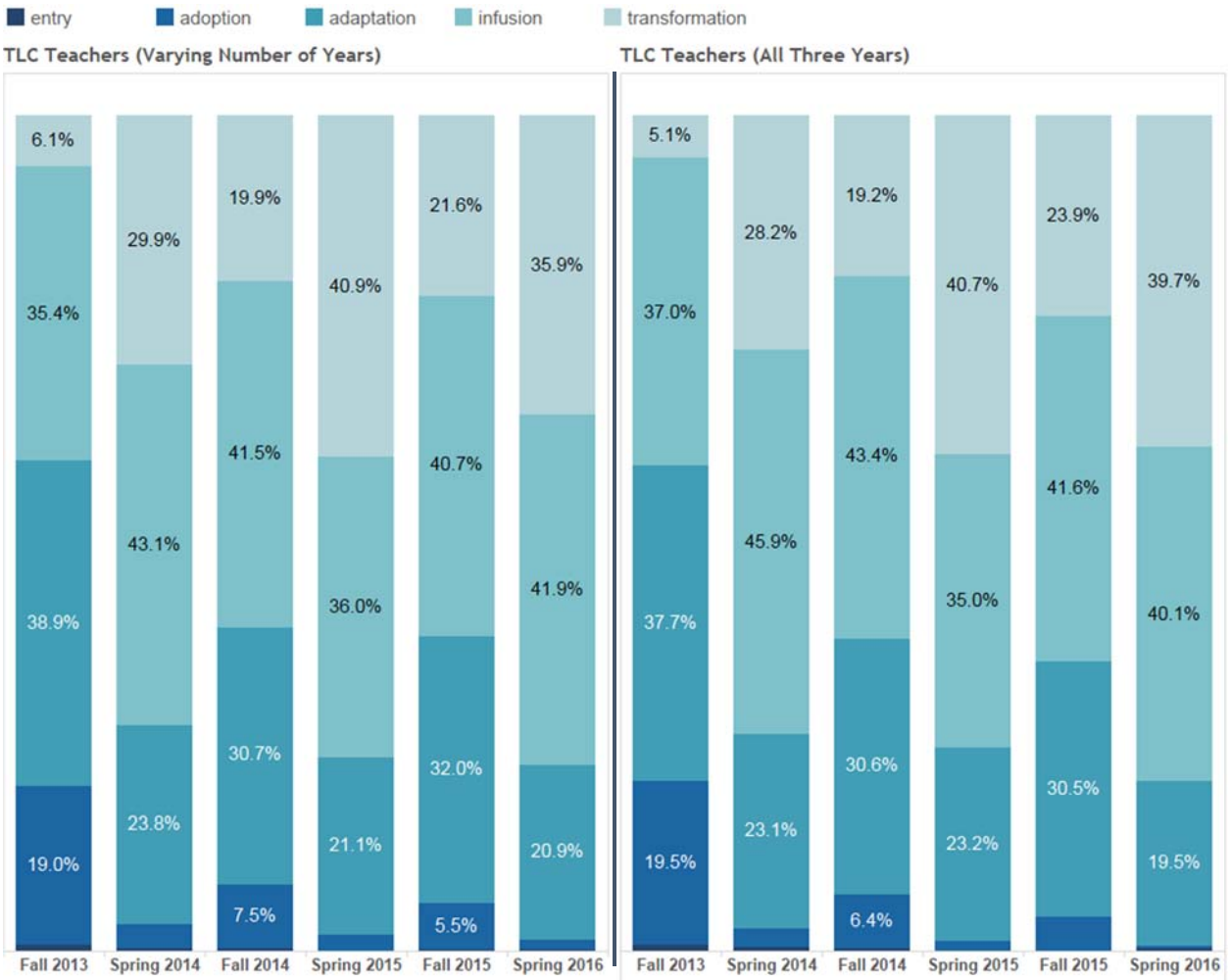
Results reflected growth in TLC teachers' self-efficacy in use of instructional technology over time, with some slippage between years (see Figure 4). Figure 4 depicts the percentage of teachers at each stage of the Technology and Digital Media continuum based on responses to the DDIS teacher survey. Teachers who participated in TLC for one, two, or three years (i.e., varying number of years) are depicted on the left; whereas, teachers who experienced the full TLC program (i.e., all three years) are depicted on the right.

- TLC members showed gains in their movement across the Stages of Technology and Digital Media continuum.
- Some progression was lost in each year's summer months e.g., Spring Year 1 to Fall Year 2)
- TLC teachers who participated all three years showed gains in their movement across the Stages of Technology and Digital Media continuum , but those gains did not differ substantially from teachers overall, some of whom only participated for one or two years.

"I think that a lot of the teacher leaders that I worked with as time went on they were more comfortable taking instructional risks."

Lead trainer

Figure 4
TLC Teacher Self-Efficacy Over Time in Percentages



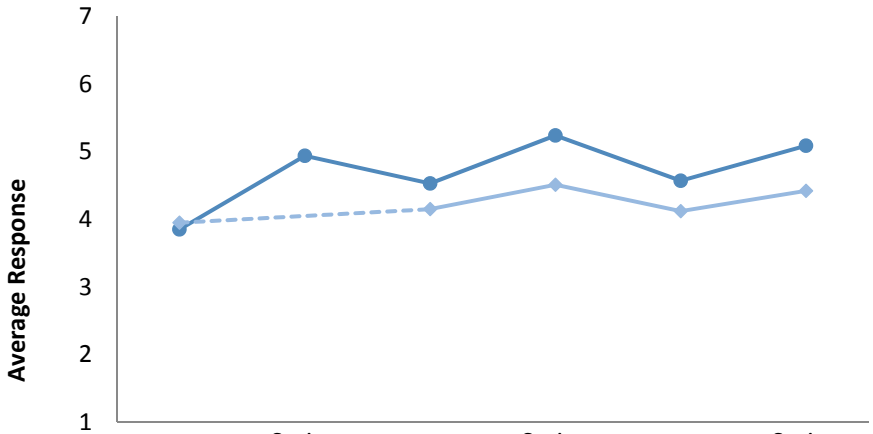
Source: DDIS Survey in fall and spring of each year.
Note: Only teachers who identified themselves with a valid employee ID on the DDIS, were confirmed at TLC teachers by WCPSS, and did not skip items on the survey were included
Note: 2013-14 Pre n=406, Post n=373; 2014-15 Pre n=506, Post n=206; 2015-16 Pre n=509, 2015-16 Post n=464
Note: 3 Years n=1,823

Note: Percentages at or below 4% are not labeled.

TLC versus Non-TLC teachers

For both the TLC and non-TLC groups, self-efficacy averages increased between the pre- and post-survey each year for both TLC and non-TLC teachers (see Figure 5). The non-TLC teachers included all other teachers in the school district. Both groups started out at the mid-point on the self-efficacy scale, with the TLC members reaching higher levels by fall of 2014 and maintaining their advantage past that point. However, there was still room for both groups to grow.

Figure 5
TLC and Non-TLC Teachers' Self-Efficacy Over Time



	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016
TLC	3.85	4.94	4.53	5.24	4.57	5.09
Non-TLC	3.95		4.15	4.51	4.12	4.42

Source: 2013-14, 2014-15, and 2015-16 DDIS Survey, scale 1-7, does not include N/A responses
Note: 2013-14 Pre (TLC n=406, Non-TLC n=658); 2013-14 Post (TLC n=373, Non-TLC is missing due to low response rate)
2014-15 Pre (TLC n= 506, Non-TLC n= 1,163); 2014-15 Post (TLC n= 206, Non-TLC n= 2,242)
2015-16 Pre (TLC n= 509, Non-TLC n= 1,035); 2015-16 Post (TLC n= 464, Non-TLC n= 658)
Note: Based on a two-sample t-test, differences between TLC and Non-TLC teachers at each time point are not statistically different in fall 2013, but are significantly different ($p < .001$) in fall 2014, spring 2015, fall 2015, and spring 2016.

Was technology incorporated meaningfully in instruction?

Teachers accessed resources more often per month than students. Teacher usage averaged about three days per month in Years 1 and 2 but declined to 1.5 times per month in Year 3. Due to decreased use over time, costs per teacher increased from $39 in Year 1 to $65 per teacher in Year 3. The costs per student were about $8 each year. Observations of TLC members in a representative sample of schools revealed technology being used in a variety of ways and with varied sophistication.

DE web usage data and observations provided data relevant to whether or not technology was incorporated meaningfully in instruction.

DE Web Usage Data

DE was the only instructional technology tool for which usage data was available over the entire three-year period of the study, but it should be noted that many other instructional technology resources were available to schools, and that the number of these resources increased somewhat across the three years. As such, DE usage represents only a sampling of the instructional technology tool usage that occurred in schools during the study period. These results can be helpful as the district considers how to structure instructional technology contracts and set standards for the level of usage or cost per day or per user that justifies purchase of a digital resource.

Results reveal greater use by teachers than individual students and greater use in Years 1 and 2 than in Year 3. Observations supported the greater use by teachers in that teachers would often display video or other materials for the full class to view. Whether access rates are appropriate to justify the cost is an open question. As shown in Figure 6:

- Teachers utilized DE an average of about 3 times a month in Years 1 and 2 but about half as often (approximately 1.5 times) in Year 3.
- Students utilized DE about 2 times a month on average in Years 1 and 2 but only 0.3 times per month in Year 3.

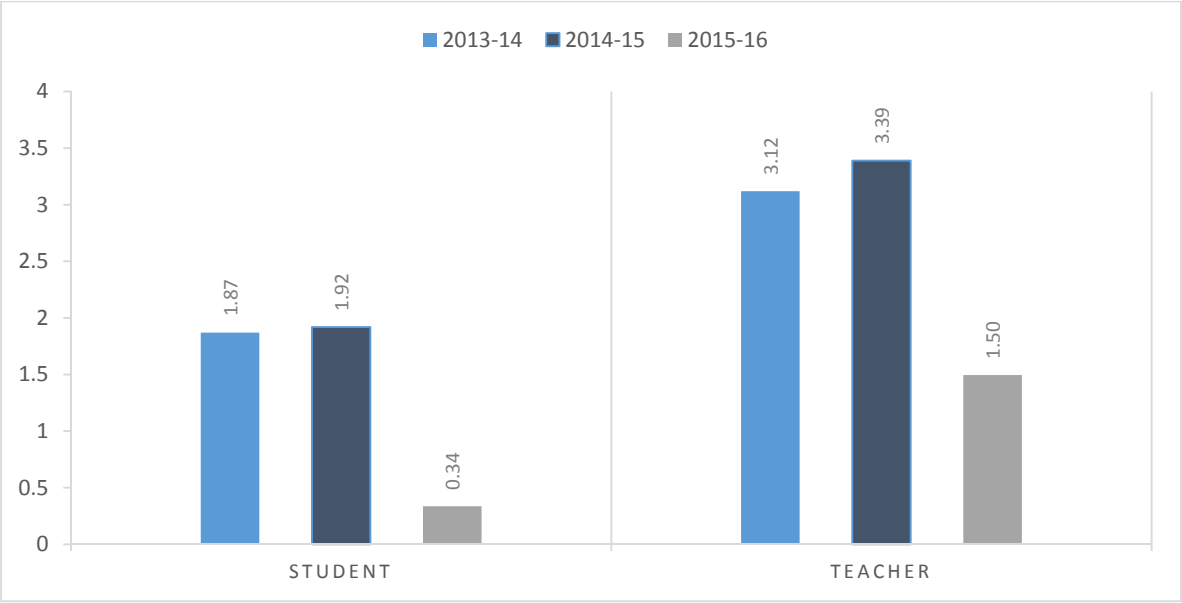
Table 9 illustrates that the frequency of use of DE became more consistent (albeit lower) across teachers in Year 3 compared to the earlier years.

- The spread of days per month that teachers accessed DE was much wider in Years 1 and 2 than in Year 3 based on standard deviations.
- Use decreased substantially in Year 3, and this decrease was evident for both TLC and non-TLC teachers.

Additional analyses are shared in Appendix G. Usage varied by month and by school. Many schools increased their usage of DE from Year 1 to Year 2. However, no schools increased usage from Year 2 to 3. No school's usage rates were higher in Year 3 than in Year 1.

The fact that usage varied considerably across schools and that use decreased over time could inform the structure of district instructional technology contracts in the future.

Figure 6
Average Days per Month Teachers and Students Accessed DE



Source: DE Usage Data (Days per Month)
Note: Differences over time are statistically significant ($p < .001$)
Note: Authentication is defined as a day where the user (student or teacher) accessed DE resources at least once.

Table 8
TLC vs Non-TLC DE Days Accessed and Standard Deviations (SD)

	Year 1			Year 2			Year 3		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
TLC	694	3.07	2.98	610	3.03	2.51	615	2.3	2.19
Non-TLC	7,340	3.25	2.89	7,346	3.52	2.96	6,085	1.31	1.75
Overall	8,034	3.25	2.89	7,956	3.51	2.96	6,700	1.49	1.99

Source: DE web usage (Authentications) from each year

Table 10 quantifies the cost of DE resources to WCPSS for students, teachers, and overall. Authentication is defined as a day where the user (student or teacher) accessed DE resources at least once. Patterns reveal that:

- The number of student users increased over time, while the number of teacher users decreased.
- The cost per student user did not vary much over time, but the cost per active teacher increased.
- The cost per day of use increased for both students and teachers and thus overall. The cost per day DE was accessed by both groups combined was just over $1.

Table 9
WCPSS Discovery Education Costs and Usage

		Year 1	Year 2	Year 3
Student	Total Students who Utilized DE	47,961	52,199	52,539
	Total Days Accessed*	221,607	268,722	195,388
	Average Days Accessed per Student	4.62	5.15	3.72
	License Costs	$391,373	$412,020	$420,640
	Cost Per Active Student	**$8.16**	**$7.89**	**$8.01**
	Cost Per Day Accessed (Per Student)	**$1.77**	**$1.53**	**$2.15**
		Year 1	**Year 2**	**Year 3**
Teacher	Total Teachers who Utilized DE	10,001	7,530	6,519
	Total Days Accessed	156,347	142,669	110,163
	Average Days Accessed per Teacher	15.63	18.94	16.90
	License Costs	$391,373	$412,020	$420,640
	Cost Per Active Teacher	**$39.13**	**$54.71**	**$64.52**
	Cost Per Day Accessed (Per Teacher)	**$2.50**	**$2.88**	**$3.82**
		Year 1	**Year 2**	**Year 3**
Overall—Students and Teachers	Total Users who Utilized DE	57,962	59,729	59,058
	Total Days Accessed	377,954	411,391	305,551
	Average Days Accessed per User	6.52	6.89	5.20
	License Costs	$391,373	$412,020	$420,640
	Cost Per Active Users	**$6.75**	**$6.89**	**$7.12**
	Cost Per Day Accessed (Per User)	**$1.04**	**$1.00**	**$1.37**

Source: Discovery Education Contract (Costs) & DE web usage (* Authentications) from each year

Observations

Observations suggest TLC members utilized technology meaningfully in instruction. Information was not available on non-TLC teachers. TLC members played a variety of roles across the lessons observed, often two or three roles within a lesson. Roles in which teachers facilitated instruction through coaching or interactive direction were more common than roles such as lecturing or monitoring.

Technology was most often considered appropriate, but not necessary, for a lesson. Student engagement was also reasonably high. These data suggest that technology was used by TLC teachers to enhance instruction. This is an area for further study due to the small sample size.

Methods

Appendix H provides details about the methodology utilized for teacher observations. With input from Instructional Technology and Media Services (ITMS) staff, DRA created an observation tool adapted from the International Society for Technology in Education (ISTE) Classroom Observation Tool (ICOT) and the Florida Center for Instructional Technology Integration Matrix Scale (Welsh, Harmes, & Winkelman, 2011). The ICOT is a free online resource for assessing technology integration in classrooms (ISTE, 2009). The TIMS Matrix (as reflected in Discovery Education's DDIS tool) assessed the quality of the interaction between the learning environment and the instructional technology integration. DRA added descriptive and open-ended questions to gain a more comprehensive understanding of the actual lessons and technology's role in them.

DRA staff conducted observations of TLC members in the spring of 2016 in a random sample of 10% of the district's schools. The sample was stratified by grade span, and also considered the percentage of students who were Educationally Disadvantaged (ED) at each school. Observations of non-TLC teachers in the school were not feasible with the resources available.

Observers first notified principals and subsequently TLC members about the purpose of the observations and the week an observer would be at the school. Observers encountered various situations that reduced the sample size or influenced scheduling. At some schools, the TLC team did not include four members as intended; some teachers were on leave or tracked out, some had student teachers (and were therefore not teaching), and some had committee/team obligations that made some days impossible for observations. Observers generally observed one lesson, with observations averaging about 30 minutes each. Overall, 49 of the 68 observations were completed (72%), as shown in the next table.

Table 11
TLC Observations Planned and Completed

Level/# Schools	# Planned	# Completed	% Successfully Completed
Elementary n=11	44	32	72.7%
Middle n=4	16	9	56.3%
High n=2	8	8	100.0%
Total	68	49	72.1%

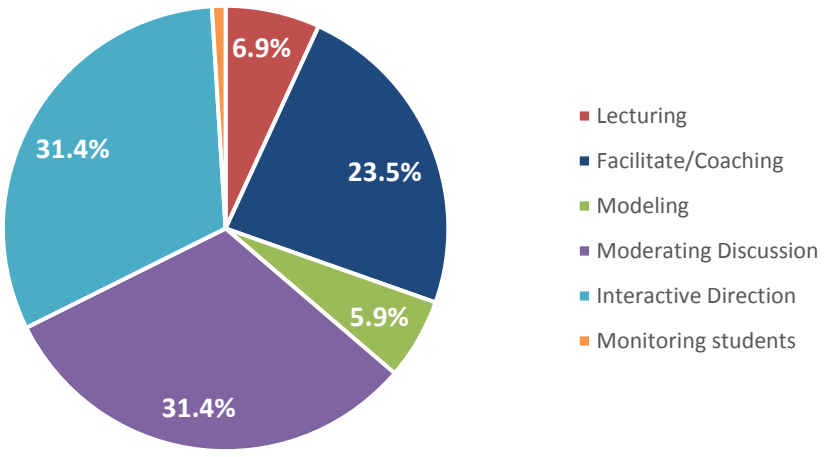
Note: n specifies number of schools. # specifies number of teachers.

