

MASSACHUSETTS DIGITAL LITERACY NOW

Final Report



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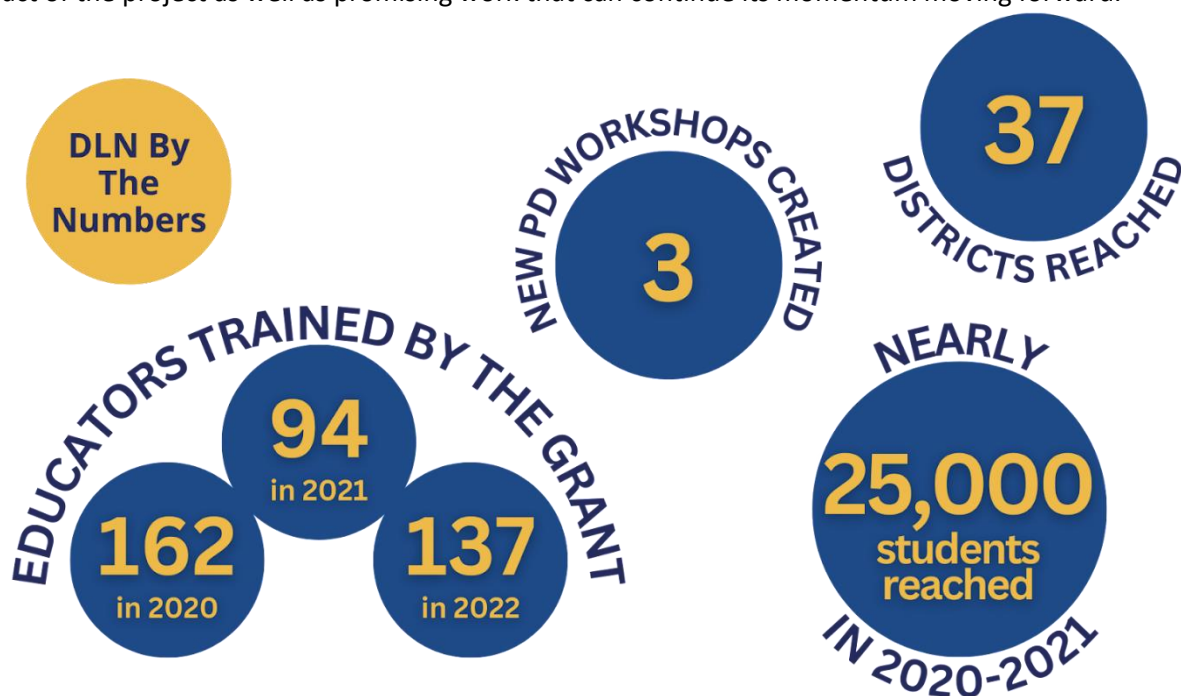
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Executive Summary

This report summarizes the key findings from the evaluation of the Massachusetts' Department of Elementary and Secondary Education's (DESE) Digital Literacy Now (DLN) Grant Program performed by SageFox Consulting Group. This evaluation spanned three fiscal years from April 2021 through December 2022 and covered grant activities that occurred from September 2019 through August 2022. Additional DLN professional development (PD) activities ran through December 2022, but not all of these were evaluated. The Digital Literacy Now grant provided MA DESE-supported funding for districts wishing to create rigorous, inclusive and sustainable K-12 Digital Literacy and Computer Science (DLCS) education. Districts first focused on grades 6-8 and then, in subsequent years, had the opportunity to expand to other K-12 grades in their districts, up to a maximum of three years of support. A cohort model encouraged cross-district learning and support.

The DLN project began its work at a difficult time in K-12 education, as the pandemic was just beginning. Even so, the project recorded notable outcomes, particularly around building capacity at the district level for making systematic changes in DLCS education. The following summary provides a brief overview of the evolution and impact of the project as well as promising work that can continue its momentum moving forward.



Project Impacts

- Overall, 36 districts and 393 teachers were impacted by the DLN project.
- Nearly 25,000 middle school students interacted with DLN-trained DLCS teachers over the course of the 2020-'21 academic year, suggesting that the training funded by the project had far-reaching impacts.
- Three new stakeholder-focused DLCS professional development opportunities were offered for counselors, administrators, and educators new to DLCS concepts, expanding the reach beyond typical teacher professional development participants.
- Anecdotal evidence from teachers suggests that the visual and hands-on nature of the DLCS work is engaging for students, but systematically examining student outcomes is challenging.
- There is strong evidence of capacity-building occurring across DLN districts, including:
 - An increasing concentration of teachers specializing in DLCS/technology/engineering.
 - Teachers from DLN districts were noticeably more likely to have attended prior DLCS PD sessions than those from non-DLN districts, suggesting growth in collective experience within districts.

- Teachers within DLN districts reported relying on colleagues for ongoing support (indicating the emergence of supportive community structures and skill sets).
- DLN districts increased the per capita number of K-8 students taking at least one DL, CS, or DLCS course sections
- DLN districts resisted the loss of DLCS teachers when compared with comparison districts
 - While DLN districts also lost teachers (especially for CS courses), they did so to a lesser degree than their comparison peers
- DLN districts increased the number of DLCS licensed teachers and sections taught by DLCS licensed teachers compared with comparison districts

Participating District Context

- Districts had a wide array of prior efforts and involvement around DLCS education, with some having had considerable DLCS experience and others having little.
- The pandemic was a significant, limiting factor on the extent to which districts and teachers could be deeply involved in DLN and DLCS-related work (and likely led to the departure of several districts).
- There were recurring issues around faculty and administrator turnover that made it difficult to achieve continuous progress within many districts.
- The curriculum selection process was often strongly influenced by the cost of the curriculum as well as associated devices and software, making Code.org’s CS Discoveries a consistently popular option.
- It should be noted that participating DLN districts can be considered “early adopters,” in that they volunteered to participate in the project. It is unclear how much effort would be required to broaden this work to the full set of public school districts in the state.

DLN Process Benefits

- SCRIPT workshops provided an opportunity to create a shared vision and long-term plan among building and district leaders.
 - Teams emphasized the importance of having a good mix of team members, including both high-level district decision-makers and building-level leaders.
- Leaders had the opportunity to examine their district at a high level, particularly patterns of DLCS offerings and course-taking. This moved them away from thinking of DLCS as a set of discrete, stand-alone offerings and more toward a broader district DLCS strategy.
- The DLN process provided a forum through which a district team could regularly meet and plan, which many teams recognized the importance of.

Opportunities Moving Forward

- Continue offering multiple tiers of support for teachers participating in PD (e.g., the *Introduction to CS for Educators* course as a precursor to an actual CS PD course).
- Continue providing opportunities for district and building leaders to meet within their districts as well as with leaders from other districts so that district teams can continue to meet and maintain (or revise) their DLCS district vision.
- Continue to maintain and expand the curriculum guide to keep a detailed inventory of CS curricula options, including cost, device requirements and teacher experiences available to district teams, many of whom reported the value of this tool.
- Continue to collect and analyze data in the future. The inception of the pandemic during the DLN project makes it extremely difficult to understand any outcomes of this work on students and will require

additional data to understand. A future examination of DLCS participation in high school of students who were in middle school when DLN began may reveal differential levels of engagement and interest as a result of participating in the project.

- Consider defining desired equity outcomes to district leaders. Discussions around diversity, equity and inclusion were prevalent during many PD sessions, though they were mostly focused strictly on increasing diversity and participation. An official definition or set of recommendations from DESE might help broaden and unify these efforts for future training and expand into areas such as structural issues and student engagement.
- Consider prioritizing the potential provision of ongoing support for DLCS educator communities and funding for equipment as these were the most important elements that teachers wanted continued access to.

Introduction

Context of the grant/evaluation

The Digital Literacy Now (DLN) grant was a three-year program sponsored by the Massachusetts Department of Elementary and Secondary Education’s (DESE) which provided financial support to K-12 districts interested in creating or expanding equitable, rigorous, and sustainable Digital Literacy and Computer Science (DLCS) education programs. Grant activities occurred between September 2019 and December 2022. Districts focused on grades 6-8 in their first year, and then had the opportunity in subsequent years to expand to other K-12 grades, up to a maximum of three years of support. A cohort model encouraged cross-district learning and support.

SageFox Consulting Group was contracted to evaluate the grant program, during an evaluation that covered three fiscal years between April 2021 and December 2022. This work was guided by a logic model (shown both as an initial and retrospective [Logic Model](#)) and a comprehensive set of specific [Research Questions](#) collaboratively developed over the course of the project with the DESE-DLN leadership team (Paula Moore, Anne DeMallie and Elana McDermott). Evaluation activities included interviews, observations, surveys, and state data analysis.

Collaboration between SageFox and the DESE-DLN Leadership team was achieved through biweekly meetings and interactive review of project instruments and reports. This report is not designed to rigorously address each research question that guided this evaluation, rather it is intended to provide a high level overview of the themes that emerged across all program evaluation activities and findings, providing links to prior reports that delve into greater detail to answer each of the specific questions (see [Report Catalog](#) for all previous reports).

Key project outputs include the participation of 36 districts and one education collaborative over the course of the grant (Table 1) and the engagement of 393 educators.

District	Cohort	1st Year	2nd Year	3rd Year
Boston	1	20-21	21-22	22-23
Dennis-Yarmouth	1	20-21	21-22	22-23
King Philip	1	20-21	21-22	22-23
Lowell	1	20-21	21-22	22-23
Nauset Regional	1	20-21	21-22	22-23
North Reading	1	20-21	21-22	22-23
Springfield	1	20-21	21-22	22-23
Burlington	2	21-22	22-23	N/A
Chelmsford	2	21-22	22-23	N/A
Dighton-Rehoboth	2	21-22	22-23	N/A
Maynard	2	21-22	22-23	N/A
New Bedford	2	21-22	22-23	N/A
Agawam	1	20-21	21-22	
Attleboro	1	20-21	21-22	
Manchester Essex	1	20-21	21-22	
Mashpee	1	20-21	21-22	
Peabody	1	20-21	21-22	
Quaboag	1	20-21	21-22	
Randolph	1	20-21	21-22	
Woburn	1	20-21	21-22	
Billerica	1	20-21		
Bourne	1	20-21		
Duxbury	1	20-21		
EDCO Collaborative	1	20-21		
Granby	1	20-21		
Holliston	1	20-21		
Ipswich Public School	1	20-21		
Lynn	1	20-21		
Somerset	1	20-21		
Southwick-Tolland-Granville	1	20-21		
Taunton	1	20-21		
Tyngsborough	1	20-21		
Berlin Boylston	2	21-22		
Gardner	2	21-22		
North Middlesex	2	21-22		
Norwood	2	21-22		
West Bridgewater	2	21-22		

Table 1: District participation in DLN project, by cohort and year

Covid-19 disruption

The implementation of the grant was disrupted by the outbreak of Covid-19 in the spring of 2020. Only a single group of districts was able to hold their initial SCRIPT workshop in person before districts shifted to remote operations. Despite this interruption, the workshops were able to be held in a virtual environment. Few districts were able to implement DLCS in their districts in that first year to the extent that they wished to do so prior to the pandemic. We also saw that a number of districts were not able to continue with the grant for a second year due to complications caused by the pandemic in staffing or resource prioritization. Due to changes in the funding allocated by the state for the program, no new districts were able to join the grant (or return to the grant, in the case of interested non-continuing districts) in the third year. Unsurprisingly, districts reported that Covid-19 was a significant barrier to progress in every domain. [[DLN 2021 Evaluation EoY Report](#)]

Findings from Districts/Schools

Educators' ability to implement DLCS, as well as the eventual schedule, pacing, availability of materials, and student participation was heavily influenced by the broader district context. Educators reported a wide range of actual instruction hours and the cadence by which they worked with students. For some educators, they worked with students for a full academic year on a weekly, if not daily basis. For other educators, they may have seen students for a total of 20 class periods across a trimester before rotating to another group of students.

[[Combined Educator & Student Survey Report 2022](#)]

Particularly important themes and findings for specific districts and schools include:

- There was massive importance and benefit to providing funding time for district teams to vision, plan, and discuss DLCS implementation, especially when supported by scaffolded activities (e.g., SCRIPT workshops).
- Districts were able to build their internal infrastructure and instructional capacity throughout their participation in the grant.
 - Much of this was due to the time and attention given to the training of teachers.
 - Additional credit should be given to districts educating counselors and administrators.

Finding a district's place in the state landscape

State ecosystem vs individual district approach

There was evidence of an increased concentration of teachers who identified as CS/technology/engineering teachers participating in DLCS PD sessions in 2022 vs. 2021. This may indicate increasing specialization within districts and, as a corollary, increased capacity to teach CS. [[DLCS Professional Learning Survey Report 2022](#)]

DLN building and district administrators were asked to think about whether DLCS goals were aligned across administrative levels (i.e., state, federal, district). About one third of respondents (including two of the three district level officials) did not feel there was alignment or were not sure there was. Those who elaborated on their response pointed to alignment between state and local goals, and did not touch on national standards. When asked how this alignment could be improved, the most common response was that more time and discussion was necessary. [[DLN Administrator PD Survey Report 2022](#)]

SCRIPT as a tool

The long-term planning process that DLN engaged districts in (particularly through SCRIPT) was seen as very important. This provided the opportunity to reflect on district data (which often showed gaps and inequities) as well as the opportunity to create a shared vision that focused district and building leaders on common goals.

This highlights the importance of administrative buy-in to support sustained change within a district. [[DLN District Survey Report 2022](#)]

Districts especially appreciated the opportunity that the grant provided to focus time and personnel on DLCS coursework. The SCRIPT process was seen as very valuable, with one district noting “it gave us a pathway, you know, so it made us see through all the weeds, what our next steps were, and things like that, to wrap our own minds around it.” [[DLN Non-continuing District Interview Report 2021](#)]. Specifically, the SCRIPT process led to:

- Increased knowledge and awareness of the happenings of DLCS and work being done at the district level, (identified by five respondents as the most important benefit).
- Time dedicated to meeting as a team, distinguished by twelve respondents as being the primary benefit, which allowed for rich discussion and an evaluation of strengths and weaknesses of DLCS education within their district. [[DLN 2021 Evaluation EoY Report](#)]

A particularly valuable exercise was being able to examine coursetaking data. In the first year evaluation report, we reported that about 33% of respondents noticed inconsistencies in their DLCS coursetaking data as presented by DESE, such as incorrect course names due to errors in course code entry. The records were drawn from ‘19-’20 coursetaking records that had been submitted to DESE by the districts themselves.

In the second year, most respondents who participated in workshops in both years felt that their first year SCRIPT ratings were largely accurate. This suggests that a) districts carefully and thoroughly reflected on their experience going into the workshop and made a candid effort to capture their actual level of DLCS instruction capacity and b) that the SCRIPT process is a valid way for framing district self-assessment going into the grant program.

Early Adopters

It should be noted that most of the DLN-participating districts can be considered “early adopters,” in that they volunteered to participate in the process of building their capacity around offering DLCS. The next phases of this work will involve bringing in districts that may be less enthusiastic or well-equipped to build this capacity, and thus it may beget challenges not seen during this phase of the work.