Teacher Roles

TLC members utilized instructional technology in a wide variety of ways across classrooms and subjects. Examples include showing a video from DE before a discussion of a topic, using an interactive spreadsheet to assign students to centers, providing students with several technology resources to create group projects, and facilitating student-created web pages or electronic newsletters.

The Teacher Leader Corps (TLC) observation form asked for the role or roles of the teacher based on five categories as shown below. Observers could select more than one role, and often selected two or three during the course of one lesson. Teachers most often were observed moderating discussion or providing interactive direction (representing over 30% each of the responses). Teachers also facilitated or coached in about one fourth of the observations. Observers saw lecturing, modeling, and monitoring students least often. Fuller descriptions of each role are included in Appendix H.

Figure 6
TLC Teachers' Role During Lessons Observed



Source: TLC Observations. 102 responses were given for 31 of the observations.

Observers' notes reflected varied teacher roles—teachers provided individual instruction and explanations, served as facilitators of student work, and supported students as they worked. More specifically:

- Individual instruction and explanation of the lessons accounted for close to one third of the coded data (10 responses or 32% of the coded data). For example, in one case the teacher discussed the appropriate uses of technology and identified good strategies that some students were using which could be helpful to others.

- Teachers worked as facilitators in their classrooms quite often as well (8 responses or 26% of coded data). For example, one observer noted that the teacher "facilitates discussion and interaction of [students] sharing what they know and adding facts to a list."

- Teachers also functioned in a support role for their students fairly often (6 responses or 19% of coded data). For example, an observer noted that the "teacher and two assistants support[ed] groups of students in drafting story problems and coming up with a plan. [The] teacher showed examples to the students of what they would create (video of her students acting out story problem last year). [The] teacher support[ed] students in working toward creating their own videos."

Technology Integration Matrix

The Technology Integration Matrix (TIMS) categorizes lessons according to the level of technology integration (i.e., entry, adoption, adaptation, infusion, or transformation). Within these levels, lessons were further characterized based on the learning environment (i.e., active, collaborative, constructive, authentic, and goal directed). The full scale is shown in Appendix H along with the frequencies with which observers saw each standard. Two examples of levels on the technology integration scale are shown in sidebars in this section, with examples of the other levels shown in Appendix H.

All levels of technology integration were observed, which is a positive finding. Table 12 shows that more lessons were in the middle of the matrix than at the extremes. This suggests that

TIMS TRANSFORMATIONAL SAMPLE
GRADE 7

Lesson: The goal of this social studies lesson was to develop student understanding of multiple events in American history via student developed multimedia presentations.

Teacher: The teacher briefly lectured about several events in American history and their impact on the development of the United States of today. The teacher then assigned each group of four students a particular event to research from a pre-selected list of resources as well as any student-selected credible resources.

Students: Students worked collaboratively within their groups to research their assigned event. Utilizing one iPad per group, students utilized a nearpod software program to create a multimedia presentation that explained in detail their event, what happened, why it was important, and the implications for today's society. At the end of the project, each student group was to present their event to the class, defend their multimedia presentation, and answer any questions from their classmates or the teacher.

Rationale: This lesson was rated as transformational because students were actively engaged and had full control of their learning once the topic was assigned. The teacher served as a facilitator of learning (not the sole source). Students had choice of the resources they used and collaborated within their team to create their presentation. Once completed, students would present and defend their research to the class and answer any questions.

teachers generally used technology in either conventional or advanced ways to provide students opportunities to work independently or in collaborative groups. On the other hand, TLC members had room to grow in terms of greater use of the most advanced levels of technology integration.

Table 12

Percentage of Observations in Each Level of Technology Integration

Entry	10.3%
Adoption	35.0%
Adaptation	30.9%
Infusion	14.4%
Transformation	9.5%

As Table 13 shows, average ratings for the level of need for technology and the appropriateness of technology were both above the midpoint on the five-point scale. The level of engagement was also above the midpoint on the scale. Need for digital resources was rated somewhat lower than the appropriateness of its use (roughly 3.5 versus 4.3 across subjects, respectively). Thus, observers often considered technology use as *appropriate* even when it was not *necessary* for a lesson. In that sense, teachers used technology to enhance their instruction.

Results by grade span are shown for descriptive purposes only, especially at the middle and high school levels where sample sizes were low. This is an area for possible further study.

Table 13

Need and Appropriateness of Technology and Student Engagement by Grade Span

Level (n)	Need	Appropriateness	Student Engagement
Elementary (32)	3.4	4.1	4.2
Middle (9)	3.9	4.8	4.1
High (8)	3.4	4.1	3.1
Overall (49)	**3.5**	**4.2**	**4.0**

Source: TLC Observations, Spring 2015. n= number of observations

Scales: Need for Technology: Not needed (1) to essential (5)
Appropriateness of Tech: Not appropriate (1) to very appropriate (5)
Level of Student Engagement: Not engaged (1) to very engaged (5)

It was not possible to assess the intended student learning or skill outcomes for TLC due to the lack of a comparison group and the possible impact of multiple initiatives simultaneously.

TIMS INFUSION LEVEL GRADE 3 SAMPLE

Lesson: The goal of this integrated language arts and social studies lesson was to build student understanding of the three branches of national government.

Teacher: The teacher was primarily a facilitator and circulated the room discussing progress with students. She provided students with feedback on the content of their graphic organizers.

Students: Students used web-based resources including Discovery Education to locate information about the branches of government, which they then recorded on a graphic organizer. Students selected two activities from a tic-tac-toe activity sheet, the use of which encouraged student-choice. Activities were designed to further deepen student understanding of the branches of government, resulting in the creation of two original products using technology. As examples, working with a partner, students created a presentation on Google Slides or Deck, created a video clip using Educreation, or created diagrams and graphics. Students worked on laptops, desktop computers, iPads, and tablets. Students collaboratively used technology, sometimes employing multiple devices to create original products.

Rationale: This lesson was rated as infusion because (a) the tic-tac-toe activity sheet encouraged flexible, self-directed student choice and (b) group work fostered collaboration in meaningful activities.

Discussion

Effective Professional Learning for Implementation and Sustainability

The impact of staff development efforts is of key interest nationwide. Killion (2008) points out that isolated staff development sessions have little chance for impact. On the other hand, professional learning programs are ongoing, coherent, and linked to student achievement. Regardless of content focus, effective complex professional learning that improves student learning must provide not only content but modeling, initial practice, and coaching (Joyce & Showers,2002; Cooper, n.d.). Cooper (n.d.) also points to research that indicates effective professional development is based on a comprehensive overall plan at the district level, occurs in multiple sessions over time, and meets the standards for effective professional development. WCPSS utilized Learning Forward (n.d.) standards as they planned this professional learning initiative.

TLC was a strong professional learning initiative, incorporating many research-based practices. These included having one team per school, meeting many times over three years, setting expectations for team members and principals that were aligned with educational standards, providing quality resources and learning experiences with opportunities for practice, and gathering data in a variety of ways all represent best practices in professional learning (Cooper, n.d., Learning Forward, n.d). TLC was strong in terms of setting expectations and providing some materials for school implementation, but sharing of training at the school level by TLC members was variable (in large part due to time constraints). Delivery of school-wide training and use of key resources dropped off in Year 3. Perhaps the weakest aspect of the TLC initiative was in the coaching, at both the central and school level. This component is considered critical for the transfer of learning to teachers' every-day practice (Joyce & Showers, 2002). Some TLC members received coaching from DE trainers if their school purchased an additional science component of the software, but most did not. In turn, TLC members' coaching of other teachers in their school was generally limited because of regular classroom duties.

The implementation science frameworks developed by NIRN (n.d.) are research-based and focus closely on whether efforts are rolled out in a way that promotes scaling up a large initiative across sites. While there is some overlap with the professional learning standards and other research discussed above, a general assessment of features of TLC that promoted scale-up in schools and those which could be strengthened can inform future professional learning efforts in WCPSS. The three types of implementation drivers identified by NIRN as beneficial are listed below, with a general assessment of WCPSS' status on each.

Table 14

Implementation Drivers / Ratings

Implementation Drivers	Rating
Competency—Training and Coaching of TLC Members	Strong
Organization—Central and school support structures	Fair
Leadership—Support for technical and adaptive issues	Fair

Possible Ratings: Very Strong, Strong, Fair, Weak

Competency Drivers:

1. Were the right staff utilized as trainers and trainees?
2. Was training of high quality to build competency and enable implementation?

3. Did staff have a chance to practice the new skills with others?
4. Was coaching available from the district level?

TLC rated high for the first three questions as described above. The amount of coaching available, however, was fairly limited.

Organization Drivers (central and school support structures):

1. Did WCPSS support the intervention with adequate resources, time, etc.?
2. Was a district implementation team available to discuss how to handle issues that arose?
3. Was the administration in the school supportive? Did schools have an implementation team to guide and monitor implementation?
4. Did staff collect data on implementation? Did staff review data promptly to influence implementation?

Organizational drivers were not as strong as the Competency area.

At the district level, WCPSS supported the intervention with adequate professional learning (13 full days over three years), but a district implementation team was not in place for ongoing support beyond these days to address questions or challenges that arose. In addition, all TLC members did not receive the resource of 10 iPads as originally planned. A variety of data were collected (e.g., training attendance and satisfaction, pre- and post-surveys on teacher efficacy in using digital resources, school implementation surveys, usage of DE) but analysis and utilization were slower than would be desirable.

At the school level, most school administrators were supportive, but the level of support varied. Generally, the less supportive the principal, the less likely time was provided for presentations to staff or learning labs scheduled in a way that non-TLC teachers could observe. The school-based TLC team supported implementation as best they could, but these teams fell short of the full facilitative role described in implementation science. Monitoring TLC implementation, coaching, and trouble-shooting technical issues were not part of the expectations for the team and were only generally mentioned for administrator roles. Survey data was collected about staff perceptions of the training and presentations to staff, but use of these data, along with direct observation of technology use, was not emphasized in the initiative.

Leadership Drivers: Was support available to address both technical issues (supplies, resources, schedules, etc.) and adaptive issues (making adjustments as issues arise)?

> *Limited district support was available for technical and adaptive issues, largely due to funding limitations.*

Some schools reported having an insufficient number of devices or a lack of a sufficient internet connection to properly take advantage of digital resources. WCPSS needed to hire DE to deliver the training because of the limited capacity of the small district instructional technology team. As such, the district's internal capacity to support the ongoing work was stretched too thin. Whether DE staff provided support on the content of the training between sessions is unknown. School-based TLC members provided content support on a limited basis as time allowed. Some schools did not replace TLC members after they left, which also reduced the likelihood the effort would take hold long-term.

Recommendations

TLC's strengths and areas for improvement should both be considered for future digital resource acquisitions as well as future professional learning initiatives in WCPSS as described below.

Consider Potential Use Before Purchasing Digital Resources

While some digital resources are free, others are a major expense. Results of the analyses on Discovery Education resources have implications for future resource procurement. Before purchases are made, district and school staff should ask questions such as:

- What need will this resource help us to meet? Do we need this resource in addition to what we already have? Should we discontinue use of another product because this one meets our needs better?
- What do we expect to accomplish as a result of the use of this resource? How can we check to see if this actually occurs? What will we do when we get the expected results (or not)?
- Will teachers be the primary users or will students need frequent direct access?
- How often do we expect staff or students will utilize this resource? How much are we willing to pay for that level of use? How can we check utilization levels and how often?

Answers to these questions can help us select the best resources to meet our needs and to negotiate the best possible contracts for their use. School and district staff may want to work through these questions together to create some guidelines for all to consider in making such purchases. Using the district's purchasing power to select resources that can be efficiently supported from the district level will also help.

Consider Goals and Buy In Before Launching District Professional Learning

Launching too many "good" initiatives at once with school staff as the primary audience can result is inconsistent buy-in and implementation by schools. TLC was not the only significant districtwide professional development effort that occurred during this time span, which could have hampered full implementation. Reducing the number of simultaneous initiatives, making the relationships clear between initiatives when more than one is happening, and coordinating scheduling can all build buy-in from school staff. A district implementation team could serve this role (which could be an existing team or a separate one). As an example, this year's professional learning focused on The Vision 2020 Strategic Plan integrates initiatives more fully and delivers training on existing meeting days; these are steps in the right direction.

More specific suggestions for ways to build buy-in with school leadership could include alerting them to the plans for the coming year, soliciting their input on the initiatives more fully, including an administrative member on school implementation teams, and communicating frequently regarding the status of the effort and expectations. (NIRN, n.d.)

Monitor school implementation more closely

NIRN (n.d.) found scale-up of interventions was much more likely with implementation teams in place at each level (e.g., schools and district) to facilitate rolling out any initiative, monitoring its success, and addressing challenges that arise. Smaller district implementation teams (e.g., with project staff) can provide ongoing support for initiatives, with periodic updates to the larger district team. One support that could be helpful is the development and sharing of videos of exemplary lessons in a virtual library at the district level. Area superintendents and their staff can also monitor implementation through their contacts with schools.

At the school level, TLC teams fulfilled part of this implementation role, mostly through presentations and learning labs. School implementation teams could be strengthened by including an administrator. This member could facilitate scheduling of sharing opportunities and monitoring of implementation. In addition, this person could help develop and then convey "look-fors" to others on the administrative team. For example, with TLC, the learning labs provided a useful way for teachers to see demonstrations of instructional technology in action. However, some schools did better than others in setting schedules that allowed teachers to visit TLC members' classrooms. One successful strategy was to have a substitute teacher who moved from classroom to classroom so that teachers could observe the lab lesson.

Monitoring implementation at regular intervals and promptly following up with low implementing schools or teachers could also help determine possible barriers and supports to address. Implementation team meetings should be maintained long after the training ends to monitor status and ensure practices become ingrained into daily instruction. New practices take time to become part of normal practice.

The drop in the frequency of TLC members sharing practices learned at the school level suggests a possible drop in interest and/or implementation for the initiative. This is common as the "newness" of an initiative wears thin and new initiatives begin. Ways to maintain or rejuvenate enthusiasm for initiatives should be planned up front, under the assumption that enthusiasm may wane over time. Staff might consider this as a topic for discussion in annual meetings, periodic web announcements, or posts on social media about school or teacher successes.

Build the Likelihood of Sustainability

The work of Joyce and Showers (2002) points to the critical role of coaching in securing fidelity of implementation for new initiatives. Peer coaching is encouraged and more coaching for TLC members as well as for other teachers in the school setting as they practiced new strategies would have strengthened the TLC training model. Classroom teachers, which nearly all TLC members were, had limited time to coach others in their school. If funds allow, creating a teacher-leader role to free up some of their time (perhaps 25%) to coach and monitor implementation would be extremely helpful. If this is not feasible, an instructional coach might play this role.

TLC was designed to be a three-year commitment for team members. While 60% of TLC team members participated all three years, 40% did not. All initiatives need to have plans to address the inevitable

replacement of team members and school administrators. TLC data suggest members' skills and sense of efficacy with technology improved whether participation was for three years or less, so it may be one- or two-year efforts can often be adequate in length.

Overall, TLC was a strong professional learning initiative which incorporated many research-based practices. WCPSS tends to be strong in selecting staff to involve in initiatives and providing high quality training—TLC was no exception. TLC was stronger than some other training models utilized in WCPSS in utilizing a teacher team per school that was trained simultaneously; in providing clear expectations for follow-up, and in supplying some of the resources to TLC members to share with school staff. Establishing district and school support structures to facilitate implementation could increase the chance that practices learned will become part of daily instruction.

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Appendices

Appendix A: Evaluation Methods and Sources

Appendix B: Logic Model

Appendix C: *Attendance at Trainings*

Appendix D Lead Trainer Interviews

Appendix E: DE PD Monitoring Tool

Appendix F: DE Digital Integration Survey (DDIS)

Appendix G: DE Usage Data

Appendix H: Classroom Observations

Appendix A

Evaluation Methods and Sources

Year 1 = 2013-14 ***Year 2 = 2014-15*** ***Year 3 = 2015-16***

Data Source/ Appendix	When Collected	Notes
Attendance at Trainings (App. C)	Years 1,2,3 June each year	**Session Attendance:** Electronic files were provided by Professional Learning which reflected attendance for each team member for each of the five days of training each year. This was cross-referenced with DE files for usage analyses. **Training Topics**: Available from eSchools and project records.
	Year 1 Completed after each day; gathered in June each year	Training Evaluations: Training attendees were required to complete a short satisfaction survey based on the trainings they received in Year 1. This requirement was removed in Year 2, and return rates were very low. We requested that staff change this back in Year 3, but it did not occur, and return rates were again too low to use. Therefore, this data is available only for Year 1 of the effort.
Lead Trainer Interviews (App. D)	Year 3 Summer	DRA staff conducted 6 interviews with the district coordinator of the TLC initiative (in person) and a sample of DE trainers (by phone). Interviews were semi-structured and focused on their reflections of the initiative over the three years.
DE PD Monitoring Tool (App. E)	Years 1,2,3 Deployed after each day of TLC training	This DE survey addressed whether or not TLC members provided trainings to staff members at their schools or conducted learning labs at their school since the last day of TLC training.
DE Digital Integration Survey (DDIS) (App. F)	Years 1,2,3 Beginning of year (pre) and end of year (post)	DE deployed the DDIS survey at the beginning and ending of each school year to both TLC and non-TLC members. The DDIS survey measured teacher's self-efficacy with integrating technology and digital resources into their classrooms. DRA included the questions in the district survey for Non-TLC members to increase return rates and representativeness of the sample.
DE Usage Data (App. G)	Year 1,2,3 Continuous	Data on individual usage of DE were collected via DE's online portal for every WCPSS teacher and student (log-ons, types of digital resources accessed (e.g., videos, lesson plans), etc.
Observations (App. H)	Year 2, 3	In Year 2, observations focused on best practices for nominated teachers. In Year 3, a random sample of TLC teachers were observed to see level of utilization of technology and student engagement.

Appendix B

Logic Model for TLC Initiative

Need: Wake County had insufficient availability and use of digital resources to support instruction. Technology was used to support instruction inconsistently. Thus, one need was to broaden teachers' toolkits. In addition, WCPSS was spending too much money on separate school-based licenses for Discovery Education (DE). The contract was re-worked at the district level over three-years beginning in 2013-14. DE provided access to DE resources for all schools and is providing PD in how to utilize technology resources.