Time and space for visioning & reflection

- An important element of the grant was its focus on funding peoples’ time to do long-term goal-setting and plan creation around DLCS education at the district level.
- The time offered to refocus and structure future work was identified by twelve respondents as being the greatest benefit of the SCRIPT experience, stating it brought their focus back “during a school year where it feels practically impossible to focus,” especially in responses to engaging with “robust prompting questions” that “stimulated some rich discussion.”
- The greatest reported benefits of the SCRIPT workshop were interactions with other districts, the opportunity to refocus and structure future work, increased knowledge and awareness about DLCS education planning, and dedicated time to work closely within district teams. [[DLN 2021 Evaluation EoY Report](#)]

Capacity and Infrastructure

- Infrastructure-building successes included increased teacher enthusiasm, greater district-level capacity for DLCS, building district level DLCS teams, and generating leadership buy-in.
 - The approach to infrastructure-building through DLN took a long-term strategy approach rather than focusing on discrete offerings (such as isolated teacher PD sessions).

- In addition to sponsoring summer PD offerings, teacher capacity was built through the Introduction to CS course, which was able to raise educators' perceived level of skill around DLCS, making them feel more prepared for upcoming PD offerings and being able to implement DLCS within their own classroom setting.
- Barriers to infrastructure-building for DLCS districts were turnover, attracting qualified teachers, and an unclear locus of decision making.

Building foundation for the district, making trained teachers want to stay

The districts reported that turnover in faculty and administrative roles as well as difficulty finding new DLCS teachers complicated DLCS coursework implementation. As one district team noted, the payscale and level of autonomy differ greatly between public school districts and the technology industry, so it can be hard to attract experienced professionals to teaching roles. One district expressed a desire for tighter integration between grant funding and certification, such as a pathway from PD to the certification. [[DLN Non-continuing District Interview Report 2021](#)]. Given that teachers are helping to not only spread awareness of DLCS, but also act as a hub of spreading practice (two-thirds of survey respondents have shared their DLCS work with colleagues and, of those, 83% reported that a colleague has implemented some element of DLCS content), they are an important source of school and district-level capacity-building. [[Combined Educator & Student Survey Report 2022](#)].

Statistical analysis shows that it is highly likely that Continuing districts have increased their reported level of DLCS district capacity. Statistically significant differences were found between Continuing districts' second year scores and each subgroup of first year scores. Growth in leadership scores seem to be the most important difference at this time. We recommend looking at the data from Cohort 2's second SCRIPT workshop to test this promising trend further. Participants did not complete the same battery for year three workshops, so we have no direct comparison. [[DLN 2021 Evaluation EoY Report](#)]

Participants noted time and again that the composition of their DLN teams mattered significantly, particularly in terms of gaining buy-in across stakeholder groups and being able to put together actionable plans. One respondent noted that, because their team did not have a representative who had the authority to make decisions for the district, they felt that their planning became more of a set of recommendations, rather than actionable items. Another respondent spoke to the importance of having principals as part of these teams, and emphasized the need to have principals on board early and across the district (not just the one or two who might be on the SCRIPT team). [[DLN 2021 Evaluation EoY Report](#)]

Evidence of infrastructure-building in DLN Districts

The growth in district capacity was evident most noticeably in the fact that nearly all respondents said that DLCS teachers within their district relied on colleagues for ongoing support, indicating burgeoning skill sets and community structures among teachers. Support capacity appeared somewhat higher in continuing districts, particularly in terms of perceived support from instructional support staff and building/district leaders. [[DLN District Survey Report 2022](#)]

Notable evidence of capacity and infrastructure-building within districts also emerged during the 2022 summer PD workshops, and included:

- Guidance counselors attending from DLN districts (which did not happen with non-DLN).
- Teachers from DLN districts were noticeably more likely to have attended a prior PD versus those from non-DLN (65% vs. 33%).

- The majority of DLN participants (roughly two-thirds) were asked to participate in their PD by their districts (versus only about one-third from non-DLN districts), indicating that this is more likely part of a systematic district plan versus decisions made by individual educators.
- DLN teachers were more likely to expect to implement workshop content with the support of their district or PD provider, while non-DLN were more likely to expect to implement independently.
- DLN respondents were more likely to attend the Intro to CS PD, suggesting that there was likely more communication and encouragement from the district on this workshop. [[DLCS Professional Learning Survey Report 2022](#)]

Some teams realized that their initial staff training and team-building plans were inadequate as they did not fully represent the needs and interests of certain groups (such as guidance counselors).

They also recognized the importance of ongoing work to build a district leadership team with a shared vision, especially with turnover of leaders. Many saw this piece as being of similar importance to teacher PD and viewed it as something that would benefit from funding. [[DLN District Survey Report 2022](#)]

Most teams had plans to continue DLN-related work going into the future. Of particular importance to most of them were issues such as developing pathways, creating and providing new offerings and advancing teacher PD. [[DLN District Survey Report 2022](#)]

Integration of CS into other subject areas is becoming increasingly important, as is evident from Table 2, below, which suggests that DLCS may be integrated into specials or 6-12 coursework (16% in 2021 vs. 34% in 2022). We are also seeing less emphasis on the elementary school classroom as time goes on - in 2021, 25% of participants were elementary classroom teachers, compared with 7% in 2022. [[DLCS Professional Learning Survey Report 2022](#)]

<i>Table 2: In which content area will you be teaching content from this course? (2021 overall vs. 2022)</i>	2021 (N=57)	2022 (N=91)
Integrated into another subject	16%	34%
Library/Media	4%	10%
My K-5 general education classroom	23%	8%
Standalone DLCS course	46%	49%
Unsure	5%	9%
Not implementing this year	4%	1%

Findings about Educators

As mentioned above, the attention given to teachers was an especially critical part of the grant. Teacher specific evaluation themes include:

- Showing teachers they were valued through the quality of the professional development opportunities they were offered and the care given to their accommodations during those programs.
- Additional opportunities remain to continue to engage educators once their training is over through ongoing curriculum support.

Treating teachers as valued professionals

In almost every survey, we found that our respondent pool was made up of highly experienced teachers, many of whom had more than 10 years of experience. These teachers bring a wealth of knowledge and practical

expertise to their DLCS teaching or support functions. This is true even for those teachers who are new to DLCS content. This breadth of experience can potentially be factored into PD offerings and expectations around implementation. In addition, it was reported to us that teachers valued that the workshops were held in nice locations with good food provided and the opportunity to stay on site or nearby overnight. Such provisions could enhance the experience for educators, and make them more likely to participate in similar opportunities in the future.

Educator engagement

The grant program took a number of steps to increase the engagement of educators in the DLCS landscape. One such activity was the creation of the *Introduction to Computer Science for Educators* PD session. This new PD demonstrated that having a dedicated CS content PD supports educators in engaging more deeply with curricular PD. This was particularly true for first-year DLCS teachers (who made up 92% of our respondents to this survey) and those who rated their prior DLCS knowledge as low or very low (~75% of the sample).

The PD seems to have met its goal of improving teachers' confidence and knowledge in CS, since most teachers "leveled-up" by rating their post-workshop knowledge at least one point higher than their pre-workshop knowledge. More than half of participants said that most or all of their CS knowledge came from this PD experience. Additionally, 61% felt very prepared for the curriculum PD they would be taking at the end of the summer, with only a single person reporting that they felt very unprepared. [[Intro to CS Workshop Report 2022](#)]

We also identified additional areas where educators could continue to be supported and engaged. One area in which teachers would like to receive more (or ongoing) support is around funding for equipment (such as devices or technology tools) as well as being able to participate in a community of other educators. [[DLCS Professional Learning Survey Report 2022](#)]

Another specific challenge encountered by a number of educators during their curriculum workshop was pacing. Many teachers commented that there seemed to be a lot of time devoted to things like debriefing, reflection and discussion but not as much time devoted to curriculum content as they would have liked. This seems to confirm that this is a core issue for some of the workshops, and not a product of the courses being taught virtually, as was speculated during the 2021 PD workshops. [[DLCS Professional Learning Survey Report 2022](#)]

Findings about Grant-provided Supports

In addition to the planning process, DLN was also praised for providing pragmatic support in a variety of ways. This included the provision of funding and time for teacher PD (both newly hired teachers as well as re-training existing ones), resources to obtain technology and devices for teaching DLCS as well as providing a forum in which curriculum could be reviewed to help ensure that it aligned with existing standards and coursework. [[DLN District Survey Report 2022](#)]

Multiple sources of support

- For some districts, the DLN experience built on prior and related work around DLCS education. Several reported that, prior to receiving the DLN grant, they had experience with other DLCS curricula through prior grant work or district initiatives. This prior experience with curricula allowed the district to make a more informed decision about which curriculum to adopt as part of this grant effort (though teams noted that the curriculum education materials provided by DESE were very informative). [[DLN 2021 Evaluation EoY Report](#)]
- The wide expanse of outside offerings and efforts occurring across districts makes it difficult to ascertain the impact of any single initiatives happening simultaneously in a district (such as DLN). Additionally,

some district leaders may have been challenged in determining the degree to which to prioritize systemic supports (such as DLN) versus more traditional, implementation-level supports.

Areas where support is still necessary

Teams were uncertain about their ability to sustain the work that had begun through DLN without additional external funding, with one major issue being the continued recruitment and retention of instructors. Other issues included finding district resources to fund dedicated administrative positions as well as providing stipends for ongoing PD. [[DLN District Survey Report 2022](#); [DLN 2021 Evaluation EoY Report](#)]

Positive data from certain interventions suggests likely benefits of continuing and/or expanding them. This was particularly true for the Intro to CS course and the administrator PD. Additionally, while the evaluation did not explicitly evaluate the Counselors for Computing professional development, that course would also likely be beneficial to continue after the grant program ends.

Most districts were somewhat uncertain about how to measure and collect metrics around DLCS and the implementation progress of their grants — they expressed uncertainty both in terms of course assessments as well as collecting metrics around student participation. [[DLN 2021 Evaluation EoY Report](#)]

Findings about Students

Future Longitudinal Examination

Student interest and awareness in courses was difficult to predict, and several teams were working on deliberate efforts to market these offerings more effectively, particularly to historically underrepresented groups. [[DLN District Survey Report 2022](#)]

Several teachers reported that the hands on, visual nature of the work engages many students. One particular scene recounted by a teacher points to the possible benefits of DLCS on students' social and emotional engagement and well-being, as well as peer collaboration and teamwork efforts. "To the point where these, these two little boys they're in, I think they're in sixth grade. They're getting so excited about creating this story. This animated story in Scratch. It was so cute. These two little boys are huddled together laughing and giggling. And for the record, ... I didn't even have this as a requirement. And they start recording their voice in the story to make the story. And I was watching them ... it was just for me it was so joyful, to see them really engaged and loving it." [[Combined Educator & Student Survey Report 2022](#)]

In order to systematically examine student outcomes from DLN, a concerted effort would need to be made to examine data from the student information system for several years after the end of the grant. The appearance of Covid-19 during the grant period makes it difficult to determine what effects school shutdowns and remote learning may have had on DLCS implementation and the student experience.

Findings about Curricula

There is evidence of capacity-building among DLN districts in terms of their curriculum training. During the 2022 professional learning series, DLN district teachers were noticeably less likely than teachers from non-DLN districts (6% vs. 35%) to participate in Code.org CS Discoveries, likely because there has already been training of someone in the district on that curriculum, or another middle school curriculum, as part of the grant. [[DLCS Professional Learning Survey Report 2022](#)]

In general, there was evidence across most districts of a more deliberate integration of DLCS into content areas (and evidence that integration is becoming an increasingly popular option). There was an overall increase in the likelihood of teachers saying that they expected to be teaching DLCS (and it was especially likely that DLCS teachers would be using the materials). Conversely, there were few who said that DLCS was not something their district offered. [[DLCS Professional Learning Survey Report 2022](#)]

One decisive factor when choosing curriculum was cost and several districts mentioned that the fact that CS Discoveries was both free and well-respected was a major factor in their decision. One district also noted that they were initially surprised by the device or curriculum cost of some of the other curriculum options. They wished that this cost information was more prominent in the curriculum guide and that the grant’s approach to allocating resources may be unnecessarily specific in some cases. For example, districts were asked to predict the amount spent per teacher on course materials and curriculum before they even knew which curriculum they were going to choose. [[DLN 2021 Evaluation EoY Report](#)]

Participants also particularly enjoyed the opportunity to learn about many different curricula and device options, as well as participating in hands-on activities [[DLN Administrator PD Survey Report 2022](#); [Intro to CS Workshop Report 2022](#)].

Finally, teams talked about the potential value of a repository of lessons learned from this work, especially around which curricula worked best under which conditions and hoped to see something like this for a future cadre of districts. [[DLN District Survey Report 2022](#)]

District challenges that emerged included the following:

- In some cases, it was necessary to change elements and/or implementation strategies of curricula partway through the academic year (mostly due to the fact that a given team had difficulty anticipating the challenges that would arise in terms of content integration and remote learning).
- Issues presented by Covid-19, which forced shifting timelines for some districts, most often resulting in slower rollout of planned pathways across multiple grade bands.
- Team struggles with aligning class schedules, or changing the pacing of classes to accommodate newly integrated DLCS content. [[DLN District Survey Report 2022](#)]

Findings about Equity

Guidance around equity

While teachers and district leaders continually endorsed the importance of equity in DLCS education, when asked for specifics, they were unable to provide concrete examples of how they intended to incorporate this into their schools and districts. Some of this may be due to a lack of specificity from DESE about what constitutes equity. Instead, individuals may be relying on their specific curricula for guidance about what equity looks like in terms of DLCS and how it would be present in the classroom. While this might be helpful at the classroom level, it will likely not include information about how to approach equity at the school or district level. [[DLN Administrator PD Survey Report 2022](#)]

Similarly, equity was an important element of emerging district plans, though teams’ definitions tended to focus exclusively on broader student access and participation. [[DLN District Survey Report 2022](#)]

Several facilitators reported that the standard training provided by curriculum partners included content on how to present DLCS-related diversity, equity, and inclusion issues to workshop participants. In general, they reported that workshop participants were willing to engage in conversations around equity. One facilitator noted “especially in the last two years, [...] people wanting to talk about equity, has made the conversations a little easier. Everyone seems to be getting trained in their schools to have these conversations. And so I think people are coming in with more of an acceptance for it, and also more of a willingness to participate. And so I’ve definitely seen those changes.” However, one facilitator acknowledged that they themselves were still in the process of learning about DEI best practices. [[DLN PD Facilitator Report 2021](#)]

Accessible curricula and integration into special education programs

Teachers reported that they saw the greatest opportunity for increasing equitable participation in CS through the creation of course pathways that span multiple grade levels, followed by internal or external PD sessions for teachers that focus on diverse learners, differentiating lessons/curricula for different learners, and increasing knowledge among guidance counselors of DLCS education offerings and opportunities (all given equal weight). [\[Combined Educator & Student Survey Report 2022\]](#)

Insights From State Data

As part of the evaluation, SageFox had access to DESE records from the SIMS, SCS, EPIMS, and ELAR databases. Data was requested for the three years prior to the grant (2017-2018, 2018-2019, 2019-2020, and 2020-2021). 2021-2022 data was not available at the time the data request was processed, but could be added to the analysis in the future as a supplement or new contract. SageFox cleaned, shaped, and analyzed the data using Knime, a client side data management tool. Additional analysis was performed in RStudio for certain statistical tests. Except when otherwise noted, high school data are excluded as due to the structure of the grant and the data available to us, we would not expect to see significant effects at the high school level in the period examined.