INPUTS	STRATEGIES	OUTCOMES – IMPACT		
		Short-Term	Intermediate	
		2013-14	2014-15	2015-16
Through the recent bond package, consistent access to digital-age resources will be available (3:1). Discovery Education Resources and others. Central staff time to coordinate trainings Discovery Education Trainers Teacher Substitutes	1. Provide access to digital-age learning resources for all classroom teachers. 2.Train four-teacher teams from every school were recruited in 2013-14 to receive 5 full days of staggered (6-8 weeks apart) professional development on the use of DE resources 3. Provide a district license for all students and teachers for discovery education and other resources.	Teacher Leader Corps (TLC) members have completed the full training program on DE Digital-Age learning resources Teacher Leader Corps (TLC) members have provided training to their school staffs. Enhanced discovery education resources was provided to all schools at a lower cost The turn-key training model provided by Discovery Education which will result in an increase in use of DE Digital Age resources by • TLC teachers • Non-TLC teachers	Increase use of Digital Learning Resources in all grade-spans as measured by an increase in teacher web usage rates and survey results Increases in teacher perception of their technology competency (Survey) Lower cost per participating student for DE Increases in the following areas: • TLC Members sharing digital resources and lesson plans at their schools • More consistent use across schools	More consistent and increased teacher web usage rates over 2014-15 Higher student engagement in classrooms in TLC vs. non-TLC classrooms. Higher engagement in high volume vs. low volume users (based on usage and teacher survey results) While not measurable because technology use is intertwined with too many other factors, it is hoped that technology for instruction will lead to higher attendance, grades, achievement test scores, and graduation rates and lower dropout rates and suspensions.

Appendix C

Attendance at Trainings

Methods

Instrument and Data Collection

WCPSS tracks teacher participation in professional development using the eSchools professional learning management system. In order to attend trainings, teachers were enrolled in DE professional development and their attendance was recorded using eSchools. As such, data regarding participation in DE professional development was downloaded from the eSchools interface.

Results

As a participating member of TLC, teachers were required to engage in five professional development sessions during each school year, resulting in fifteen total sessions per TLC member. Due to the large number of teachers participating in TLC, teachers attended trainings in groups of approximately 30 to 40 teachers. During 2013-14 (Year 1), DE trainers delivered 166 sessions, which included mostly in-person group professional development, as well as some individual in-classroom coaching to TLC participants. During 2014-15 (Year 2), DE trainers delivered 105 sessions to TLC members. During 2015-16 (Year 3), DE trainers delivered 105 sessions to TLC members. One group of teachers missed the fifth session in Year 2 (2014-15) due to inclement weather. These teachers were asked to complete the session on their own with provided materials and support from DE trainers, but their completion of these materials was not tracked.

Table C.1 depicts the participation rates and the percent of TLC teachers who attended all or some of the professional development sessions. Participation in professional development was relatively strong, with 66% and 71% of the TLC members attending all days of the training in 2013-14 and 2014-15, respectively. On average, TLC members received about 30 hours of training per year.

Table C.1
TLC Session Attendance Rates by Year

Year	Attended at all	Attended all trainings		# attended 3-4 days		# attended 1-2 days		Average Hours of PD completed
		#	%	#	%	#	%	
2013-14	695	459	(66.0%)	189	(27.2%)	44	(6.3%)	29.78
2014-15	660	466	(70.6%)	139	(21.1%)	55	(8.33%)	30.81
2015-16	643	303	(47.2%)	294	(45.8%)	45	(6.9%)	29.21

Source: WCPSS eSchools Databases
Note: 2014-15 counts for participants attending all days includes participants who did not complete the fifth day of training due to inclement weather.

What was the attrition rate on TLC teams across years?

Table C.2 shows the attrition rate for TLC teachers from years one to two and years one to three. There were 695 TLC teachers in 2013-14, 646 in 2014-15, and 626 in 2015-16 (as of October 2015). Out of the 695 TLC teachers in 2013-14, 527 were still TLC participants in 2014-15 and 407 in 2015-16.

Table C.2
TLC Session Continuous Enrollment Rates across Years

	2013-14	Still There in 2014-15	Still There in 2015-16
started in 2013-14	**695**	**527**	**407**
% of 2013-14		**75.8%**	**58.6%**

Did TLC members fit the guidelines?

Principals were asked to select four teachers from their building who showed potential to become teacher leaders. Principals were encouraged to select classroom teachers to engage in TLC, and they were asked to not select technology contacts, media specialists, IRTs, or other with formal coaching or professional development responsibilities. Table C.3 depicts the job classifications for TLC teachers during Years 1, 2, and 3. Nearly all TLC teachers fit the description of elementary, secondary, or non-grade level specific teachers. During Year 1, 21 participating teachers (3%) did not fit the specified criteria for teachers; in subsequent years, less than one percent of participating teachers did not meet the classroom teacher criterion. Additional detail regarding TLC teachers' job classifications is listed in Tables C.5 through C.7.

Table C.3
Job Classification of TLC Members (School-Based Only)

Job Classification	Year 1		Year 2		Year 3	
	N	%	N	%	N	%
Elementary Teachers	248	41.8%	241	44.2%	342	56.6%
Secondary Teachers	223	37.6%	204	37.4%	175	12.4%
Teachers (non-grade level specific)	101	17.0%	93	17.1%	84	13.9%
Media Coordinator	2	0.3%	2	0.4%	3	0.5%
School Administrators	8	1.3%	1	0.2%	0	0.0%
Other Professional Staff	11	1.8%	4	0.7%	0	0.0%
Total (School-Based Positions Only)	593		545		604	

Source: eSchools Database and WCPSS Employee Database.

Did TLC members believe the training was of high quality and helpful?

Following the professional development sessions, teachers were asked to complete a survey in eSchools regarding the quality of the DE professional development. Teacher survey data was collected during Year 1 (2013-14), but due to a technical issue, the professional development satisfaction survey was not required in Years 2 and 3. Therefore, data on teacher satisfaction with the training itself was only collected for Year 1. Table C.4 depicts teacher satisfaction with the TLC trainings following the 2013-14 trainings. During the first year, 86% or more of teachers agreed with the statements supporting the helpfulness of the DE professional development sessions.

Table C.4

TLC Member eSchool Ratings of 2013-14 Training

Item	% Agree
The facilitator(s) created a respectful and inclusive environment for my learning.	94.9%
The training/learning objectives were clearly identified in a structured agenda.	92.6%
The training/learning objectives clearly matched the course description in eSchools.	91.5%
The facilitator(s) clearly connected the course content to current research/relevant data sources.	90.0%
The training content clearly built on my prior level of knowledge/skills.	88.5%
The facilitator(s) gave me adequate time to collaborate with others.	88.4%
The facilitator(s) gave me adequate time to reflect on how I will use this learning in my classroom/at my job.	87.4%
If I implement what I learned from this training it will significantly enhance the effectiveness of my work in my classroom/on my job.	86.9%
This training helped me develop strategies to make instruction more relevant for diverse learners.	86.3%

Note: N=611 Sorted by % Agree (Descending)
Source: 2013-14 eSchools session ratings.

Table C.5

2013-14 TLC Member Characteristics

Job Classification 2013-14	Frequency	Percent
Assistant Principals (Non-Teaching)	6	0.86
Elementary Teachers	221	31.80
Guidance	2	0.29
Media- Audiovisual Staff	2	0.29
Other	5	0.72
Other Professional Staff	6	0.86
Other Teachers	100	14.39
Principals	2	0.29
Secondary Teachers	129	18.56
Teachers (Federally Funded) Elementary	3	0.43
Teachers (Federally Funded) Secondary	1	0.14
Teachers (Locally Funded) Elementary	9	1.29
Teachers (Locally Funded) Secondary	4	0.58
Teachers (State Funded) Elementary	115	16.55
Teachers (State Funded) Secondary	89	12.81
Teachers (Vocational Funded)	1	0.14

Source: eSchools Database and WCPSS Employee Database.

Table C.6

2014-15 TLC Member Characteristics

Job Classification 2014-15	Frequency	Percent
Assistant Principals (Non-Teaching)	1	0.15
Elementary Teachers	211	32.66
Media- Audiovisual Staff	2	0.31
Other	1	0.15
Other Classroom Teachers-State Funds	1	0.15
Other Professional Staff	3	0.46
Other Teachers	92	14.24
Secondary Teachers	121	18.73
Teachers (Federally Funded) Elementary	2	0.31
Teachers (Federally Funded) Secondary	1	0.15
Teachers (Locally Funded) Elementary	9	1.39
Teachers (Locally Funded) Secondary	4	0.62
Teachers (State Funded) Elementary	119	18.42
Teachers (State Funded) Secondary	78	12.07
Teachers (Vocational Funded)	1	0.15

Source: eSchools Database and WCPSS Employee Database.

Table C.7

2015-16 TLC Member Characteristics

Job Classification 2015-16	Frequency	Percent
Elementary Teachers	229	35.67%
Media- Audiovisual Staff	3	0.47%
Other	8	1.25%
Other Professional Staff	8	1.25%
Other Teachers	98	15.26%
Secondary Teachers	105	16.36%
Teachers (Federally Funded) Elementary	3	0.47%
Teachers (Locally Funded) Elementary	9	1.40%
Teachers (Locally Funded) Secondary	4	0.62%
Teachers (State Funded) Elementary	107	16.67%
Teachers (State Funded) Secondary	66	10.28%
Teachers (Vocational Funded)	2	0.31%

Source: eSchools Database and WCPSS Employee Database.

Appendix D

Lead Trainer Interviews

Methods

Data Collection

At the end of the three-year TLC initiative, evaluation staff interviewed five of the lead trainers from Discovery Education who had worked with different cohorts of schools over the past three years. The interview protocol consisted of a semi-structured interview to gather descriptive data about the DE trainers' involvement with the initiative, as well as questions to elicit their perceptions of their overall analysis of the process. Each individual interview lasted approximately 10 to 20 minutes.

Data Analysis

District staff members transcribed and then read through all responses to develop initial codes from the data. In all, there were 87 coded comments. The initial codes were then reorganized and integrated into larger themes that emanated from the interviews. This second coding cycle resulted in five themes and nineteen subthemes.

Results

Majority of the DE trainers had worked with the initiative for all of the three years. Overall, they described the feedback from the TLC members throughout that time period as positive. During the interviews, DE trainers referenced specific factors that served to facilitate the success of the initiative including the visibility of the Central Office staff at trainings, being able to consistently work with a cohort throughout the initiative, and the opportunity that the TLC members had to collaborate with their peers.

They also discussed some barriers to implementation and offered some recommendations for going forward. These included trying to better secure administrator buy-in for the project, emphasizing the coaching piece where the DE trainers would have been able to work with individual TLC members in their cohort at their school sites, and making the expectations more clear in the beginning of the initiative so as to aid recruitment of TLC members.

The trainers also discussed their perceptions of professional outcomes demonstrated by the TLC members that they worked with throughout the initiative. Overall, the DE trainers noted that they felt the TLC members grew as professional leaders in their schools. In particular, they gained the ability to lead collaboration efforts at their schools. In addition, the DE trainers expressed that they felt the TLC members developed the potential to lead future instructional initiatives at the school level.

Table D.1
Frequency of TLC DE Trainer Interview Responses.

Theme	Code/Comments Frequency (%)
Positive Feedback about the initiative	28 (32.6%)
Barriers/Challenges to Implementation	13 (15.1%)
Recommendations	16 (18.7%)
TLC Member Outcomes	25 (29.1%)
Feedback from TLC members was positive.	5 (5.8%)

Note: All five DE trainers mentioned these themes.

Table D.2
DE Trainer Interview Responses

Topics	Findings	Examples/Quotes
Positive Feedback about the Initiative	• The visibility of the Central Office staff at trainings helped clarify the goals and reinforce the importance of the initiative to TLC members. • Consistency of DE trainer working with the same cohort all three years helped build rapport with TLC members. • Teachers liked the opportunity to collaborate with colleagues. • Schools with principal support experienced more successful implementation. • Focusing on pedagogical strategies before the technology led to more success and buy-in from the teachers. • Coaching provided important supports to members. • The design of the training balanced inquiry and modeling and kept teachers engaged.	• The presence of Central Office staff at district trainings helped make the teacher understand "the importance of TLC and that their role was truly important in the district and within their school." • "I think that having the consistency of one presenter with a specific group the whole three years really helped to build a nice relationship where the teachers were able to trust me. They believed the things I was presenting to them." • "…once we got a feel of how much material should be presented giving them time to have that hands on time to plan and work together and collaborate, they truly loved it." • "Wake County did an awesome job putting the training in front of the devices." • "So I met with them either ten to twelve times a year and worked with their four teachers they had selected for TLC and we did just a process of just meeting, observing, and coming up with individual goals for each teacher, and then we did a cycle of co-teaching and modeling and then also inviting other teachers from the school into their classroom to observe and that went very well."

Topics	Findings	Examples/Quotes
Barriers/Challenges to Implementation	• TLC member turnover rates made consistency difficult among cohorts. • Some of the expectations and end goals of the initiative were unclear to TLC members at the onset. • Lack of administrator support at some schools adversely affected the implementation.	• "A couple of the concerns that the teachers had was the turnover in their group." • "It would be helpful to clarify more to the teachers when they would be receiving their devices and what the timeline was for that." • One trainer commented that in particular, re-delivery of the skills learned were not possible considering "their administrator didn't provide the allotted time to go back and teach their peers."
Recommendations	• DE Trainers felt more coaching opportunities were needed. • Increased administrator buy-in is critical. • Revise the method of TLC member selection.	• Two of the interviewees raised the point that more coaching opportunities would be beneficial to the initiative. • A frequent comment from the trainers reflected that getting more administrator buy-in is critical to future success. "So if there was that administrator piece where the administrators really bought into the TLC and really understood what was happening on the teacher level and the growth that could happen then I think that could really enhance it and the teachers would find it more valuable as well." • Three of the DE trainers felt that if the County had devised a better method to choose its TLC members, participants' investment in the program could be enhanced. "But if there was a way that they could apply so that they were a little bit more invested so the presenter didn't have to create that level of investment and begin the initial piece with that, it would have been great."
TLC Member Outcomes	• TLC members became more comfortable taking and helping others take instructional risks. • TLC members learned how to lead collaboration efforts at their schools. • TLC members developed the skills to become instructional leaders. • TLC members gained the ability to differentiate to meet the learning needs of the teachers at their schools. • TLC members grew professionally. • TLC members developed the potential to lead other instructional initiatives at their schools.	• Two of the trainers indicated they saw their teachers become "more comfortable taking instructional risks" over time. • Three of the trainers saw their cohort members leading collaboration efforts at their own schools. "Sharing, collaborating, so they started leading other teachers and sharing and collaborating." • Some of the teachers were seen as gaining the skills to differentiate and meet the individual staff needs of their colleagues at their own schools. "...so they just became more comfortable just leading their staff as a whole

Topics	Findings	Examples/Quotes
		and recognizing what each individual teacher might need…" • Teacher professional growth was cited as an outcome four times during the five interviews. "...they had grown as a teacher, as an individual, throughout the training process." • There were six comments throughout the five interviews where the trainers referenced the potential that the TLC members had to continue to lead instructional initiatives at their schools. "I see them being an excellent resource for when the teachers, for when the schools, are doing professional development."

Appendix E

DE PD Monitoring Tool

Background

TLC members were expected--as part of their initial commitment to the program--to re-deliver important aspects of each day's training at their schools. TLC members were also expected to conduct learning labs in which they would open their classrooms for other teachers at the school to give them an opportunity to observe some of what they learned through the TLC trainings. School leaders were asked to provide support (e.g., planning time, classroom coverage, presentation opportunities) for TLC members to accomplish these tasks after each completed day of TLC training (approximately five times per year).

Methods

Data Collection

Discovery Education developed an informal survey instrument--the PD Monitoring Tool (see link at bottom of this page), to measure the frequency with which teachers completed the expected dissemination as well as their perceptions of what went well or did not go well. This survey consisted of a combination of multiple choice, Likert rating scales, and open-ended items. The PD Monitoring Tool was launched by DE after each of the five training days each year of the initiative. Each TLC participant was sent an email with a link to the online survey. In Year 1, 56.6% of the participants who attended the trainings completed the survey. In Year 2, the response rate fell to 36.3% of the TLC attendees and in Year 3 the response rate increased to 50.2%.

Table E.1
Survey Return Rates Per Year

Year	Number TLC Members	Number of Potential Submissions	Number of Actual Submissions	Response Rate
2013-2014	695	3480	2003	56.6%
2014-2015	660	3300	1198	36.3%
2015-2016	643	3215	1613	50.2%

Analyses

Frequency counts from the PD Monitoring Tool were tallied by district staff across all of the days. Percentages of dissemination events completed were also calculated. If teachers had indicated on the survey that they did not conduct a learning lab or training module, the survey then asked for the TLC members to elaborate on why they were unable to conduct these events. This response was collected as an open-ended item.

https://drive.google.com/file/d/0BzfrbkWzCUalN0ZkOGdJZjRubUE/view

For those TLC members who had been prompted to report why they had not conducted a training or hosted a classroom learning lab since the last day of the TLC training, district staff analyzed and coded their open-ended responses for overall themes (see later under Results, Training Modules) to provide a clearer picture of what obstacles had prevented them from disseminating these events at their schools. The number and percentage of comments related to each theme was then calculated. For the most common responses (e.g., time), subcodes were devised and analyzed as well to better characterize the nature of the time constraints.