Since the grant period coincides with the Covid-19 pandemic, the data may not be representative of what a similar program would achieve without a significant intervening catastrophe. Indeed, both comparison and DLN districts saw a net loss of K-8 students from 2018 to 2021, even though both showed a slight recovery from 2020 to 2021 (Table 3). As we based many of our calculations on a factor per 1,000 K-8 students, these reduced student population sizes complexify the task of determining the influence of the grant program itself.

District Type	2018	2019	2020	2021	2020-2021 Pct. Change
Comparison	346,145	347,122	304,750	337,256	11%
DLN	141,841	142,085	128,912	133,666	4%

Data from DESE web enrollment records

DLN districts were compared to a pool of comparison districts, which were drawn from DESE’s DART Tool. Only non-DLN districts were included as comparisons. With 160 comparison districts, we had a ratio of 4 comparison districts to each DLN district. A full list of comparison districts can be found in the Appendix C. A district was considered to be a DLN district if they participated in the grant for at least one year, and unless otherwise specified, all DLN districts were included regardless of whether they continued in the grant for multiple years. EDCO collaborative, which was part of the first cohort of grantees, was excluded from the analysis as they closed down in June 2021 and operated on a fundamentally different basis than the other districts in the DLN and comparison pools.

Many of our analyses focused on identifying the impact of the grant on teachers and then tracing that impact to students. Teachers were included in the state data analysis if they had taught at least one CS, DL, or DLCS course between 2018 and 2021. DLCS courses were identified using a list of course codes and their classification provided by DESE. Some teachers were further identified by whether or not they possessed a “Digital Literacy/Computer Science” license in the ELAR database. Some teachers were also identified by whether or not they had participated in a DLN curriculum workshop.

Students and Courses

To see the reach of the grant’s teacher training element, we attempted to identify all students who received DL, CS, or DLCS instruction by a teacher who participated in one of the 2020 summer curriculum PD sessions. We were able to identify MEPIDS for 108 of the 133 (81%) participants in the 2020 summer curriculum PD sessions for whom we had contact information using DESE’s license lookup tool. Teachers were unmatched if they were not found in the database (we speculate that they may have registered for the workshop under a middle or nickname, or changed names since taking the PD) or multiple teachers with the same name were returned by the search and we were unable to positively identify the teacher who attended the PD (for example, two results were returned and one was a school nurse and the other a classroom teacher, we would include the classroom teacher in our study, but would not guess if two classroom teachers were returned). We then created a list of MEPIDs to flag as trained teachers. Names and other identifying data were not combined with DESE data.

Analysis suggests that at least 24,479 elementary and middle school students have been directly impacted during the 2020-2021 school year by at least one teacher that participated in the 2020 summer curriculum professional development workshops. Most students (16,100) were reached by only one of these teachers, however a significant number (8,379) were reached by at least two. One student was reached by five participating teachers, but students who took courses with more than two teachers were exceedingly rare. This does not include students impacted by the 2021 workshop cohort of teachers, as they had not begun teaching by the time of data collection. Therefore, we expect the total number of students reached during the lifetime of the grant to be significantly higher.

When normalized per 1,000 K-8 students, DLN districts increased the per-capita student participation rate, even during the pandemic. The comparison districts remained static compared to 2018, and decreased over the pandemic period (Table 4).

Table 4: K-8 students in DL, CS, or DLCS course sections taught by a DLCS-licensed teacher per 1,000 K-8 students

District Type	2018	2019	2020	2021	2020-2021 Pct. Change
Comparison	0.54	0.58	0.56	0.54	-4%
DLN	0.59	0.60	0.61	0.62	2%

On the other hand, treatment districts appear to have seen an overall reduction in the number of DL, CS, and DLCS course sections offered per thousand students between 2020 and 2021 (Table 5). The number of DL, CS, and DLCS courses offered per 1,000 students in control districts appears to have changed little over the same time period, which suggests that course sections may have been removed as a function of declining student population and not due to less interest in offering courses.

Table 5: DL, CS, and DLCS course sections per 1,000 K-8 students by type of course and year

District Type	Course Type	2018	2019	2020	2021	2020-2021 Pct. Change
Comparison	CS	1.1	1.5	1.5	1.5	0%
	DL	10.2	10.2	9.7	10.6	9%
	DLCS	14.4	16.4	14.6	14.9	2%
DLN	CS	1.4	2.1	1.5	1.0	-33%
	DL	10.4	10.0	7.4	7.9	7%
	DLCS	13.1	14.2	17.4	15.8	-9%

Licensure

DLN participation appears to have had a profound impact on the number of DLCS-licensed teachers in DL, CS, and DLCS courses in treatment districts. Comparison districts saw overall losses in the number of teachers in these courses in 2021, however treatment districts saw double-digit increases in the percentage of DLCS-licensed teachers over the same time period that appear to exceed existing trends. Table 6 shows that the number of teachers (both licensed and unlicensed) tended to decrease over time in the comparison districts while the DLN districts tended to increase at best and decrease less than the comparison districts at worst. This also held true when normalized per 1,000 K-8 students in the groups (Table 7).

Table 6: Unique teacher counts by category, DL, CS, and DLCS course taught, DLCS licensure status, and year (the number of teachers who taught DL, CS, and DLCS category in a given year (teachers may appear in multiple categories))

District Type	Teacher Licensure Status	DLCS Course Type	Year			
			2019	2020	2021	20-21 Pct. Change
Comparison	DLCS	CS	112	136	94	-31%
		DL	231	256	240	-6%
		DLCS	543	501	492	-2%
		Overall	886	893	826	-8%
	Non-DLCS	CS	32	39	21	-46%
		DL	27	39	34	-13%
		DLCS	46	53	53	0%
		Overall	105	131	108	-18%
DLN	DLCS	CS	39	41	30	-27%
		DL	406	378	406	7%
		DLCS	146	150	149	-1%
		Overall	591	569	585	3%
	Non-DLCS	CS	10	13	14	8%
		DL	16	16	13	-19%
		DLCS	24	21	31	48%
		Overall	50	50	58	16%

**Data for 2018 have been excluded due to the small number of licensees in that year*

Table 7: Unique teacher counts by category, DL/CS/DLCS course taught, DLCS licensure status, and year per 1k students

District Type	Licensure Type	Course Type	Year			
			2019	2020	2021	20-21 Pct. Change
Comparison	DLCS	CS	0.32	0.45	0.28	-38%
		DL	0.67	0.84	0.71	-15%
		DLCS	1.56	1.64	1.46	-11%
		Overall	2.55	2.93	2.45	-16%
	Non-DLCS	CS	0.09	0.13	0.06	-51%
		DL	0.08	0.13	0.10	-21%
		DLCS	0.13	0.17	0.16	-10%
		Overall	0.30	0.43	0.32	-26%
DLN	DLCS	CS	0.27	0.32	0.22	-29%
		DL	2.86	2.93	3.04	4%
		DLCS	1.03	1.16	1.11	-4%
		Overall	4.16	4.41	4.38	-1%
	Non-DLCS	CS	0.07	0.10	0.10	4%
		DL	0.11	0.12	0.10	-22%
		DLCS	0.17	0.16	0.23	42%
		Overall	0.35	0.39	0.43	12%

**Data for 2018 have been excluded due to the small number of licensees in that year*

Chi square tests were performed to look at the yearly composition of teachers teaching DL, CS, and DLCS courses between DLN and comparison districts. Results for these tests are in Table 8 below.

No substantial differences in the proportion of DLCS-licensed/unlicensed teachers were found among those teaching CS courses for any year, although it should be noted that the significance and effect size of the differences went from highly insignificant and almost non-existent ($p > 0.90$, $V < 0.020$) to much closer to significant and small ($p = 0.103$, $V = 0.146$), respectively. This was due to DLN districts seeming to experience a reduction in proportion of DLCS-licensed teachers in CS courses, however the already small number of these teachers in CS courses makes a true trend difficult to differentiate from noise.

Among DL courses, results are more promising. DLN districts started with a larger proportion of DLCS-licensed teachers in DL courses than the comparison districts (96% and 88%, respectively), but by 2021 had increased their lead over the comparison districts (97% and 86%, respectively). While testing resulted in a small effect size, the results are statistically significant and point to a small increase in teachers in the DLN districts compared with a small loss in teacher numbers in the comparison districts.

DLCS course teacher compositions remain largely unchanged from 2019-2021, with comparison districts holding a slightly larger proportion of DLCS-licensed teachers in DLCS course teaching roles as compared to DLN districts. DLN districts appeared to be on track to overtake comparison districts in 2020 as the comparison districts lost ground and DLN gained ground (resulting in a move from a significant difference in 2019 to an insignificant difference in 2020), but this trend failed to persist into 2021.

Course Type	Year								
	2019			2020			2021		
	Test Statistic (Yate's)	p-value	Effect Size (V)	Test Statistic (Yate's)	p-value	Effect Size (V)	Test Statistic (Yate's)	p-value	Effect Size (V)
CS	0.004	0.948	0.019	0.008	0.930	0.018	2.663	0.103	0.146
DL	10.938	<0.001	0.133†	18.041	<0.001	0.167†	21.246	<0.001	0.181†
DLCS	5.539	0.019	0.091‡	0.775	0.379	0.038	6.711	0.010	0.101‡

*Data for 2018 have been excluded due to the small number of licensees in that year

†Significant effect in favor of DLN

‡Significant effect in favor of comparison

When looking at course sections taught by DLCS licensed teachers, the DLN districts show a large increase, especially when compared with the comparison districts (Table 10). These gains are preserved when normalizing the number of DLCS licensed teachers per thousand students to better compare districts of dissimilar size, with treatment districts seeing an average increase of 0.13 DLCS licensed teachers per thousand students versus the comparison average increase of 0.03 (Table 9).

District Type	2019	2020	2021	2020-2021 Pct. Change
Comparison	0.56	0.59	0.62	5%
DLN	0.74	0.73	0.86	18%

*Data for 2018 have been excluded due to the small number of licensees in that year

Table 10: Count of course sections taught by DLCS-Licensed teachers by category, type of course, and year

District Type	Course Type	Year			2020-2021 Pct. Change
		2019	2020	2021	
Comparison	CS	160	175	92	-47%
	DL	489	579	595	3%
	DLCS	820	974	913	-6%
DLN	CS	42	60	92	53%
	DL	298	273	345	26%
	DLCS	374	390	556	43%

*Data for 2018 have been excluded due to the small number of licensees in that year

Data Specific Conclusions & Future Directions

Despite the disruption caused by the pandemic, DLN districts appear to have resisted decreases in many key areas of DL, CS, and DLCS education as compared with the comparison districts. In addition, DLN districts were able to increase the number of courses taught by DLCS licensed teachers to a much greater degree than we had expected this early on in available data. This points to the strong potential for the grant program to have had a significant impact on the participating districts. However, we must add the caveats that 1) districts who self selected into the DLN grant program may have prioritized DLCS prior to joining in a way that makes them fundamentally different from the comparison group, 2) due to the many other DLCS initiatives which are happening in the state and nation, there are too many variables involved to conclusively attribute progress solely to the grant. To fully understand the impact of the DLN grant on licensure, students, and coursetaking, we suggest expanding these analyses in the following ways:

- Repeat the analyses with at least two additional years of data
- Expand analysis to high school level course taking for later years of study
- Study teacher movement between districts, especially among DLCS licensed teachers
- Compare and contrast the cohorts with each other and whether the duration of participation affects the educator and student outcomes we describe here

Future Work

Through the course of the evaluation, we generated a pool of recommendations from the individual data collection efforts. These can be found classified by recommendation type in Appendix B following the report catalog. In the process of writing this final report, we developed several key recommendations that emerged from reviewing the totality of the evaluation work. We have broken these down into practices to continue and actions to consider.

Continue

- Continue offering multiple tiers of support for teachers participating in PD (e.g., the *Introduction to CS for Educators* course as a precursor to an actual CS PD course).

- Continue providing opportunities for district and building leaders to meet within their districts as well as with leaders from other districts so that district teams can continue to meet and maintain (or revise) their DLCS district vision.
- Continue to maintain and expand the curriculum guide to keep a detailed inventory of CS curricula options, including cost, device requirements and teacher experiences available to district teams, many of whom reported the value of this tool.
- Continue to collect and analyze data in the future. The inception of the pandemic during the DLN project makes it extremely difficult to understand any outcomes of this work on students and will require additional data to understand. A future examination of DLCS participation in high school of students who were in middle school when DLN began may reveal differential levels of engagement and interest as a result of participating in the project.

Consider

- Consider encouraging shared district learning, particularly as it pertains to understanding various teams' experiences with different curricula, what mistakes they made and what they would do differently based on the experience. This may help future districts avoid these (seemingly common) challenges and mistakes. These issues ranged from:
 - Making decisions about which grade bands to focus on without consulting district-level course-taking and participation data (i.e., not being responsive to actual needs) or without having a cohesive district plan and vision in place.
 - Selecting a curriculum without hearing feedback and experience information from others who have already used it (e.g., some curricula do not align well with certain standards or lack cultural relevance).
 - Not allocating enough time for teachers to familiarize themselves with curricula beforehand and learn how to adapt them to their teaching. This was particularly important for elementary-level educators who need to embed curriculum into general education versus teaching a separate, discrete class.
- Consider providing teams with options and ideas for obtaining the future resources they are interested in. This includes grant funding options from a variety of agencies and foundations that can help them fund recruitment, training of teachers, dedicated time to bring district teams together for visioning sessions and funding for equipment. Teams recognized the importance of ongoing funding, with most saying they were planning to pursue additional support, though few had a specific funding agency or program in mind. [[DLN District Survey Report 2022](#)]
- Consider helping districts gain a more nuanced understanding of what DESE means when it says "equity." Equity considerations were present in most teams plans, though they typically focused almost exclusively on the need to provide access and participation in DLCS for all. District teams may find it helpful to receive a more comprehensive definition that includes other facets of equity, such as student engagement and structural issues around courses that may limit meaningful participation. [[DLN District Survey Report 2022](#)]
- Consider providing additional support and guidance for districts around assessment and metrics practices as districts did not seem certain what to monitor in the case of DLCS. [[DLN 2021 Evaluation EoY Report](#)]
- Consider encouraging districts to ensure that someone in the district has decision-making authority for DLCS and a clear accountability structure. Since there are few external accountability mechanisms around DLCS (such as standardized testing), accountability needs to come from district and school personnel for the time being. With many competing demands on school personnel, DLCS education can

fall off the radar without a local decision making and accountability mechanism to move implementation forward. [\[DLN 2021 Evaluation EoY Report\]](#)

Appendix A: Report Catalog

2022 Activities

- [Combined Educator & Student Survey Report 2022](#)
- [DLN District Survey Report 2022](#)
- [DLCS Professional Learning Survey Report 2022](#)
- [DLN Administrator PD Survey Report 2022](#)
- [Intro to CS Workshop Report 2022](#)

2021 Activities

- [DLN PD Facilitator Report 2021](#)
- [DLN Non-continuing District Interview Report 2021](#)
- [DLCS Professional Learning Survey Report 2021](#)
- [DLN 2021 Evaluation EoY Report](#)

Other Relevant Documents

- [DLN Research Questions](#)
- [DLN Updated Logic Model - 2022](#)
- [Best Practices for Digital Literacy and Computer Science Pathway Implementation Presentation Slides](#)
- [Folder complete with all above mentioned documents](#)