Results

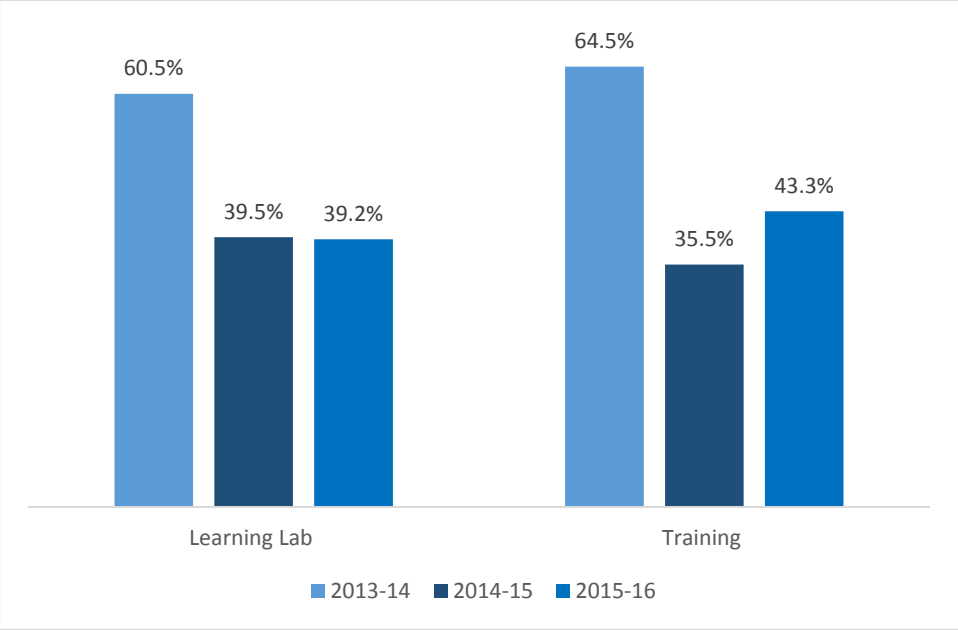
Did TLCs share training with school staff?

Results indicated that 65% of the TLC members who completed the PD Monitoring Tool were able to provide training modules for the teachers at their school during Year 1 (2013-14). By Year 2 (2014-15), this number dropped by roughly one third to 36%. In Year 3 (2015-16), the percentage of TLC members who were able to deliver the training modules increased slightly to 43%, see Figure E.1.

Did TLCs set up a learning lab in their classroom?

In Year 1 (2013-14), 61% of TLC members conducted learning labs at their school sites; however, by Year 2 (2014-15), that percentage dropped to approximately 40%. In Year 3 (2015-16), the percentage remained relatively consistent with Year 2 with 39% of the TLC members conducting learning labs.

Figure E.1
TLC Dissemination Events by School Year



Source: PD Monitoring Tool data from each school year
Responses: 2013-14: N=2,003; 2014-15: N=1,198; 2015-16: N=1,613
Note: Data were collected at five different time points after each training.

Table E.2
Year 3 TLC Responses to PD Monitoring Question: What prevented you from implementing any of the training modules with other teachers at your school?

Category	Frequency	Percent
Time	498	90.9
New TLC Member	15	2.7
TLC Member not prepared	14	2.5
Lack of support/interest	11	2.0
Not enough information to present	5	0.9
Alternative plan/method	4	0.7
Attrition	1	0.1

Source: PD Monitoring Tool data from Year 3
Note: Due to rounding percentages may not equal 100.

Training Modules

Time was the most cited challenge that prevented teachers from implementing a training module at their school, comprising 90% of the 548 responses (see Table E.2). A subcode analysis of the 498 "time" responses resulted in ten subcodes:

- general reference to time (32% of 498),
- administration did not allot time (20% of 498),
- other professional development initiatives (16% of 498),
- inclement weather/vacation*,
- track out*,
- schedule conflicts*,
- testing and/or curriculum mandates*,
- no professional development or early release days on the schedule*,
- TLC member absences*, and
- not enough planning time or class coverage*.

Note: * indicates frequency was less than 10%.

As shown in Table E.2, The TLC members cited other factors that did not relate to time; however, they occurred at a much lower frequency from 0.1% to 2.7% of the total responses. The next most frequent response (2.7%) was made by new members of the TLC program with comments such as, "This is my first session." Approximately 2.5% of the TLC members responded with quotes such as "What's a training module?" or "First year on the team" which seemed to indicate the TLC member was not prepared to redeliver training. Two percent of the responses conveyed that the TLC members failed to hold redelivered training at their school due to a lack of interest or support among staff with quotes such as "Lack of teacher motivation," and "We attempted to do an online training but received no response from our staff."

Why have you not been able to conduct a learning lab?
For those who provided a response for why they had not conducted a learning lab at their school since the last TLC district training, 577 responses were analyzed and coded into 10 categories, see Table E.3.

Similar to the TLC members' responses as to why they were unable to redeliver training to their schools, time was also cited as the largest factor impeding their ability to conduct a learning lab at their school.

Table E.3
Year 3 TLC Responses to PD Monitoring Question: If no, why have you not been able to conduct a learning lab?

Category	Frequency	Percent
Time	430	74.5
Lack of interest/participation	29	5.0
Lack of Technology Resources	27	4.7
No coverage for teachers	25	4.3
TLC Member not prepared/lack of training	24	4.1
New TLC Member	18	3.1
TLC Member not aware of expectations	10	1.7
Used other method	7	1.2
Lack of support	5	.8
Previous unsuccessful attempts	2	.3

Source: PD Monitoring Tool data from Year 3

Of the total 74.5% of responses that related to time, 35% of those responses made only a general reference to "time" with statements such as "We have not had time." To better understand the remaining 4% of time related responses, district staff conducted a subcode analysis of these responses that resulted in 9 subcodes for the Time category:

- general reference to time (35%),
- administration (9%),
- testing and/or curriculum mandates (8%),
- schedule conflicts (6%),
- other professional development initiatives (6%),
- track out (5%),
- inclement weather/vacation (3%),
- TLC member absences (2%), and
- too little time between trainings (1%).

As can be seen above, TLC members felt that testing and curriculum mandates, other professional development initiatives, and schedule conflicts at their schools adversely affected the time they had available to implement a learning lab at their school similar to why they were unable to redeliver the training. For example:

> "We are on a strict curriculum which has us teaching lessons as written in CMAPP or Caulkins."
> "School-wide professional development has been focused on MTSS Tier 2 plans, as we are a cohort school."

In addition to time prohibiting TLC members from conducting learning labs, 24.5 % of responses made up the remaining 9 codes. As depicted in Table E.3, some of the more frequently cited challenges were a lack of interest by staff members (5%), a lack of appropriate technology resources for students and/or teachers to allow them to successfully conduct a learning lab (5%), the inability to obtain coverage for teachers' classrooms to enable them to observe in the TLC members' classrooms (4%), and feelings of unpreparedness on the part of the TLC members (4%).

Four percent of the responses comprised the remaining four codes. See Table E.3 for a complete listing of the codes and their respective occurrences.

Summary

As can be seen from the results, many of the reasons given by TLC members for being unable to disseminate trainings at their schools were similar to the reasons stated for being unable to conduct learning labs. For both events, responses related to time constraints were the most frequent comprising 91% of the total responses for the inability to redeliver trainings and almost 75% for not conducting learning labs.

Appendix F

DE Digital Integration Survey (DDIS)

Methods

One short-term goal of the TLC initiative was to increase TLC teachers' self-efficacy in utilizing technology appropriately for instruction. Another goal was for TLC teachers to cultivate other teachers' self-efficacy in utilizing instructional technology, thereby increasing all teachers' self-efficacy. Self-efficacy is defined as the belief in one's capabilities to organize and execute the steps necessary to successfully accomplish tasks in a particular domain (Bandura, 1986).

Data Collection

Discovery Education (DE) deployed the DDIS to all teachers in the district (TLC and non-TLC members) at the beginning and at the end of each school year throughout the three-year project (2013-14, 2014-15, and 2015-16). The method of dissemination varied by group (i.e., TLC vs. non-TLC) with TLC members completing the survey on the first and last day of training each year. Non-TLC members, all WCPSS teachers excluding TLC members, were invited to complete the DDIS survey via email. The 2013-14 Post test for non-TLC members was deployed during the last week of the 2013-14 school year with a three-day survey window and produced a very low response rate (12 participants). Due to this low response rate, DRA managed and deployed the 2014-15 and 2015-16 non-TLC DDIS Post survey as part of the WCPSS annual teacher survey. This resulted in much higher response rates. Table F.1 provides response rates for both TLC and non-TLC teachers for each survey deployment.

Response rates were higher for TLC teachers.

- Response rates for TLC teachers ranged from 54% to 78% in all but one case. The exception was the 2014-15 post-survey, which had a lower return rate (32%). Late dissemination and a short window for completion contributed to the low return rates in this case. Thus, results for spring 2015 may be less representative of the overall group of TLC members.
- Non-TLC teacher response rates were low overall, which limits the generalizability of the findings for non-TLC teachers and comparisons to TLC members over time.

Table F.1

DDIS Teacher Response Rates

Time point		*TLC*			*Non-TLC*		
		No. of responses (n)	Population size (N)	% response rate	No. of responses (n)	Population size (N)	% response rate
2013-14	Pre	406	695	58.4	658	9,177	**7.2**
	Post	373	695	53.7	12	9,177	**0.1**
2014-15	Pre	506	647	78.2	1,163	9,329	**12.5**
	Post	206	647	**31.8**	2,242	9,329	**24.0**
2015-16	Pre	509	662	76.9	1,035	8,392	**12.3**
	Post	464	662	70.1	658	8,392	**7.5**

Source: DDIS survey data, human resources data, and TLC participation for 2013-14, 2014-15, and 2015-16.
Note: DDIS survey data were matched to human resource data and TLC participation information using employee identification numbers. Only teachers who completed all 10 DDIS are included as respondents.

Matching Employee Identification Numbers to DDIS Data

Prior to analysis, individual teacher responses on the pre- and post-surveys were matched based on teacher's employee identification number to teacher characteristics, which were made available by WCPSS human resources department. In some cases, teachers provided incorrect employee identification numbers. Teachers' responses that were not able to be hand-matched to information from the human resources department using email address or other identifying information were excluded from analysis. This excluded less than 15% of responses at each survey time point. Based on district records, the number of years that a teacher participated in the TLC initiative was included. Teachers were only included as a TLC teacher in the analysis if the system had a record of them participating in TLC.

Instrument

The Discovery Education Digital Integration Survey (DDIS) assesses teachers' self-efficacy toward instructional technology in ways consistent with the stages of technology integration identified by Dwyer, Ringstaff, and Sandholtz (1990). The DDIS is based on the University of Florida's Technology Integration Matrix (Allsopp, Hohlfeld, & Kemker 2007) and references the five levels of technology and digital media integration cited by Dwyer et al (1990) as shown in Figure F.1. These stages represent a range in the ways teachers integrate instructional technology for learning, spanning from basic use (i.e., entry) to high-level engagement in learning that would not be possible without technology (i.e., transformation). To illustrate, a teacher at the entry stage of self-efficacy toward technology may reach his or her limit of comfort in using technology at basic use, which might include having students practice multiplication facts using a website. On the other end of the spectrum, a teacher at the transformation stage of self-efficacy toward technology is comfortable having students share their learning with others in a virtual space via student-created websites or podcasts. In this way, students have autonomy in their technology use and the use of technology supports their learning in ways that would not be possible without it.

The DDIS includes 10 items that specifically target teachers' self-efficacy with technology integration. The items on the survey are written such that higher scores reflect stages of self-efficacy that are more aligned with the transformational technology integration. The 10 items were scored on a scale specifying 1=*Not True of Me Now* and 7=*Very True of Me Now*. Total scores were generated for each teacher across the 10 items; teachers were then assigned to a stage of technology integration based on

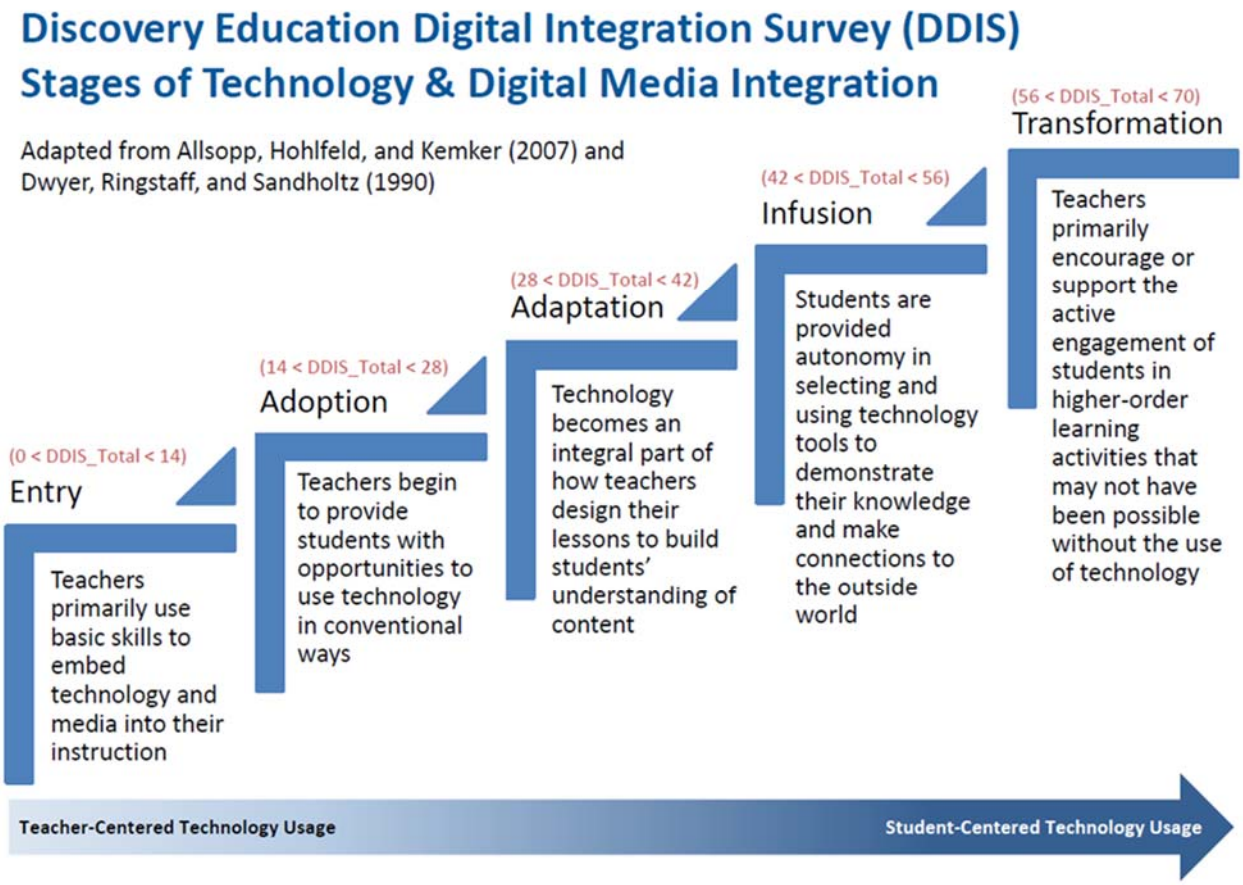
cut scores established by Discovery Education. The 10 items are included in Table F.2 and descriptive statistics are reported in Table F.3. Means for each item are depicted in Table F.3. Overall, these means indicate that both TLC and non-TLC teachers increased on each item within each year as measured by the pre- and post-survey.

Table F.2
DDIS Survey Items

	Question
Question 1	I am skilled at working on my own to identify digital resources and media (such as videos, interactive reading passages, and simulations) that are aligned with my state standards and to integrate them into my lesson plans and student assignments.
Question 2	I am skilled at using digital resources and media to assign classroom activities and homework that are tailored to students' unique learning styles, working strategies and abilities.
Question 3	I am skilled at working with students as they use the classroom technology and digital resources to locate, analyze, evaluate and use information to support their research and learning.
Question 4	I am skilled at engaging my students to participate in online collaborative projects (not including email exchanges) with other students or professionals to work on their self-selected projects.
Question 5	I am skilled at locating and implementing instructional units that emphasize students using the classroom technology and digital resources to solve "real-world" problems or issues.
Question 6	I am skilled at developing instructional activities that allow students to create their own web pages or multimedia presentations to showcase what they have learned in class.
Question 7	I am skilled at using digital resources to develop formative and summative assessments aligned with the content standards.
Question 8	I am skilled at engaging my students in collaborative learning activities that allow them to work with other students in the classroom to clarify their conceptual understanding and to engage in creative thinking and planning.
Question 9	I am skilled at presenting information to students using multimedia presentations or electronic "slideshows" to reinforce the content standards that I am teaching.
Question 10	I am skilled at developing instructional activities that allow students to use digital models and simulations to explore complex systems and issues, identify trends and forecast possibilities, process data, and report results.

Figure F.1

Discovery Education Digital Integration Survey (DDIS) Stages of Technology and Digital Media Integration



Note 1: Reprinted from Discovery Education (n.d.). Reprinted with permission.
Note 2: Discovery Education totals self-rating scores (10 questions with a scale of 1-7) to categorize respondents into implementation stages. The ranges above each stage specify the scores assigned to each level.

Results

Sense of Self-Efficacy with Technology

TLC Member Responses

The goal was for TLC members to increase their self-efficacy over time in using technology meaningfully for instruction. Therefore, the percentages of staff who considered themselves to be at the entry or adoption level over time decreased and those who considered themselves to be at the infusion or transformation level increased over time. Levels of technology integration were assigned to teachers based on their sum score on the 10 items on the Discovery Education pre- and post-survey. The cut scores for each stage are specified in red in Figure F.1. As Figure F.2 illustrates, the percentage of TLC teachers who reported self-efficacy at the entry or adoption stages with technology decreased each spring from 3% in 2014 to 2% in 2015 and 1% in 2016 (i.e., the percentage of teachers who scored the lowest levels each spring). Within year, the percentage of teachers who viewed themselves at the transformation level increased each spring, going from 6% to 30% in 2013-14, 20% to 41% in 2014-15, and 22% to 36% in 2015-16. The increases in fall 2014 and 2015 of teachers who rated themselves as entry or adoption is likely attributed to staff turnover across years (23% between 2013-14 to 2014-15 and 40% between 2013-14 to 2015-16). Principals were asked to select new TLC teachers when teachers withdrew from the initiative or moved to different schools. Given this influx of new teachers each year, comparing results from fall to spring *within* each year is best practice.

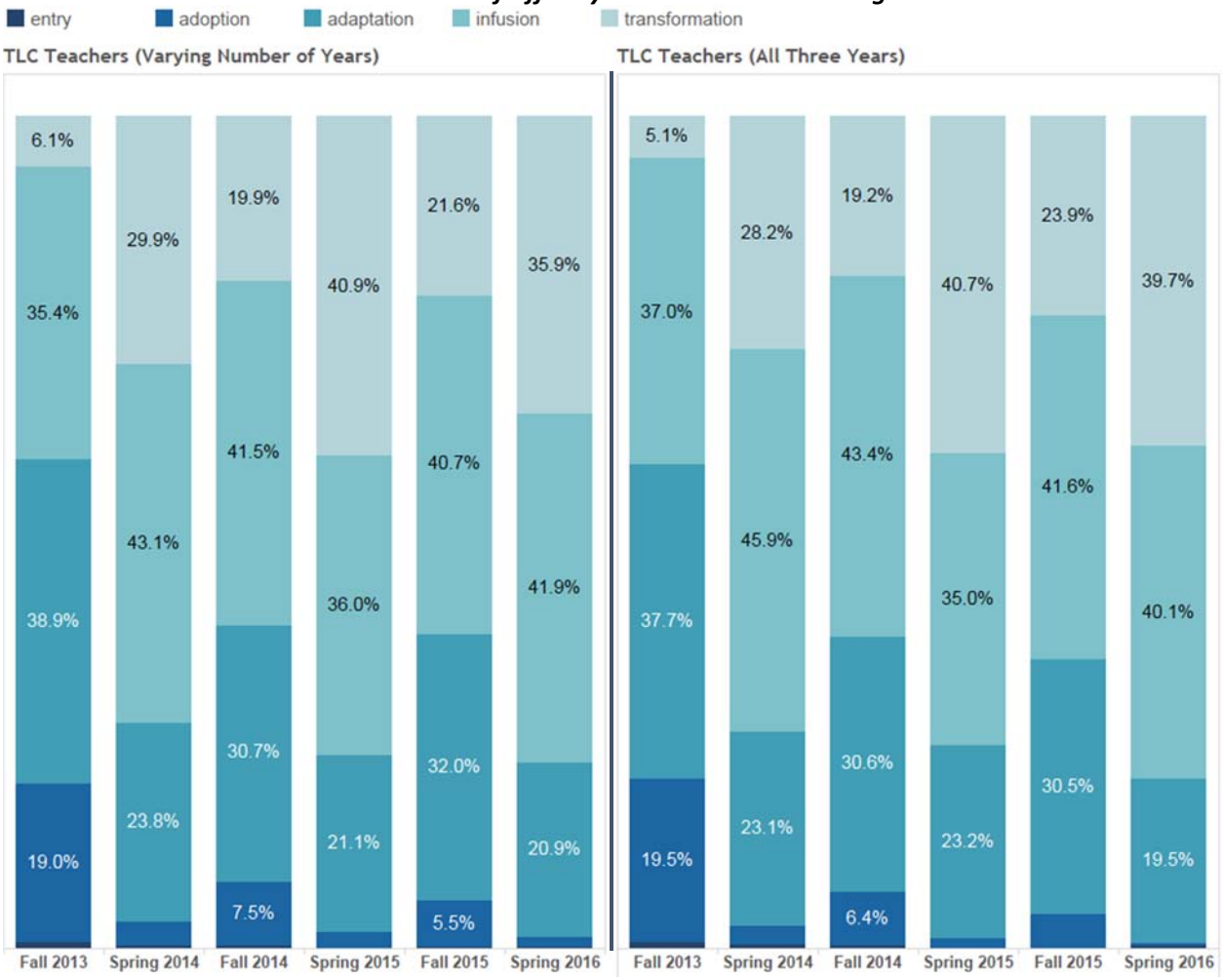
Based on all respondents to the pre- and post-surveys, trends in results support the attainment of the goal of increased self-efficacy during each year of program implementation. As shown in Figure F.2:

- From fall 2013 to spring 2014, the percentage of TLC teachers rating themselves at the entry or adoption level decreased from 20% to 3%, and the percentage rating themselves at the infusion or transformation level increased substantially from 42% to 73%.
- From fall 2014 to spring 2015, the percentage of TLC teachers rating themselves at the entry or adoption level decreased from 8% to 2%. The percentage rating themselves at the infusion or transformation stage increased from 61% to 77%.
- From fall 2015 to spring 2016, the percentage of TLC teachers who rated themselves at the infusion or transformation stage increased from 62% to 78%.

Next results were disaggregated by those teachers who were part of the initiative for all three years compared to teachers who were part of the initiative for one or two years (Figure F.4). Here we focus on the results for teachers who were part of the TLC initiative for all three years and therefore received the full TLC treatment. Figure F.2 depicts levels of self-efficacy for teachers who were part of TLC for all three years. For teachers who were in the program for all three years, the percent of teachers reporting their self-efficacy toward technology integration at the highest level (i.e., transformation) increased from 5% in fall 2013 to 40% in spring 2016. Trends in levels of self-efficacy for teachers who were engaged in TLC for one or two years are illustrated in Figure F.4.

Figure F.2

TLC Teacher Self-Efficacy Over Time in Percentages



Source: DDIS Survey in fall and spring of each year.

Note: Only teachers who identified themselves with a valid employee id on the DDIS, were confirmed at TLC teachers by WCPSS, and completed the 10 DDIS items are included

Note: 2013-14 Pre n=406, Post n=373; 2014-15 Pre n=506, Post n=206; 2015-16 Pre n=509, 2015-16 Post n=464

Note: 3 Years n=1,823

Note: Percentages at or below 4% are not labeled.

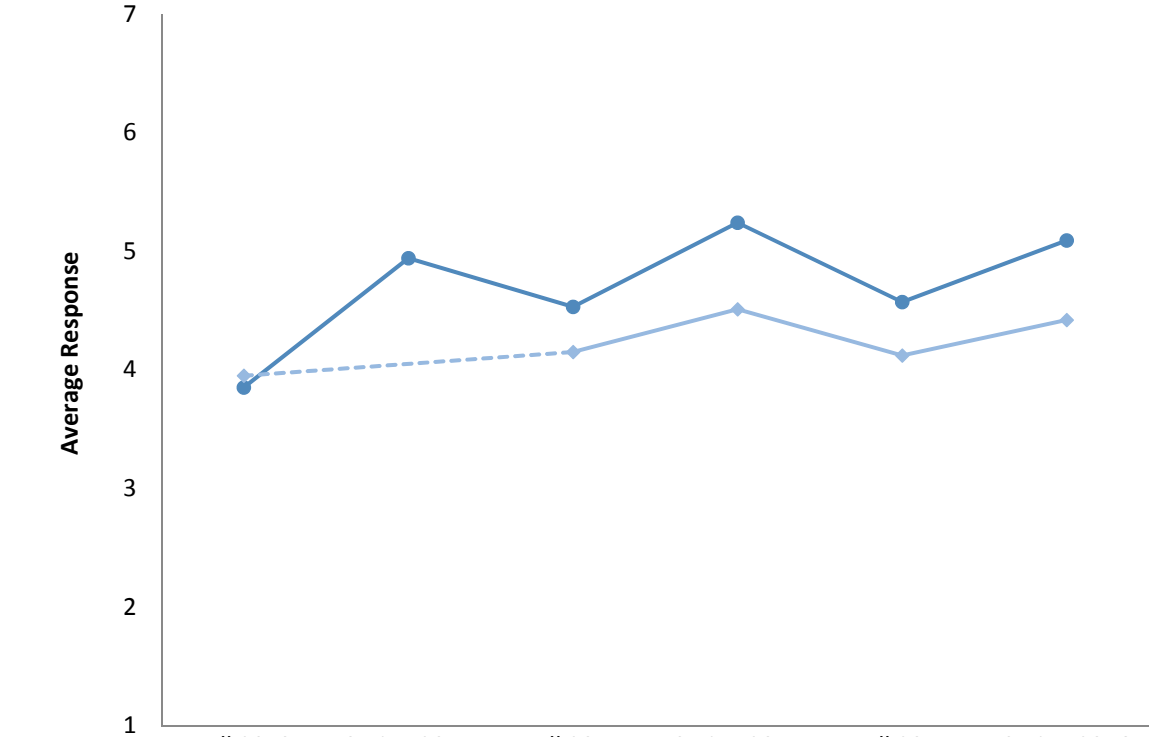
TLC Versus Non-TLC Members

Figure F.3 shows average self-efficacy scores for both TLC and non-TLC teachers for the years when data were available. Response rates were too low (0.1%) for the 2013-14 post-test to be able to provide a trend comparison for non-TLC teachers. For both the TLC and non-TLC groups, self-efficacy averages increased between the pre- and post-survey each year for both TLC and non-TLC teachers by about the same amount. TLC teachers as a group started out higher, but the expectation that their increase would be more rapid was not met. Teachers' level of self-efficacy was based on their response to the Discovery Education pre- and post-survey. Table F.3 lists the 10 self-efficacy questions from the Discovery Education pre- and post-survey, as well as means for each question across years.

Figure F.3 depicts that overall TLC and non-TLC teachers followed similar trends in their self-efficacy over time. As shown in Figure F.3, eachers felt most efficacious at the end of year compared to the beginning of year. Only 12 non-TLC teacher responses were recorded in spring 2015; therefore, an examination of self-efficacy for non-TLC teachers from fall 2013 to fall 2014 is not appropriate. The means in fall 2013 indicate that TLC and non-TLC teachers reported similar self-efficacy toward technology integration. The response rates for the non-TLC teacher survey were low; therefore, the findings are not generalizable to all non-TLC teachers.

As shown in Figure F.3, both TLC and non-TLC teachers' average self-efficacy scores increased between the pre- and post-test for Years 2 and 3 of the initiative. It is interesting to note that although it was expected that the self-efficacy of the TLC group would increase at a more rapid rate than the non-TLC group, both groups in Years 2 and 3 experienced relatively the same amount of growth between the pre- and post-tests. Based on mean scores, TLC and non-TLC teachers reported the highest mean self-efficacy in spring 2015. Average self-efficacy decreased slightly in spring 2016 compared to spring 2015, whereas we would have hoped that the score would have increased consistently across time.

Figure F.3
TLC and Non-TLC Teachers' Self-Efficacy Over Time

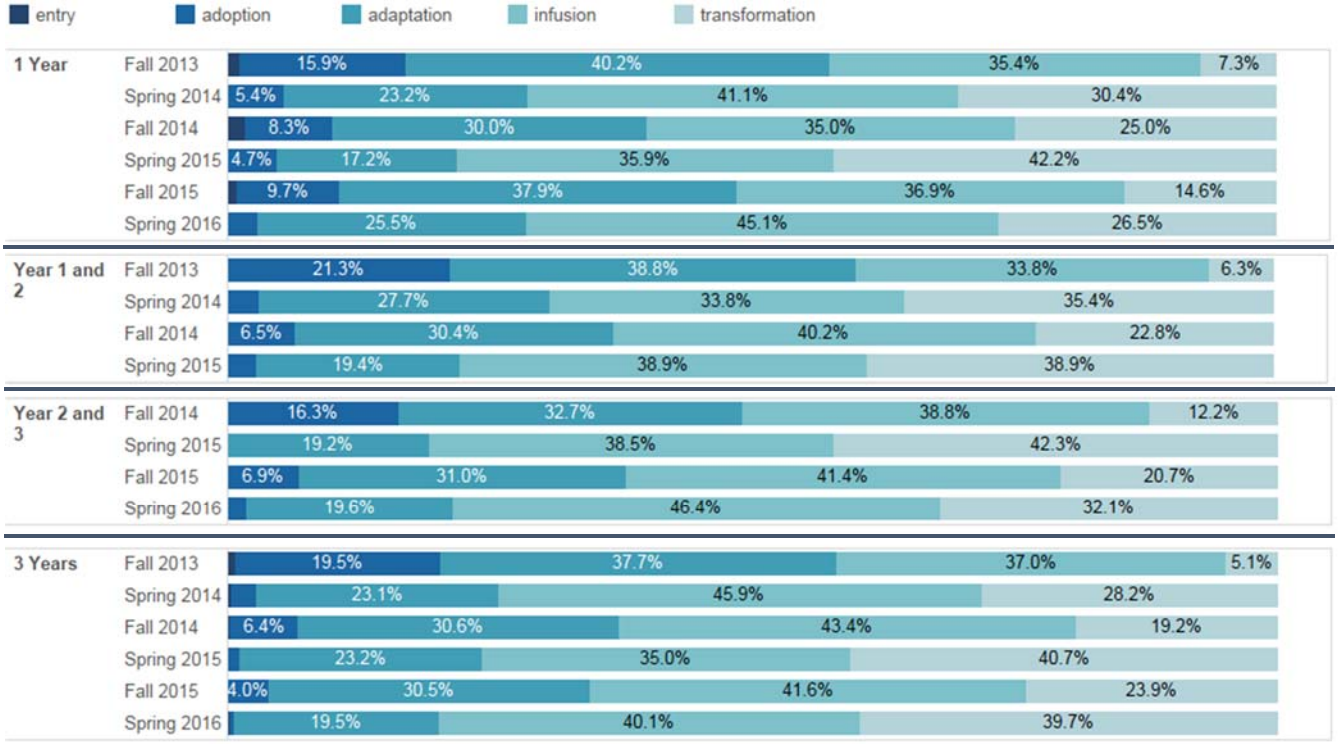


Source: 2013-14, 2014-15, and 2015-2016 DDIS Survey, scale 1-7, does not include N/A responses
Note: 2013-14 Pre (TLC n=406, Non-TLC n=658); 2013-14 Post (TLC n=373)
2014-15 Pre (TLC n= 506, Non-TLC n= 1,163); 2014-15 Post (TLC n= 206, Non-TLC n= 2,242)
2015-16 Pre (TLC n= 509, Non-TLC n= 1,035); 2015-16 Post (TLC n= 464, Non-TLC n= 658)
Note: Based on a two-sample t-test, differences between TLC and non-TLC teachers at each time point are not statistically different in fall 2013, but are significantly different ($p < .001$) in fall 2014, spring 2015, fall 2015, and spring 2016.

Teacher self-efficacy across time points for teachers who were part of the initiative for one, two, or three years are depicted in Figure F.4. While the percentage of third year TLC teachers (i.e., 3 Years) who reported that their level of self-efficacy was in the infusion or transformation stage was 80%; the percentage of teachers who were only involved in TLC for one year (i.e., 1 Year) was 72%, which does not provide strong evidence that participating in TLC across all three years was associated with substantially higher self-efficacy. It is possible that self-efficacy increased for all teachers because the TLC teachers shared the instructional technology resources with other teachers at the school, increasing the distributed expertise for all teachers in the district.

Figure F.4

Teacher Self-Efficacy Over Time By Number of Years Participating



Source: DDIS Survey in fall and spring of each year.
Note: Only teachers who were matched to human resource data are included.
Note: 1 Year n=545; 2 Years n=559; 3 Years n=1,823
Note: Percentages at or below 3% are not labeled.

Table F.3 depicts the means for each item on the Discovery Education pre- and post-survey at each timepoint.

Table F.3

Self-Efficacy Questions from Discovery Education Pre and Post-Survey

Group	TLC						Non-TLC					
Item	**2013-14**		**2014-15**		**2015-16**		**2013-14**		**2014-15**		**2015-16**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
1. I am skilled at working on my own to identify digital resources and media (such as videos, interactive reading passages, and simulations) that are aligned with my state standards and to integrate them into my lesson plans and student assignments.	4.66	**5.69**	5.30	**5.80**	5.29	**5.62**	4.67	**5.55**	4.72	**5.03**	4.80	**5.04**
2. I am skilled at using digital resources and media to assign classroom activities and homework that are tailored to students' unique learning styles, working strategies and abilities.	3.67	**4.91**	4.45	**5.32**	4.63	**5.11**	3.87	**5.18**	4.19	**4.59**	4.19	**4.59**
3. I am skilled at working with students as they use the classroom technology and digital resources to locate, analyze, evaluate and use information to support their research and learning.	4.24	**5.22**	4.80	**5.54**	4.82	**5.29**	4.37	**5.27**	4.49	**4.79**	4.46	**4.76**
4. I am skilled at engaging my students to participate in online collaborative projects (not including email exchanges) with other students or	3.12	**4.23**	3.88	**4.76**	4.02	**4.59**	3.29	**4.64**	3.57	**4.13**	3.51	**3.84**

Group	TLC						Non-TLC					
Item	2013-14 Pre	2013-14 Post	2014-15 Pre	2014-15 Post	2015-16 Pre	2015-16 Post	2013-14 Pre	2013-14 Post	2014-15 Pre	2014-15 Post	2015-16 Pre	2015-16 Post
professionals to work on their self-selected projects.												
5. I am skilled at locating and implementing instructional units that emphasize students using the classroom technology and digital resources to solve "real-world" problems or issues.	3.54	**4.85**	4.31	**5.12**	4.38	**5.00**	3.71	**5.18**	4.02	**4.44**	3.96	**4.33**
6. I am skilled at developing instructional activities that allow students to create their own web pages or multimedia presentations to showcase what they have learned in class.	3.27	**4.51**	3.98	**4.84**	4.03	**4.68**	3.34	**5.00**	3.53	**3.96**	3.43	**3.77**
7. I am skilled at using digital resources to develop formative and summative assessments aligned with the content standards.	3.69	**4.72**	4.29	**5.09**	4.43	**4.95**	3.79	**5.00**	4.00	**4.37**	4.08	**4.33**
8. I am skilled at engaging my students in collaborative learning activities that allow them to work with other students in the classroom to clarify their conceptual understanding and to	4.18	**5.24**	4.83	**5.34**	4.73	**5.20**	4.19	**5.45**	4.50	**4.67**	4.32	**4.56**

Group	TLC						Non-TLC					
Item	2013-14 Pre	2013-14 Post	2014-15 Pre	2014-15 Post	2015-16 Pre	2015-16 Post	2013-14 Pre	2013-14 Post	2014-15 Pre	2014-15 Post	2015-16 Pre	2015-16 Post
engage in creative thinking and planning.												
9. I am skilled at presenting information to students using multimedia presentations or electronic "slideshows" to reinforce the content standards that I am teaching.	4.98	**5.63**	5.45	**5.86**	5.39	**5.75**	4.96	**5.82**	4.98	**5.10**	4.88	**5.12**
10. I am skilled at developing instructional activities that allow students to use digital models and simulations to explore complex systems and issues, identify trends and forecast possibilities, process data, and report results.	3.21	**4.42**	3.95	**4.80**	4.02	**4.70**	3.23	**5.09**	3.53	**4.00**	3.44	**3.87**