Appendix B: Compiled Report Recommendations

PRIOR REPORT RECOMMENDATIONS

The following recommendations have been synthesized across the body of evaluation reports produced throughout the contract period. They have been thematically organized. Several of the themes are responding to factors outside of the direct control of DESE staff. For instance, DESE is not in a position to mandate that all schools and districts follow the same scheduling. Likewise, DESE has very little control over public health and the presence or absence of a global health event. As some of the reports are based on small datasets and we cannot ensure that the DLN districts are representative of all MA districts, the findings may not be generalizable outside of the response group. Our primary recommendation would be to explore the themes presented in this report with the MA DLCS community more broadly to continue to gather input. Given these limitations we offer the following recommendations (recommendations may appear in multiple sections):

Funding

- **Provide teams with options and ideas for obtaining the future resources they are interested in:**
 - Several districts cited an ongoing challenge related to recruiting, retaining, and funding the training of DLCS teachers. Challenges around retention and recruitment may require further investigation such that DESE can provide additional guidance into the causes of these issues as well as possibly providing a more detailed statewide profile of teacher experience and mobility.
 - Districts continue to pursue grant funding and could likely use guidance on current programs and opportunities to meet their ongoing needs (e.g., through federal agencies like NSF as well as state-based grant options).
 - District teams noted the value of the strategic planning and visioning that occurred within their team meetings. They expressed an interest in continuing to meet, suspecting that if they did not, their momentum might decline. Further investigation into what resources and logistical support are needed to continue these efforts may be worthwhile, and teams should be encouraged to understand the importance of this sustained work, and that it can not simply be done once or twice, but requires ongoing maintenance.
- Identify mechanisms to encourage districts to identify and provide implementation support to educators and administrators. Many survey respondents desired additional support or resources at the district level that would require time allocation or district expenditures. Districts should proactively attempt to identify and provide these resources as implementation proceeds as soon as possible to ensure that classroom teachers are supported. However, districts may not be aware of how or when to best get feedback from their DLCS educators. Additional guidance from DESE could assist districts in identifying and alleviating roadblocks to DLCS implementation or integration.
- Encourage or facilitate community among DLCS instructors and administrators. Many respondents reported being interested in creating a community of DLCS instructors, both within their districts and in the broader DLCS education ecosystem. Such a community would align with DESE's broader goals for DLCS adoption within the state. DESE has already made some steps in this area by launching the DLCS Leaders' Network. However, there may be additional interest in similar networking and practice sharing opportunities for classroom educators who are not part of the Leaders' Network. Implementing this recommendation may also require the expenditure of resources that are not currently allocated, whether it would be organized through DESE, a district, a PD partner, or another third party.

Professional Development

- **Work in coalition to address ongoing curriculum development.** We encourage DESE to explore what it might look like to work with districts as well as professional development providers and curriculum developers and professional organizations such as (CSforMA, CSTA, and specific curricula providers) to

create additional opportunities for educators to undertake the work that they've identified as important moving forward. As an example two activities deemed to have the high potential impact for increasing equitable participation in CS are internal or external PD sessions for teachers that focus on diverse learners and working to differentiate lessons and curricula for different learners. These are efforts that could be undertaken by a coalition or taskforce as a state-wide endeavor.

- Encourage PD Coordinator and PD providers to review their direct participant feedback to identify areas where workshop attendees may have felt overwhelmed by the material. Several respondents reported that the pacing or amount of material presented was too much for the time allotted. PD providers should use any feedback that they collected directly from course participants to consider the course's materials, pacing, and duration. Since most workshops were held virtually this year, it is possible that the workshops were not optimized for remote participation.
- **Monitor next year's PD sessions for pacing and content overwhelm.** In the 2021 PD Survey Report, we noted that some educators felt overwhelmed by the amount or pacing of the material in the workshop. In this present analysis, we found that some of the facilitators also believed this was an issue from their perspective. Agreement on the part of the instructors and participants indicates that a change might be necessary here. It is important to note that for the most part, facilitators had to adapt in-person trainings to a remote format and this may be at least partially responsible for this issue. Should next year's PD sessions be held in person, feedback mechanisms should evaluate whether participants and facilitators still find that pacing and content overload issues persist. In the event that PD sessions will be held virtually again next year, PD facilitators and/or curriculum partners should proactively review their lesson plans with an eye toward pacing and content absorption.

Sustaining Collaboration

- **Empower and Support the DLCS Leaders' Network to work on specific problems of practice.** There are several problems of practice which emerged out of each of these data sources. District leaders may be able to collectively and collaboratively design possible solutions, or at least testable alternatives to addressing these problems of practice.
 - Districts may need support in thinking through other approaches to scheduling structures that enable greater cross-district collaboration. This may be a potential topic for the Leaders' Network to take up a funded taskforce around (with mandatory teacher and support staff engagement).
 - Teachers noted that at times, DLCS content is not what they deem to be the most crucial curricular intervention that students need. It could be worthwhile to explore how DLCS tools, concepts, and teaching can be interwoven with other supporting and culturally responsive and sustaining teaching strategies.
 - One activity deemed to have a high potential impact for increasing equitable participation in CS is increasing knowledge among guidance counselors of CS education offerings and opportunities. There may be efforts already underway to expand PD opportunities to guidance counselors working with the organization Counselors for Computing. The DLCS Leaders' Network could be a great platform for showcasing for district leaders why counselors are important for increasing equitable CS, but also provide concrete approaches for engaging the counselors in their district.
- **Encourage shared district learning:** District teams learned a great deal over their recent experience implementing DLCS curricula, especially in terms of which curricula worked best for their grade bands and circumstances. Some discussed challenges they encountered as they implemented their strategies, saying that they would have benefited from being able to learn from others to avoid certain mistakes. It would be advisable to find a way to collect this experience in some kind of repository or shareable document to be distributed to other districts interested in doing their own DLCS implementation.

- Encourage or facilitate community among DLCS instructors and administrators. Many respondents reported being interested in creating a community of DLCS instructors, both within their districts and in the broader DLCS education ecosystem. Such a community would align with DESE’s broader goals for DLCS adoption within the state. DESE has already made some steps in this area by launching the DLCS Leaders’ Network. However, there may be additional interest in similar networking and practice sharing opportunities for classroom educators who are not part of the Leaders’ Network. Implementing this recommendation may also require the expenditure of resources that are not currently allocated, whether it would be organized through DESE, a district, a PD partner, or another third party.
- Another recommendation for DESE is to create a mechanism for future districts to talk with currently-implementing districts. Specific approaches mentioned were a drop-in panel and maintaining an email list of those districts willing to talk one-on-one with other districts about their experiences, or to act as a “buddy” to talk through planning and implementation issues.