Note: Blue Shade/font Indicates post-survey values, which all showed an increase over the pre-test.
Note: Scale is 1=Not true of me now and 7=Very true of me now (0=N/A not included in descriptive statistics).
Note: Pre was given in the fall before the first training and post in the spring after the last training.
Note: Only teachers who identified themselves with a valid employee id on the DDIS, were confirmed as TLC teachers by WCPSS, and completed the 10 DDIS items are included.
Note: 2013-14 Pre (TLC n=406, Non-TLC n=658); 2013-14 Post (TLC n=373)
2014-15 Pre (TLC n= 506, Non-TLC n= 1,163); 2014-2015 Post (TLC n= 206, Non-TLC n= 2,242)
2015-16 Pre (TLC n= 509, Non-TLC n= 1,035); 2015-16 Post (TLC n= 464, Non-TLC n= 658)

Appendix G

DE Usage Data

Methods

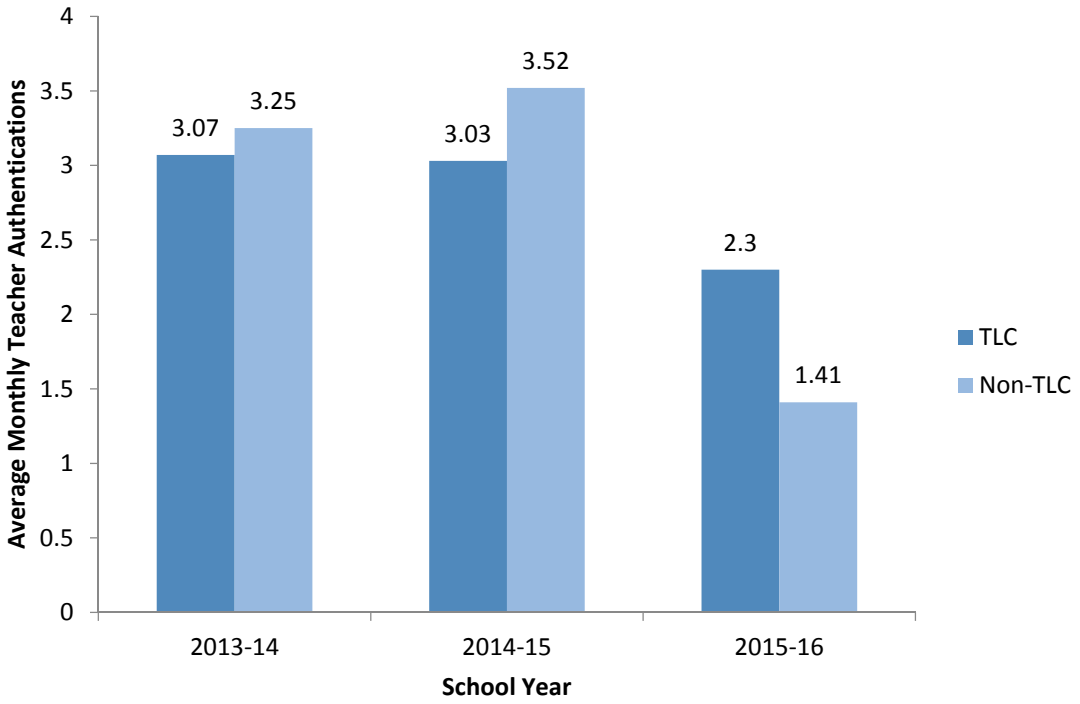
One short-term goal was for TLC members (all WCPSS teachers long-term) to use digital resources more frequently during instruction. Discovery Education resources are one type of digital resource that teachers and students were encouraged to use in their classrooms. For the purpose of this evaluation, DE is the only resource that DRA staff had the ability to track frequency of use for students and teachers. Therefore use of other technology resources is unknown. Instructional Technology staff did indicate that some other technology resources were introduced to staff over time, which may help explain some of the trends found at least partially.

The Discovery Education digital resource platform tracks the frequency with which teachers and students log in to the resources based on teacher or student ID number. DE refers to each day a user logs in to the DE resources as an authentication. The duration of the authentication was not recorded. The data reported in this appendix were collected throughout each school year for the TLC initiative.

Results

How often did TLC and non-TLC teachers access DE resources? Did usage increase over time?
Figure G.1 depicts the average frequency of TLC and non-TLC teacher authentications per month. In the first and second years of the initiative, TLC and non-TLC teachers accessed the DE digital resources about three times per month. In the third year of the initiative, TLC and non-TLC teachers used the DE resources approximately once or twice per month on average, indicating a decrease in usage in the last year. Non-TLC members actually accessed DE slightly more in Years 1 and 2 but less in Year 3. No specific goal was set for the frequency of usage desired, so it is difficult to say whether this level of use is sufficient or cost effective.

Figure G.1
TLC vs Non-TLC Teachers Average Monthly Authentications



Source: Discovery Education Usage Data (Days per Month)
Note: 2013-14 (TLC n=694, Non-TLC n=7,340)
2014-15 (TLC n= 610, Non-TLC n= 7,346)
2015-16 (TLC n= 615, Non-TLC n= 6,085)

Table G.1 shows the average monthly authentications and standard deviation for TLC and non-TLC teachers. The standard deviations indicate more variation in teacher use in the first and second years of the initiative than in the third year. Thus, the standardized variance around the mean was close to three days in Years 1 and 2 versus less than two and ½ days in Year 3 (ranging from 1.31 for non-TLC teachers to 2.3 for TLC teachers). This suggests that teachers were much more consistent in using DE at a lower level in Year 3.

Table G.1
TLC vs Non-TLC Teacher Average Monthly Authentications with Standard Deviations

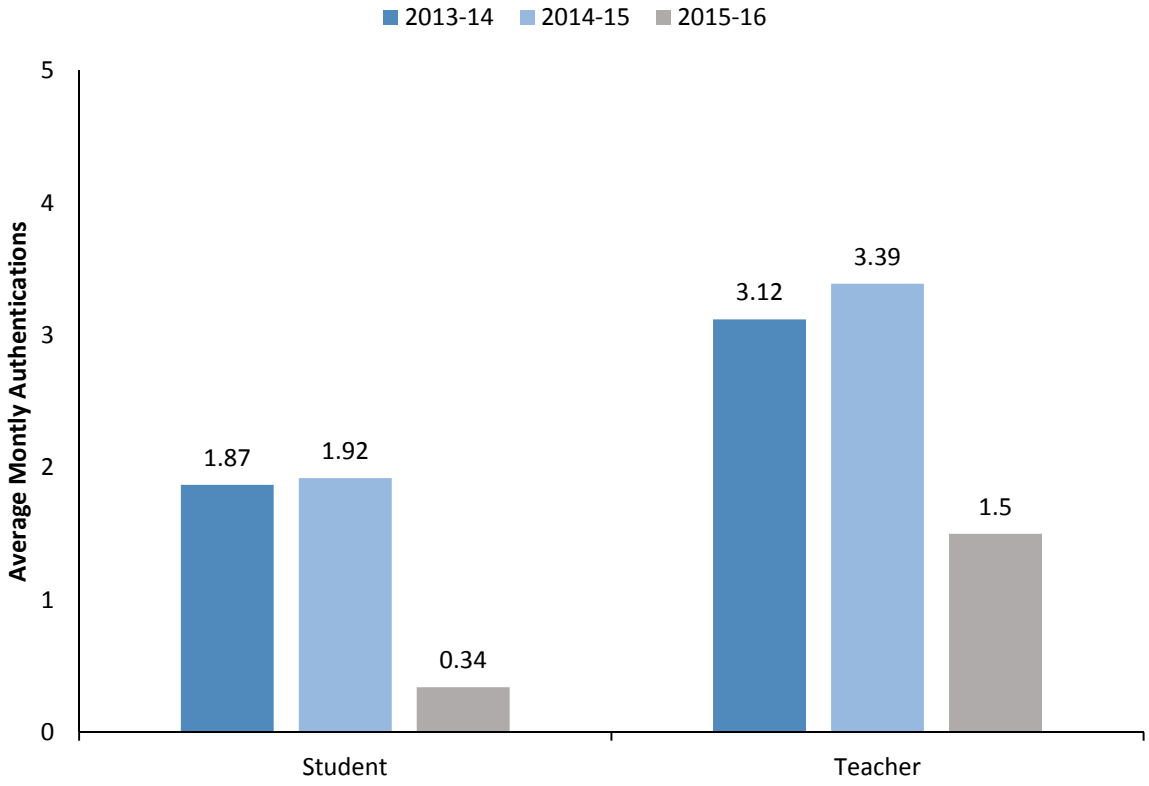
	Year 1			Year 2			Year 3		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
TLC	694	3.07	2.98	610	3.03	2.51	615	2.3	2.19
Non-TLC	7,340	3.25	2.89	7,346	3.52	2.96	6,085	1.31	1.75
Overall	8,034	3.25	2.89	7,956	3.51	2.96	6,700	1.49	1.99

Source: Discovery Education Usage Data (Days per Month)

Goal: Use of technology increases over time

Another goal of the TLC initiative specified that teacher and student appropriate usage of technology resources should increase across time. This includes the usage for all students and teachers in WCPSS. Again, data was only available for DE to measure this goal. Figure G.2 illustrates student and teacher average monthly authentications. The figure shows that teacher and student usage was consistent from the first to the second year of the initiative. In the third year of the initiative, usage decreased. The average monthly authentications for students and teachers ranged from about twice per month for students to about three times per month for teachers during the first two years (with decreased usage in the last year). This evidence suggests that teachers and students were not using DE resources more frequently across time as desired. However, it is possible that teachers were utilizing other digital resources and therefore not using DE as frequently.

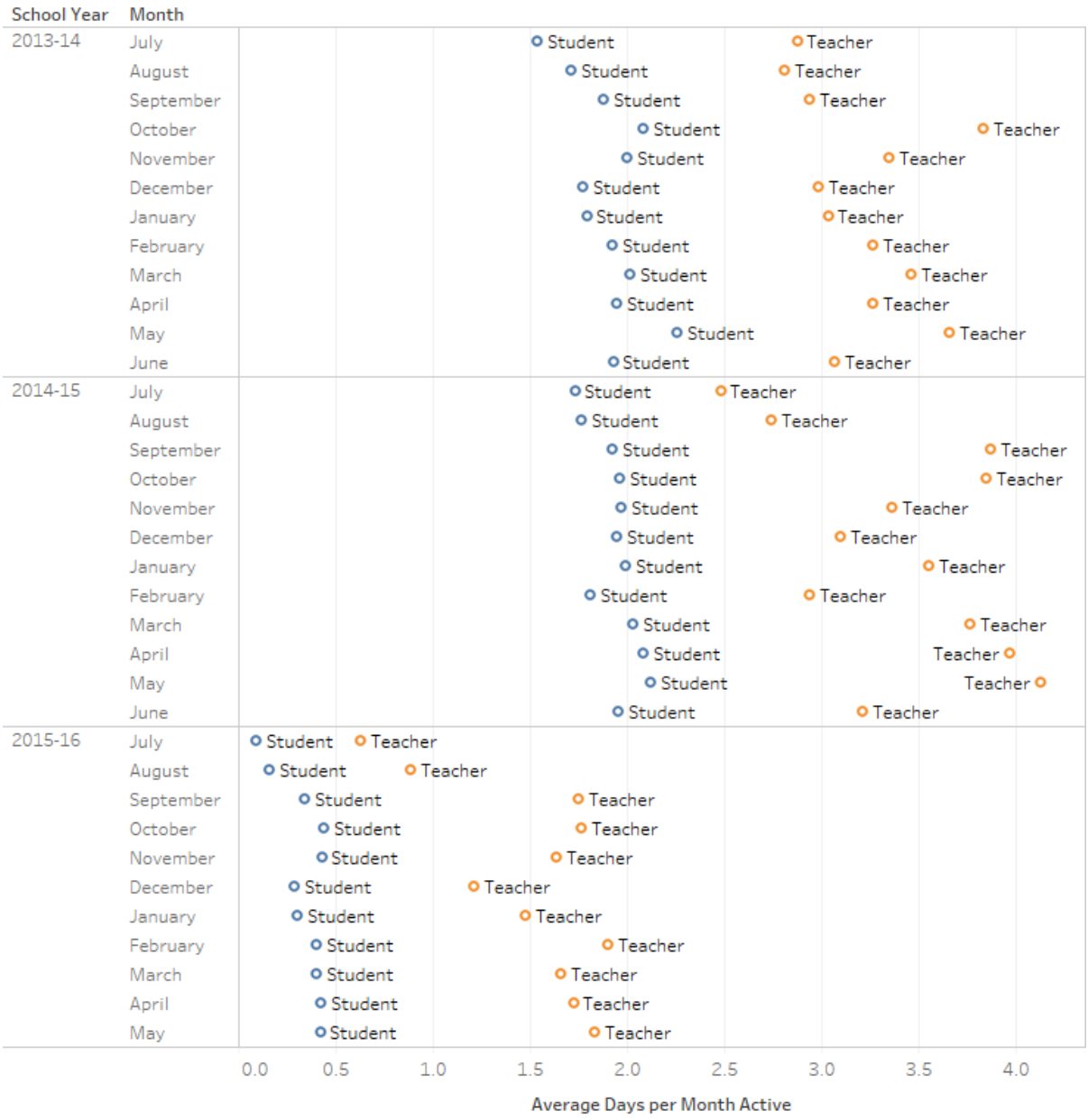
Figure G.2
Student and TLC and Non-TLC Teacher Average Monthly Authentications



Source: DE Usage Data (Days per Month)

Figure G.3 illustrates student and teacher average authentications by month for each year of the initiative. The figure shows that *students consistently used DE resources less often than teachers*. Average usage was lower in the third year of the initiative relative to the first and second years. Use tended to be highest in October for teachers.

Figure G.3
Student and Teacher Average Authentications by Month



Note: Insufficient data was available in June to generate an average.

Table G.2 depicts the overall monthly average authentications for teachers and students by grade span including elementary, middle, and high schools.

- Elementary school teachers and students had the highest overall average monthly usage during each year of the initiative. Middle and high school teachers and students were almost similar in their average monthly usage.
- Average monthly usage for all grade spans did not exceed three authentications per month, suggesting infrequent usage. Additionally, all grade levels decreased in their usage from the first

and second year to the last year. In the first year, average monthly usage ranged from 1.8 for high schools to 2.6 for elementary schools; in the third year, average usage was 0.3 for middle and high schools to 0.7 for elementary schools.

Table G.2
Average Authentications for Teachers and Students (combined) by Grade Span

	School Year		
Grade Span	2013-14	2014-15	2015-16
Elementary	2.58	2.53	0.66
Middle	1.94	1.96	0.29
High	1.79	1.94	0.29

Source: DE Usage Data

Table G.3 depicts teacher and student average monthly authentications and the percent difference in average authentications from the previous year by grade span including elementary, middle, and high schools. Again, the table shows that in the first year, elementary students and teachers used the DE resources most often. For elementary students, average monthly usage of the DE resources decreased from 2.1 in the first year to 0.5 in the third year. For elementary teachers, average monthly usage of the DE resources decreased from 3.6 to 1.9 in the third year.

Table G.3
Student and Teacher Average Authentications and Change from Previous Year by Grade Span

Role	Grade Span		2013-14	2014-15	2015-16
Students	Elementary	Avg. Authentications	2.08	2.08	-0.45
	Middle	Avg. Authentications	1.76	1.82	0.25
	High School	Avg. Authentications	1.41	1.53	0.19
Teachers	Elementary	Avg. Authentications	3.62	3.78	1.87
	Middle	Avg. Authentications	2.62	2.88	0.94
	High School		2.06	2.62	0.59

Source: DE Usage Data
Note: E indicates elementary schools; M indicates middle schools; H indicates high schools.

Table G.4 depicts the average student and teacher monthly authentications by area or region of WCPSS. Teacher and student monthly usage is disaggregated by elementary, middle, and high schools. Overall, this table shows that student and teacher usage was similar in all areas of the district, including elementary support schools. Patterns across years mirrored those found in other analyses. Students used DE resources about twice per month and this average declined in the third year to less than one authentication per month. Teachers used DE resources between two to three times per month during the first year, with a decline in the third year of less than twice per month in most regions of WCPSS.

Table G.4
Average Student and Teacher Monthly Authentications by Area

Area	Role	2013-14			2014-15			2015-16		
		E	M	H	E	M	H	E	M	H
Central	Student	2.28	1.81	1.48	2.14	1.67	1.74	0.54	0.18	0.20
	Teacher	3.90	2.32	2.04	4.04	2.82	2.23	1.86	0.89	0.55
Eastern	Student	1.98	1.74	1.74	1.99	1.80	1.69	0.44	0.50	0.18
	Teacher	3.68	2.87	1.88	3.67	2.65	2.29	1.81	0.77	0.66
Elem. Support	Student	2.08			2.03			0.40		
	Teacher	3.53			3.33			1.23		
Northeastern	Student	1.83	2.56	1.48	1.96	2.14	1.39	0.41	0.27	0.19
	Teacher	3.72	2.49	2.60	3.89	2.33	3.32	1.83	0.87	0.53
Northern	Student	2.09	1.83	1.22	2.11	1.80	1.49	0.44	0.29	0.19
	Teacher	3.32	2.55	2.04	3.69	2.62	2.29	1.85	0.87	0.58
Northwestern	Student	2.18	1.32	1.39	2.08	1.75	1.57	0.45	0.18	0.22
	Teacher	3.94	2.35	2.14	4.00	2.61	2.76	2.15	0.58	0.45
Southern	Student	2.22	1.78	1.50	1.98	1.73	1.30	0.40	0.14	0.17
	Teacher	3.56	2.61	2.04	3.69	3.06	3.36	1.86	1.14	0.90
Southwestern	Student	2.01	1.67	1.74	2.16	1.77	1.74	0.41	0.18	0.18
	Teacher	3.47	2.59	1.86	3.77	2.98	2.31	2.13	0.88	0.45
Western	Student	1.82	1.87	1.24	2.12	2.13	1.40	0.52	0.29	0.14
	Teacher	3.47	2.85	2.08	3.84	3.23	2.81	2.04	1.24	0.78

Source: DE Usage Data
Note: E indicates elementary schools; M indicates middle schools; H indicates high schools.

Goal: Costs for technology per pupil for DE decline over time.
Table G.5 shows the following trends for students:

- The total number of students who used DE increased slightly each year, but the frequency with which those students used the DE resources decreased in Year 3.
- The cost per student each year for the use of DE was about $8.00 per student with a small decrease across years.
- On the other hand, given the decreased number of times that students accessed these resources (authentications), the cost per authentication increased from $1.77 in Year 1 to $2.15 in Year 3.