Providing Information/Guidance

- **Provide teams with options and ideas for obtaining the future resources they are interested in:**
 - Several districts cited an ongoing challenge related to recruiting, retaining, and funding the training of DLCS teachers. Challenges around retention and recruitment may require further investigation such that DESE can provide additional guidance into the causes of these issues as well as possibly providing a more detailed statewide profile of teacher experience and mobility.
 - Districts continue to pursue grant funding and could likely use guidance on current programs and opportunities to meet their ongoing needs (e.g., through federal agencies like NSF as well as state-based grant options).
 - District teams noted the value of the strategic planning and visioning that occurred within their team meetings. They expressed an interest in continuing to meet, suspecting that if they did not, their momentum might decline. Further investigation into what resources and logistical support are needed to continue these efforts may be worthwhile, and teams should be encouraged to understand the importance of this sustained work, and that it can not simply be done once or twice, but requires ongoing maintenance.
- **Give districts a more nuanced understanding of what DESE means when it says “equity:”** Though several teams discussed equity in their responses, almost all discussion thereof related to enabling CS education access and participation for all students. Though this is an important element of equity, it is unclear if teams’ understanding goes beyond these elements and gets into the experience of students and the extent to which the content and structure of classes is engaging for all. It may be beneficial for DESE to create a formal definition of equity within DLCS to emphasize all relevant components.
- **Create a framework for collecting and distributing a web-based collection of resources for DLCS instructors and administrators.** Respondents were interested in having easy access to additional resources for the curricula that would be implemented in their classrooms. A similar recommendation was made based on the interviews with C1 non-continuing district administrators, which suggests that this type of resource would be welcomed by multiple grant stakeholder groups. DESE should consider how best to organize this work, and whether it is more prudent to host this service in-house, through a PD coordinator, or through a different third party. Implementing this recommendation may require resources that DESE does not currently have allocated.
- **Create a DLCS data dashboard.** Numerous facilitators talked about the potential benefits of collaborating across districts, peer cohorts for curriculum implementation, and developing a greater understanding of how PD is being used in the classroom. One possible first step towards this would be to create a dashboard of DLCS course implementation across the state, including information about how long courses have been taught and what curricula are being used. In addition to enabling CS teachers and facilitators to be more broadly informed about what is occurring regarding DLCS across the state, it may encourage a greater degree of alignment between district offerings as well as a source of guidance for new districts in search of information about what they should offer. Additionally, a dashboard of this

nature would also support understanding what kinds of CS pathways are being developed within districts.

- Provide additional support for districts around DLCS stakeholder and community engagement. One other challenge that districts struggled with was in conveying the importance of CS to other district stakeholders - this was manifested both in their challenges around how to stress to students and parents the importance of career skills associated with DLCS as well as how to incorporate some kind of accountability for the standards (e.g. through MCAS).
- Provide additional support and guidance for districts around assessment and metrics practices as districts did not seem certain what to monitor in the case of DLCS.

Grant Program Modifications

- **Focus the next iteration of DESE efforts on pathways creation and alignment.** From the educator survey, the activity deemed to have the highest potential impact for increasing equitable participation in CS is the creation of course pathways that span multiple grade levels. We know that this effort requires a great deal of allocated planning time, course and standard alignments, as well as staffing and budgetary impacts. We suggest that DESE make this a focus of future potential grant opportunities, and a feature of ongoing district support work.
- **Create a mechanism for new districts to modify the way their funds are allocated after their initial SCRIPT and curriculum.** When new districts apply to the grant, they may not be aware of the “best” way to allocate the grants funds prior to attending the SCRIPT workshop and reviewing the curriculum options. To the extent possible within the confines of the grant, allow districts to modify their expected allocations once they have completed their initial district planning, or make it clear to districts that they will be able to do so.
- For future workshops:
 - Send workshop agendas out in advance, with links to materials and information about what is expected of participants. In particular, meeting facilitation and meeting logistics were mentioned as areas that could benefit from an increased focus on program management.
 - Allow additional, optional structured time for districts who need additional time to complete the exercises. Since SCRIPT was condensed this year due to the online format, this may not be necessary for in-person workshops.
- Encourage districts to ensure that someone in the district has decision making authority for DLCS and a clear accountability structure. Since there are few external accountability mechanisms around DLCS (such as standardized testing), accountability needs to come from district and school personnel for the time being. With many competing demands on school personnel, DLCS education can fall off the radar without a local decision making and accountability mechanism to move implementation forward.
- Give districts more advanced notice ahead of application deadlines, award decision timelines, and workshop scheduling. Most team members noted that DESE was very supportive and accessible but there were some structural aspects to the rollout of the grant that districts recommended changing. Most notably, districts felt that the timeline of submitting the application, receiving notice of award, and attending the workshops was too compressed. Districts reported feeling like they didn’t have enough time to properly schedule substitutes for teacher team members, and that it was difficult to pull administrative team members away from their other responsibilities on short notice.
- Identify mechanisms to encourage districts to identify and provide implementation support to educators and administrators. Many survey respondents desired additional support or resources at the district level that would require time allocation or district expenditures. Districts should proactively attempt to identify and provide these resources as implementation proceeds as soon as possible to ensure that classroom teachers are supported. However, districts may not be aware of how or when to best get feedback from their DLCS educators. Additional guidance from DESE could assist districts in identifying and alleviating roadblocks to DLCS implementation or integration.

District Focused Recommendations

- Bring key stakeholders on board early on. Every interviewee spoke to the importance of building support for the initiative among key constituencies (principals, district administrators, and teachers), as well as having a team in place with representatives from each of those groups, prior to implementing the grant. They did note that having representatives was not sufficient and that you needed to do outreach with all principals (for example) who you expect to implement, even if they were not part of the team that attended DLN grant activities.
- Have individuals with decision making powers on your district team. Ensuring that you have representation from decision makers in the district is crucial to feeling like the planning process will actually be implemented and supported within the district.
- Be proactive in thinking about teacher and course implementation needs. For instance, districts with existing technology teachers and classes will be able to implement DLCS more seamlessly than teachers who are in other content areas (e.g. math, science, social studies) and may be less comfortable with technology.
- **Find efficiencies in scaling and sustaining.** Continue to identify within-district opportunities for scaling and deepening DLCS. Some educators teach multiple subjects into which CS could be integrated, potentially also teaching standalone CS courses; however teachers are not integrating CS into all subjects that they teach, even when they have some experience in teaching CS. One potentially more cost-effective approach to ensuring a continued expansion of DLCS offerings is to more efficiently utilize the existing teaching staff.

Appendix C: Comparison Districts in Alphabetic Order

Comparison Districts:

Abington	Acushnet	Amherst Pelham	Arlington	Ashburnham Westminster	Ashland
Athol Royalston	Auburn	Avon	Ayer Shirley	Barnstable	Bedford
Belchertown	Bellingham	Berkley	Berkshire Hills	Beverly	Blackstone Millville
Braintree	Bridgewater Raynham	Brockton	Cambridge	Canton	Carver
Central Berkshire	Chelsea	Chicopee	Clinton	Cohasset	Concord
Concord Carlisle	Danvers	Dedham	Douglas	Dover Sherborn	E Longmeadow
Easthampton	Easton	Everett	Fairhaven	Fall River	Falmouth
Fitchburg	Foxborough	Framingham	Freetown Lakeville	Gateway	Georgetown
Gloucester	Gosnold	Grafton	Greenfield	Groton Dunstable	Hamilton Wenham
Hampden Wilbraham	Hanover	Haverhill	Hingham	Holbrook	Holyoke
Hoosac Valley	Hopedale	Hudson	Hull	Lawrence	Lee
Leicester	Lenox	Leominster	Lincoln	Lincoln Sudbury	Littleton
Longmeadow	Ludlow	Lunenburg	Lynnfield	Malden	Mansfield
Masconomet	Medfield	Medford	Medway	Melrose	Mendon Upton
Methuen	Millbury	Millis	Milton	Monomoy	Monson
Mount Greylock	Narragansett	Nashoba	Nashoba Valley	Natick	Newburyport
North Attleborough	Northampton	Northampton - Smith Vocational	Northborough	Northbridge	Norton
Norwell	Old Rochester	Palmer	Pembroke	Pentucket	Pittsfield
Quabbin	Quincy	Reading	Revere	Salem	Sandwich
Saugus	Savoy	Scituate	Seekonk	Sharon	Shrewsbury
Silver Lake	Somerville	South Hadley	Southborough	Southbridge	S Berkshire
Spencer E Brookfield	Stoneham	Stoughton	Sudbury	Sutton	Swampscott
Swansea	Tantasqua	Taunton	Tewksbury	Triton	Up-Island
Uxbridge	Wakefield	Walpole	Ware	Wareham	Watertown
Wayland	Webster	Wellesley	West Boylston	West Springfield	Westborough
Westfield	Westford	Westport	Westwood	Weymouth	Wilmington
Winchendon	Winchester	Winthrop	Worcester		