For teachers:

- The number of teachers who utilized DE resources and their total number of authentications decreased each year. Because fewer teachers used the resources, the average cost per teacher increased from $39.13 in the first year to $64.52 in the final year.
- Similarly, the cost per teacher authentication increased from $2.50 in the first year to $3.82 in the third year.

The total number of users (teachers and students) remained relatively consistent across years because more students and fewer teachers used the resources across years. However, the cost per active user (teacher or student) and cost per authentication for teachers and students increased across years. This is because the teachers and students used the resources less often in the third year, resulting in an increased cost per active user from $6.75 in year one to $7.12 in year three. The cost per authentication also increased from $1.04 in year one to $1.37 in year three. While these increases are not large, they are not in the desired direction, suggesting that teachers and students were not utilizing the DE resources with the frequency and intensity intended by the initiative.

Table G.5
Discovery Education Costs

		Year 1	Year 2	Year 3
Students	Total Students who Utilized DE	47,961	52,199	52,539
	Total Authentications (Students Only)	221,607	268,722	195,388
	Average Authentications per Student	4.62	5.15	3.72
	License Costs	$391,373	$412,020	$420,640
	Cost Per Pupil	$8.16	$7.89	$8.01
	Cost Per Authentication (Students Only)	$1.77	$1.53	$2.15
		Year 1	**Year 2**	**Year 3**
Teachers	Total Teachers who Utilized DE (Teachers)	10,001	7,530	6,519
	Total Authentications (Teachers Only)	156,347	142,669	110,163
	Average Authentications per Teacher	15.63	18.94	16.90
	License Costs	$391,373	$412,020	$420,640
	Cost Per Active Users (Teachers)	$39.13	$54.71	$64.52
	Cost Per Authentication (Students & Teachers)	$2.50	$2.88	$3.82
		Year 1	**Year 2**	**Year 3**
Overall	Total Users who Utilized DE (Students & Teachers)	57,962	59,729	59,058
	Total Authentications (Students & Teachers)	377,954	411,391	305,551
	Average Authentications per User	6.52	6.89	5.20
	License Costs	$391,373	$412,020	$420,640
	Cost Per Active Users (Students & Teachers)	$6.75	$6.89	$7.12
	Cost Per Authentication (Students & Teachers)	$1.04	$1.00	$1.37

Source: DE usage data and DE cost data

Goal: Increase in the number of schools integrating technology appropriately into instruction.
The number of schools with teachers and students utilizing the DE resources did not increase as desired across time. Table G.6 shows the ratio of elementary, middle, and high schools with students and teachers using DE resources, along with the percentage increase in the number of schools compared to

the year prior. During the first year, more than half of the elementary schools and nearly three-quarters of the middle and high schools had at least one teacher using DE resources. About half of the elementary, middle, and high schools had at least one elementary student utilizing DE resources. In some schools, teachers or students were utilizing the resources, not both. Only 34% of elementary schools had both teachers and students utilizing the DE resources. Half of the high schools had both teachers and students utilizing the resources. Unfortunately, the percentage of schools with teachers or students using DE resources did not increase between Years 1 and 2 or Years 2 and 3, suggesting that schools that used DE resources in the first year either continued or discontinued use in the second or third year.

Table G.6
Number of and Percentage Increase in Schools with Teachers and Students Using DE Resources

		Increase from Year 1 to 2		Increase from Year 2 to 3		Increase from Year 1 to Year 3	
		Ratio	***Percentage of Schools that Increased***	***Ratio***	***Percentage of Schools that Increased***	***Ratio***	***Percentage of Schools that Increased***
Elementary	***Teachers***	63/106	59.43	0/106	0	0/106	0
	Students	48/106	45.28	0/106	0	0/106	0
	Both	36/106	33.96	0/106	0	0/106	0
Middle	***Teachers***	26/36	72.22	0/36	0	0/36	0
	Students	21/36	58.33	0/36	0	0/36	0
	Both	16/36	44.44	0/36	0	0/36	0
High	***Teachers***	22/30	73.33	0/31	0	0/30	0
	Students	16/30	53.33	0/31	0	0/30	0
	Both	15/30	50	0/31	0	0/30	0
Overall	***Teachers***	111/172	64.53	0/173	0	0/172	0
	Students	85/172	49.42	0/173	0	0/172	0
	Both	67/172	38.95	0/173	0	0/172	0

Source: DE Usage Data

Appendix H

Classroom Observations

Methods

Sample

The sample for this study included 165 WCPSS schools. The four alternative schools and two Leadership academies were excluded (see Table H.1). A stratified random sample of 10% of the 165 schools was created and included schools at the elementary, middle and high school levels. The percentage of students who were Economically Disadvantaged (ED) at each school was also used as a control variable to ensure a mix of schools with varying student demographics. The method used was systematic random sampling using SAS Proc Surveyselect. The schools selected are shown in Table H.2.

Table H.1
Sample Pool of WCPSS Schools by Grade Span and Type

Grade Range	Regular	Percent of Pool
Elementary	106	64.2
K-8	1	0.6
Middle	33	20.0
High	25	15.2
Total	165	100.0

Note: Four alternative schools and two leadership academies were excluded as atypical.

Table H.2
TLC School Sample for Observations 2015-16

School Code	School Name	Percent Economically Disadvantaged
	Elementary (11)	
307	Alston Ridge Elementary	7.19
447	Holly Springs Elementary	16.64
572	Underwood Magnet Elementary	22.14
624	Willow Springs Elementary	27.31
451	Harris Creek Elementary	33.59
544	Rolesville Elementary	38.30
448	Hunter Magnet Elementary	43.09
460	Kingswood Elementary	50.86
618	Wildwood Forest Elementary	59.72
440	Green Elementary	71.63
403	East Garner Elementary	80.71
	Middle (4)	
502	Mills Park Middle	8.71
450	Holly Ridge Middle	24.51
592	Wake Forest Middle	42.92
408	East Millbrook Magnet Middle	69.43
	High (2)	
473	Leesville Road High	18.31
412	Enloe Magnet High	32.74

Instrument

DRA created an observation tool adapted from the International Society for Technology in Education (ISTE) Classroom Observation Tool (ICOT) and the Florida Center for Instructional Technology Integration Matrix Scale (Welsh, Harmes, & Winkelman, 2011). The ICOT is a free online resource helpful in assessing technology integration in classrooms and it reflects ISTE Student Standards from 2007 (ISTE, 2009). The TIMS Matrix (as reflected in Discovery Education's DDIS tool) assessed the interaction of the learning environment with the level of technology integration into the curriculum. DRA added descriptive and open-ended questions to gain a more comprehensive understanding of the actual lessons and technology's role in them. Examples of each level are included in the blue sidebars showing increasing levels of integration.

Data Collection

Each school was allotted four TLC member spots. Each of the six observers attempted to observe all TLC members at two or three schools in a geographic area. Steps taken included:

- Principals were notified of the purpose of the visit and to verify who the TLC members were,
- Teachers were then emailed about the purpose of the observations and the week an observer would be at the school. Teachers were asked to note if any times would not work, but were not told the actual day that the observation would occur (to keep instruction as natural as possible). Middle and high schools typically provided times to avoid due to other commitments.

We found various situations which impacted our sample size and scheduling. At some schools, the TLC team was not full (4 members), some teachers were on leave or tracked out, some had student teachers (and were therefore not teaching), and some had committee/team obligations that made some days impossible for observations. Additionally, some schools had field trips or school picture days during this period which made scheduling more difficult. The number of situations that pulled teachers out of their classrooms was somewhat surprising. In a few cases, teacher commitments meant teachers knew observations would be one of two days.

TIMS ENTRY LEVEL*
GRADE 5 SAMPLE

Lesson: The goal of this lesson was to review the functions of the main human body systems.

Teacher: During this portion of the lesson, the teacher showed the class a PowerPoint presentation she created with one or two slides that highlighted the parts of a body system and the function of that system in the body. On at least two occasions, the teacher played familiar songs where the lyrics were changed to describe a body system.

Students: The students responded as a whole group to the teacher's questions about different body systems. They were asked to make notes so they would have reference study materials for an upcoming test.

Rationale: This lesson was rated as entry (the lowest level of integration) because the teacher delivered all of the information while the students played a passive role. The use of technology in this setting was very conventional with no student choice or opportunity for exploration and collaboration.

* The level of technology integration is one way to classify lessons. See TIMS Section later in this appendix for level descriptions.

Overall, 49 of the 68 observations were completed (72%), as shown below.

Table H.3
TLC Members by School and Observation Completion

Level/# Schools	# Observations Expected	# Observations Completed	% of Sample Observed
Elementary n=11	44	32	72.7%
Middle n=4	16	9	56.3%
High n=2	8	8	100.0%
Total	68	49	72.1%

Some of those who could not be observed were asked for an example of how they used what they learned in TLC and whether they found it valuable.

Results

Technology was used by TLC members in a wide variety of ways in the observations, representing all levels of integration into instruction. Some were quite basic, such as watching videos, while others were more advanced, such as students selecting a topic and then utilizing various technology to find information and produce a presentation or report. Technology was more often considered as appropriate, but not necessary for a lesson. This implies technology was used as a way to enhance the learning. Student engagement was high. Teachers most often modeled discussion or provided interactive direction, but also often facilitated or supported student learning. DRA staff observed examples of all student ISTE standards.

How Did TLC Members Use Digital Resources?

What technology was used and how?

A wide range of technology was utilized by students and teachers in the observed lessons. Some of the most common were computers (desktop and laptop), interactive white boards, iPads, Smartphones/handhelds, presentation software, and Google documents and spreadsheets. Less commonly noted were video cameras, televisions, Website builders, response system, Discovery Education, Splash Math, Wikis, assessment software, and graphics. Teachers also occasionally used document cameras.

In a few of the observations, teachers used one device with the whole class; in others two or three students shared a device (perhaps an iPad or laptop or a combination); and all other students had a device to work on individually (through the use of a laptop cart, a computer lab, or as part of a Bring Your Own Device effort). There were instances when students also rotated through activities or centers which did and not involve digital learning. In addition, technology was used to display timers and student group membership, to create graphic organizers, and to prepare reports and presentations. Specific examples of lessons are included by type based on the TIMS framework in the summary of this report and in this appendix.

In most of the observations, full classes of students were observed. The average number of students was 21 overall, with secondary observations having more students on the average than the elementary

observations. The number of students per device available was lower in high school and elementary classrooms than in middle schools. Access was usually best when students worked in a computer lab setting.

Table H.4
Number of Devices and Students Observed by Grade Span

	Average # Students	Average # Devices	Students Per Device
Overall	**21.0**	**7.2**	**3.4**
Elementary	19.3	5.3	2.7
Middle	23.6	15.4	6.6
High	24.9	6.0	2.4

Source: Classroom observations (n=49)

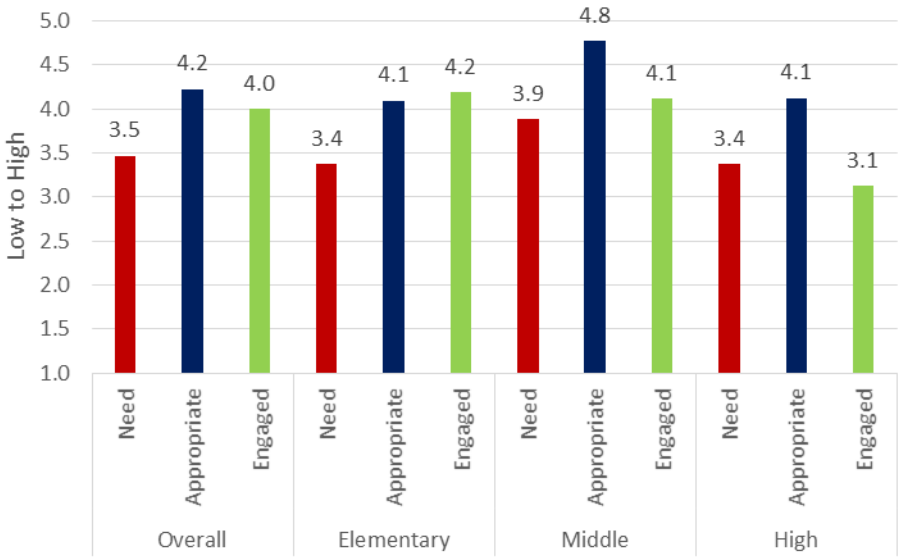
Did the use of technology enhance the instruction?

- **Was it needed for the lessons?**
- **Was it used appropriately?**
- **What was the level of student engagement?**

As Figure H.1 shows, average ratings for the level of need for technology and the appropriateness of technology were both above the midpoint on the five-point scale. The level of engagement was also above the midpoint on the scale.

Need for digital resources was rated somewhat lower than the appropriateness of its use (roughly 3.5 versus 4.3 across subjects, respectively). Thus, technology use was often considered *appropriate* even when it was not *necessary* for a lesson. In that sense, teachers saw technology as enhancing their instruction. In terms of student engagement, ratings also were fairly high (4.1 in middle and 4.2 in elementary) except in high school, which was 3.1 (just above the scale midpoint). Middle schools had the highest ratings for need and appropriateness.

Figure H.1
Need and Appropriateness of Technology and Student Engagement by Grade Span



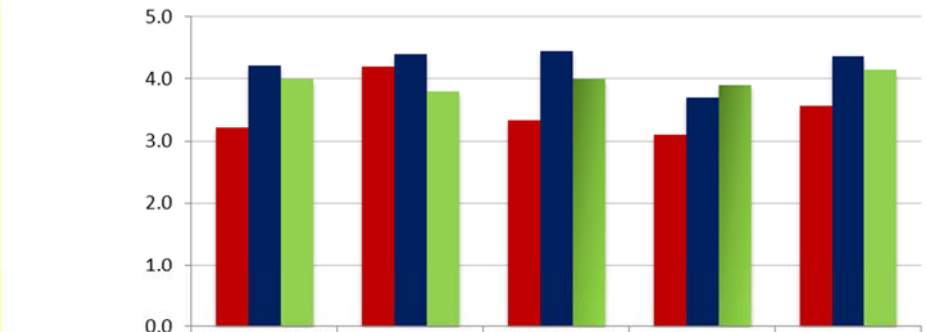
Level (n)	Need	Appropriateness	Student Engagement
Elementary (32)	3.4	4.1	4.2
Middle (9)	3.9	4.8	4.1
High (8)	3.4	4.1	3.1
Overall (49)	3.5	4.2	4.0

Source: TLC Observations, Spring 2015. n= number of observations
Scales: Need for Technology: Not needed (1) to essential (5)
Appropriateness of Technology: Not appropriate (1) to very appropriate (5)
Level of Student Engagement: Not engaged (1) to very engaged (5)

When examined by subject (see Figure H.2), the pattern of responses was similar to those by grade span, with appropriateness highest, engagement next, and need lowest (but still above the midpoint of the scale). The need and appropriateness and engagement of students varied somewhat by subject. Small sample sizes should lead to cautious interpretations of the following trends:

- Science was observed as having the highest need for technology in the lesson and the second highest appropriateness.
- Math was observed to have the lowest need for technology and the lowest appropriateness, but student engagement levels were higher when technology was used.
- The Multiple Subjects category scored the highest for level of student engagement. Nine out of 14 of these observations combined Language Arts with another subject.

Figure H.2
Need and Appropriateness of Technology and Student Engagement by Subject



	Language Arts (n=9)	Science (n=6)	Social Studies (n=9)	Math (n=10)	Multiple (n=14)
Need	3.2	4.2	3.3	3.1	3.6
Appropriateness	4.2	4.4	4.4	3.7	4.4
Engaged	4.0	3.8	4.0	3.9	4.1

Source: TLC Classroom Observations, Spring 2015 Scale 1-5
n=number of observations. Total was 49, but sample sizes by subject were small.

What were the teacher and student roles?

Technology Integration Matrix (TIMS)

The Technology Integration Matrix (TIMS) categorizes lessons according to the level of technology integration (i.e., entry, adoption, adaptation, infusion, or transformation). Within these levels, lessons are further characterized based on the learning environment (i.e., active, collaborative, constructive, authentic, and goal directed). The full scale is shown in Table H.7. An example of each level on the technology integration scale is shown in sidebars in this report and in Figure H.6 along with the characteristics of the learning environment.

All levels of technology integration were observed, which was a positive finding. More lessons were in the middle of the matrix than at the extremes as shown in Table H.5. This indicates teachers had generally gotten past the use of technology per se (although it was sometimes found useful for basic tasks) and had adopted use of technology in conventional ways as well as adapting lessons to give students more opportunity to work independently or in collaborative groups.

Table H.5

Percentage of Observations in Each Level of Technology Integration

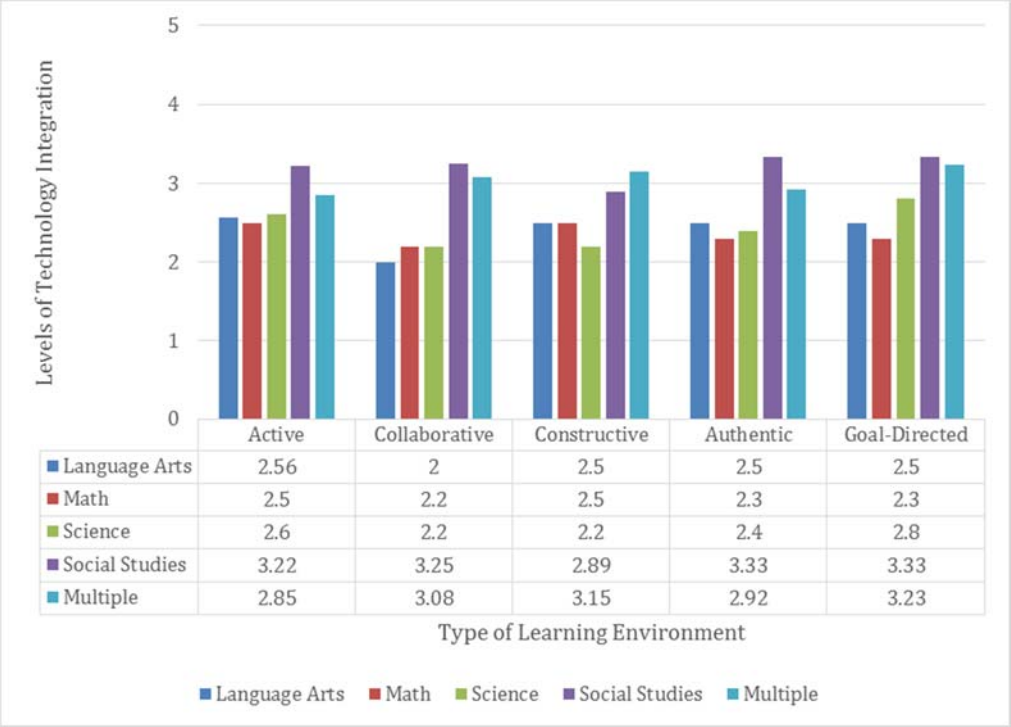
Entry	10.3%
Adoption	35.0%
Adaptation	30.9%
Infusion	14.4%
Transformation	9.5%

N= 49 observations

In terms of the characteristics of the learning environment, all levels (i.e., active, collaborative, constructive, authentic, and goal directed) were observed. By subject, average ratings of technology integration were generally highest for social studies and multiple subject lessons. By type, collaborative environments were rated lower for technology integration than the other types.

Figure H.3

Average Ratings of Learning Environment by Subject Based on TIMS Matrix



Note: The numbers on the Y axis correspond to the Levels of Technology Integration into the Curriculum according to the TIMS Matrix. 1= Entry, 2= Adoption, 3= Adaptation, 4= Infusion, and 5= Transformation. Based on 45 observations with necessary data.

Teacher Roles

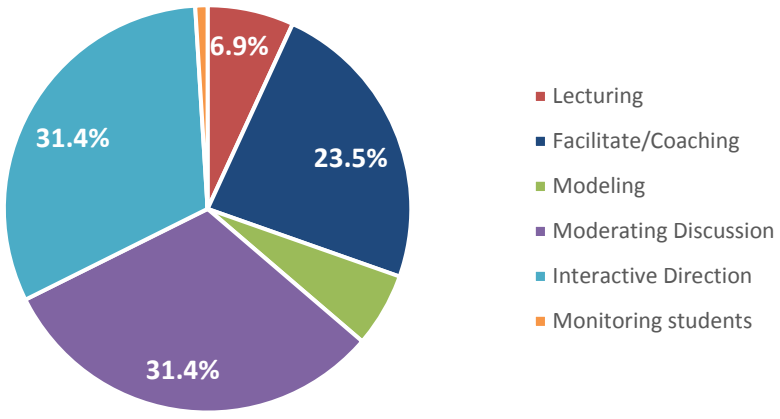
One section of the Teacher Leader Corps (TLC) observation form asked for the role or roles of the teacher based on five categories as shown below.

Table H.6
Definitions for Teacher Roles

Lecturing	Teacher conveying information to the students with little or no interaction during the presentation.
Interactive Direction	Teacher presenting material while asking questions and eliciting prior knowledge or critical thinking.
Facilitating/Coaching	Teacher providing advice to learning activities undertaken by the students outside of teacher presentation.
Modeling	Teacher explicitly demonstrating behavior or procedures. Distinguished from lecturing by the emphasis on demonstration rather than explication.
Moderating Discussion	Group facilitation, where the teacher advises a dialog conducted among students. Distinguished from Interactive direction by the emphasis on student interaction with one another rather than response to the teacher.
Other (Monitoring Students)	Teacher is monitoring students completing individual or group work. This could be an assessment, assignment, or independent reading.

Monitoring was the only response noted in the "Other" category. Observers could select more than one role, and often two or three were selected during the course of one lesson. Moderating discussion and interactive direction were most commonly observed (representing over 30% each of the responses). Facilitate/coach was also quite common with 24% of the responses. Lecturing, modeling, and monitoring students were least commonly observed.

Figure H.4
TLC Teachers' Role During Lessons Observed



Source: TLC Observations. 102 responses were given for 31 of the observations.

Observers had the option to provide additional notes on the role of the teacher. These comments were coded categorically, and provided more detail on teacher roles. Comments reflected that teachers' roles were varied, and indicated teachers provided individual instruction and explanations, served as facilitators of student work, and supporting students as they worked.

- Individual instruction and explanation of the lessons accounted for close to one third of the coded data (10 responses or 32% of coded data). The following is one example of a teacher's role: The teacher discussed the appropriate uses of technology and explained good strategies that some students were using which could be helpful to others.

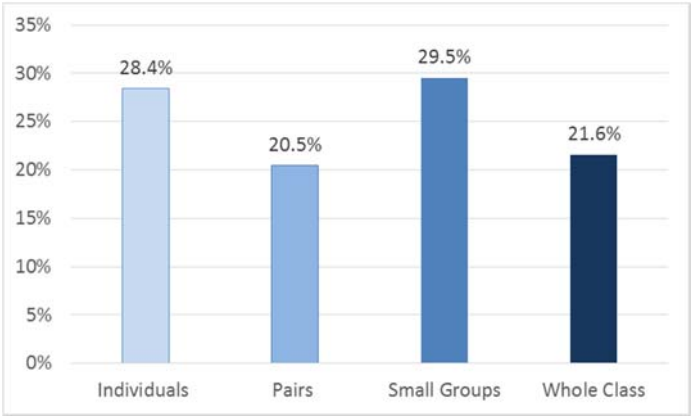
- Teachers worked as facilitators in their classrooms often (8 responses or 26% of coded data). For example, one observer noted that the teacher "facilitate[ed] discussion and interaction of sharing what they [knew] and adding facts to a list."

- Teachers also functioned in a support role for their students (6 responses or 19% of coded data). For example, an observer noted that the "Teacher and two assistants support[ed] groups of students in drafting story problems and coming up with a plan. [The] teacher showed examples to the students of what they would create (video of his/her students acting out story problem last year). [The] teacher support[ed] students in working toward creating their own videos."

Student Roles

Small group and individual work were observed somewhat more often than work with the whole class or in pairs, but each student group size represented at least 20% of the responses.

Figure H.5
Percentage of Responses Related to Student Group Size during Observations



N = 88 responses.
Note: Multiple responses were possible within one lesson.

Observers indicated the occurance of a variety of activities during each observation. Trends in the types of activities observed were that:

- A wide variety of activities were observed, sometimes within the same lesson.
- The most frequent activities observed (11% to 14% of the time), included information analysis, watching a video, student discussion, drill and practice, and writing.
- Creating a presentation, giving a presentation, hands-on skills, and conducting research were observed 6% to 9% of the time.
- Activities observed less than 5% of the time were receiving a presentation, taking a test, or playing an instructional game.

Observer notes provided more detail on the choices students were provided within lessons for 39 observations. These qualitative data were coded into descriptive categories and indicate the following trends related to student choice and instructional technology available. Comments were mixed on student engagement.

- The most common coding category (10 of 39 responses or 26% of coded data) suggested that students had a choice either of the type of technology used or the particular software being used on a device. For example, one observer noted, "This lesson provided the students the opportunity to engage in their own research on a topic of their choosing. Students were able to select the type of device they were most comfortable using and were apparently told to bring a device from home prior to class." Conversely, four responses or 10% of the coded data reflected that the students lacked choice in the lesson observed. For example, an observer noted that there was "very little student choice and not a lot of critical thinking or inquiry" in that particular lesson.
- The second largest coding category (8 responses or 21% of coded data) indicated that students had access to multiple types of technologies in the lessons observed. As one observer noted, "[The] teacher utilized multiple technology programs and hardware seamlessly. [The teacher] utilized Google Documents and Edmodo in ways that built collaboration and kept parents aware and involved."

ISTE Standards

The ISTE Standards for student use of technology (2007 version) relate to creativity, communication, information fluency, critical thinking, digital citizenship, and technology operations. Each area has four standards associated with it. The full list of standards is included at the end of this appendix. As mentioned earlier, the largest number of observations was at the elementary level, so this list is most reflective of elementary TLC teachers. Activities were observed which related to all of the standards. These standards included:

- Creativity--Apply existing knowledge to generate new ideas, products, or processes.
- Communications-- Interact, collaborate, publish with peers in digital environments and communicate information ideas to audiences using a variety of media and formats were mentioned an equal number of times.
- Information fluency--Locate, organize, analyze, evaluate, synthesize information or data.
- Critical thinking-- Plan and manage activities to develop a solution or complete a project.
- Digital citizenship--Practice safe and responsible use of technology, and exhibit positive attitude. toward technology that supports collaboration were mentioned most frequently.
- Technology operations-- Demonstrated understanding of technology being used.

The full list of frequencies for each standard, along with the complete list of standards, is shown in Table H.8. Based on the 52 observations recorded, the standard most often observed was under technology operations (43 times). The next most common related to digital citizenship, in which two standards were commonly observed including practice safe and responsible use of technology and exhibit positive attitude toward technology that supports collaboration (35 and 34 times, respectively). These reflect basic skills and attitudes students must have to take advantage of technology in learning.

The standard least often observed was under the creativity standard (5 times in 52 observations). Additionally, critical thinking was another standard that was seldom observed (12 times).

Some examples of basic and advanced activities under creativity included students:

- Completing skill and drill practice problems
- Exploring how bee-keeping equipment works
- Looking up characters, places, words from their books that were historical fiction focused on the Civil War
- Using many different strategies to solve complex word problems
- Creating a newsletter in Publisher or Word on one of the three regions in NC designed to share why people should visit or move to the area. They reviewed articles and a website to find information for the newsletter, and produced the newsletter in one of two software programs (Grade 4)

Table H.7

Levels of Technology Integration into the Curriculum

Characteristics of the Learning Environment	Entry	Adoption	Adaptation	Infusion	Transformation
Active	Information passively received	Conventional, procedural use of tools	Conventional independent use of tools; some student choice and exploration	Choice of tools and regular, self-directed use	Extensive and unconventional use of tools
Collaborative	Individual student use of tools	Collaborative use of tools in conventional ways	Collaborative use of tools; some student choice and exploration	Choice of tools and regular use for collaboration	Collaboration with peers and outside resources in ways not possible without technology
Constructive	Information delivered to students	Guided, conventional use for building knowledge	Independent use for building knowledge; some student choice and exploration	Choice and regular use for building knowledge	Extensive and unconventional use of technology tools to build knowledge
Authentic	Use unrelated to the world outside of the instructional setting	Guided use in activities with some meaningful context	Independent use in activities connected to students' lives; some student choice and exploration	Choice of tools and regular use in meaningful activities	Innovative use for higher order learning activities in a local or global context
Goal-Directed	Directions given, step-by-step task monitoring	Conventional and procedural use of tools to plan or monitor	Purposeful use of tools to plan and monitor; some student choice and exploration	Flexible and seamless use of tools to plan and monitor	Extensive and higher order use of tools to plan and monitor

Figure H.6
Sample Classroom Observations of TLC Members

TIMS ADAPTATION LEVEL GRADE 2 SAMPLE

Lesson: The goal of this science lesson was to develop student understanding of the lifecycle of a butterfly.

Teacher: After the teacher showed the class a video about the life cycle of butterflies, she facilitated an interactive activity where students shared new information that they learned from the video.

Students: Students watched a video on the SMART Board about the life cycle of a butterfly and then wrote a novel fact on a piece of paper. Sitting in a circle, students then crumbled their paper and had a "snowball fight," which involved throwing their paper in the middle of the circle. Students selected a paper from the pile, read the fact, and added another novel fact. This repeated three times until students had a sheet of four facts. Each student then shared something they learned during the snowball fight with the class before lining up for lunch.

Integration of technology was at the adaptation level in that the video provided the content for the lesson and students were allowed choice in their contribution to the list of facts. Furthermore, students had to explore and analyze previous contributions to identify new pieces of information which they could contribute to the list of facts. This activity stimulated collaborative accumulated knowledge in a virtual environment.

TIMS ADOPTION LEVEL GRADE 3 SAMPLE

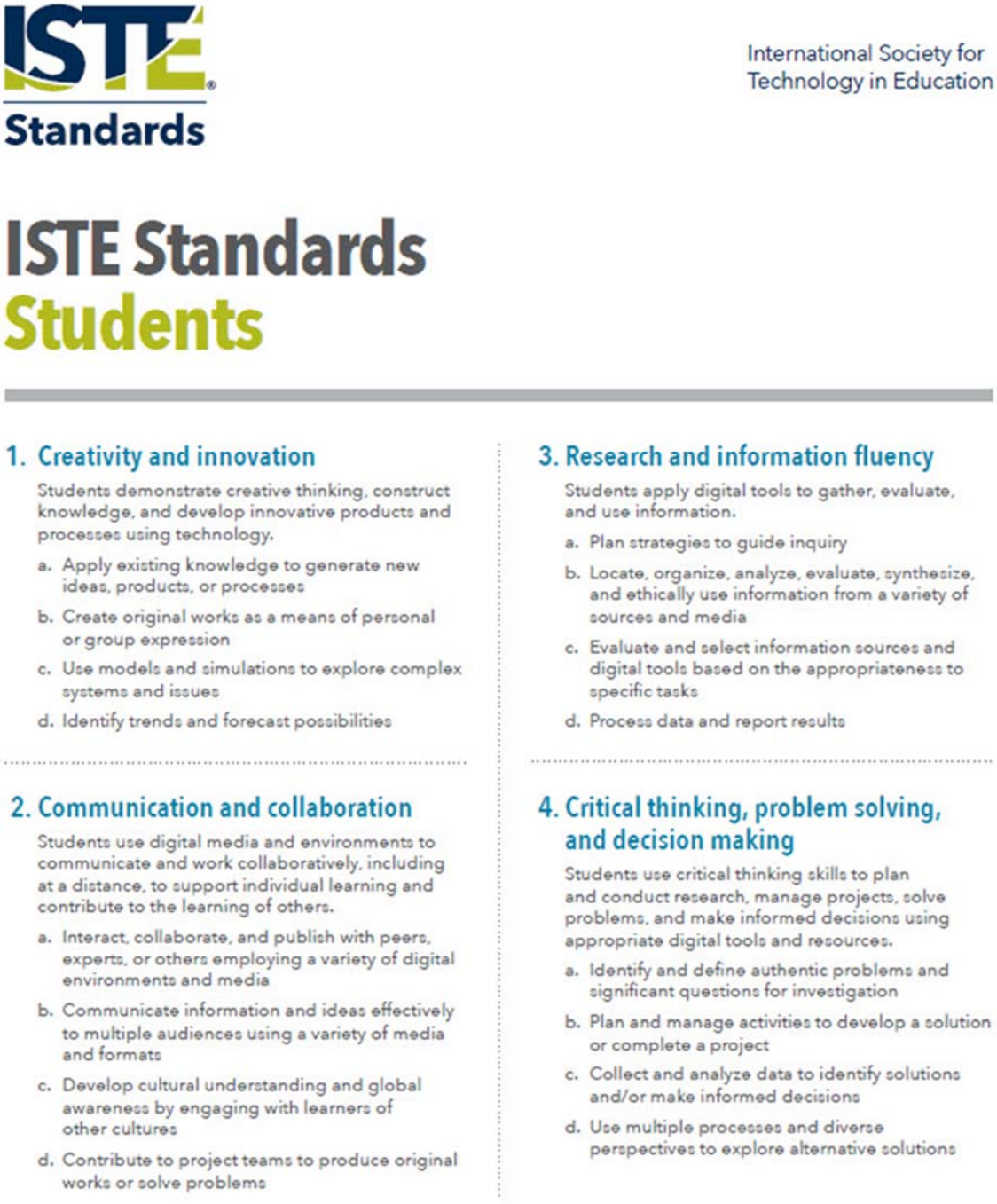
Lesson: The goal of this math level was to review student skills with fractions. The teacher led the students through a fractions game on an interactive white board.

Grouping*:* Students either paired up and shared an iPad or worked independently.

Teacher: Started with an interactive review of how the game worked, and then functioned as a facilitator as she led students through the game. Technology integration was primarily at the adoption level; students were given a structure to follow for the game, and frequently collaborated to solve problems, but in a conventional manner without individual choices.

Students: The 17 students practiced skills previously learned about fractions. To be successful at the game, students had to use prior knowledge to solve questions about fractions and record their responses via iPad. Students were allowed to create team names that protected their identities when scores were reported. Students were at ease and comfortable using technology.

Figure H.7
Student ISTE Standards



ISTE Standards

International Society for Technology in Education

ISTE Standards Students

1. Creativity and innovation

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.

a. Apply existing knowledge to generate new ideas, products, or processes

b. Create original works as a means of personal or group expression

c. Use models and simulations to explore complex systems and issues

d. Identify trends and forecast possibilities

2. Communication and collaboration

Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.

a. Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media

b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats

c. Develop cultural understanding and global awareness by engaging with learners of other cultures

d. Contribute to project teams to produce original works or solve problems

3. Research and information fluency

Students apply digital tools to gather, evaluate, and use information.

a. Plan strategies to guide inquiry

b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media

c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks

d. Process data and report results

4. Critical thinking, problem solving, and decision making

Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

a. Identify and define authentic problems and significant questions for investigation

b. Plan and manage activities to develop a solution or complete a project

c. Collect and analyze data to identify solutions and/or make informed decisions

d. Use multiple processes and diverse perspectives to explore alternative solutions

(continued from previous page)

5. Digital citizenship

Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.

a. Advocate and practice safe, legal, and responsible use of information and technology

b. Exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity

c. Demonstrate personal responsibility for lifelong learning

d. Exhibit leadership for digital citizenship

6. Technology operations and concepts

Students demonstrate a sound understanding of technology concepts, systems, and operations.

a. Understand and use technology systems

b. Select and use applications effectively and productively

c. Troubleshoot systems and applications

d. Transfer current knowledge to learning of new technologies

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Table H.8
Frequency of Observation of Each Student ISTE Standard

Creativity	Communication	Information Fluency	Critical Thinking	Digital Citizenship	Technology Operations
1a) 27	2a) 24	3a) 15	4a) 17	5a) 35	6a) 43
1b) 18	2b) 24	3b) 25	4b) 26	5b) 34	6b) 27
1c) 17	2c) 17	3c) 18	4c) 18	5c) 22	6c) 14
1d) 5	2d) 18	3d) 17	4d) 12	5d) 23	6d) 13

Note: 52 observations of full lessons occurred. Often more than one standard was addressed.