

SEPTEMBER 30, 2016

# TRANSFORMING LEARNING EVERYWHERE

## A STUDY OF THE SECOND YEAR OF IMPLEMENTATION

### EXECUTIVE SUMMARY



PRINCIPAL INVESTIGATOR – RON OWSTON, PHD  
RESEARCH TEAM – HERBERT WIDEMAN, KURT THUMLERT, TARU MALHOTRA  
PROJECT CONSULTANT – GERRY SMITH

## Executive Summary

---

This report provides a comprehensive description, analysis and assessment of the Hamilton-Wentworth District School Board (HWDSB) initiative, *Transforming Learning Everywhere* (TLE). TLE is a 5-year project with the ambitious goal of transforming learning environments across the district by integrating new instructional practices with innovative technology use, including 1:1 iPad distribution.

TLE is still in the initial phases of implementation, with full implementation planned for the 2017-18 school year. This report provides an analysis of TLE during the 2015-16 school year. The focus of our research was a family of 7 TLE pilot schools which were in the second full year of 1:1 implementation of iPads in grades four through eight. The research was carried out over the second half of the school year; its goals were to examine the impact of TLE on transforming teaching practices, enhancing student engagement, and improving student learning and 21<sup>st</sup> century skill development.

### TLE rationale

*Transforming Learning Everywhere* has as its goal the design and creation of innovative learning environments for developing student knowledge, skills, and life-long learning dispositions essential for learners to succeed in the 21<sup>st</sup> century, and to help students meet the challenges of the rapidly changing environments outside of school in the domains of communication, work, and citizenship.

TLE is based on the principle that, while technology tools can accelerate and support student learning, it is effective pedagogy – transformative teaching together with rich support for learning – that is the cornerstone of the initiative. To this end, the TLE initiative has advanced a strategic plan to bring together technology tools with innovative inquiry-based learning (IBL) practices to support deep learning engagement, self-directed student learning, and fluency with new media tools and 21<sup>st</sup> century literacies.

### TLE logic model

We developed a logic model to guide our research based on the district's theory of action and implementation plans for the TLE initiative. The model focusses on the relationship between TLE inputs (funding; technology distribution; professional development for iPad use and new inquiry-based pedagogies; and evidence-based feedback), short and intermediate term mediating outcomes such as teacher buy-in and student engagement, and longer-term goals. These longer-term goals include creating a professional culture supporting TLE; supporting teacher desire to change pedagogy in accordance with TLE aims and purposes; having teachers acquire new instructional competences for inquiry-based learning and digital tool use; and generating evidence of improved student engagement and learning. The logic model gave us a comprehensive frame to assess TLE's plan of action, and address these inputs and desired outputs, as well as draw conclusions and make strategic recommendations.

### Research questions

In this report, we consider if, how, and to what extent TLE's particular implementation of inquiry-based learning (IBL) and infusion of technology through its 1:1 iPad distribution were effective in enacting TLE's goals. Our specific research questions, informed by our TLE logic model and its theory of action, are outlined below. They are organized by their domains of action: the school system level, the teacher level, and the student level.

**System level:** What policies and TLE inputs have been put in place to implement and scale TLE, and to support professional development and a professional culture supportive of TLE aims and practices? How have these efforts been translated to the teacher and student domains? And how have key TLE

actors created or sustained change, and promoted a culture where actors at all levels of the board can begin to take ownership of the initiative and maintain momentum as TLE is scaled?

**Teacher level:** To what extent have teachers embraced TLE and transformed their pedagogy, becoming facilitators of student learning, and in particular, how are they promoting deep learning through the adoption of inquiry-based teaching? The teacher level of analysis includes factors like formal and informal professional development, the impact of technology tools, and teacher dispositions and perspectives surrounding new inquiry-based pedagogies and iPad and technology use.

**Student level:** What kinds of learning tasks were instantiated and what roles did 1:1 device use play in advancing TLE goals? What strategies were being used to assess student learning? What is the evidence for transformed learning environments, student engagement, and achievement in teacher and student interviews and student work samples?

## Situating TLE in context of the literature

*Transforming Learning Everywhere* is based on the view that inquiry-based learning (IBL), supported by one-to-one technology distribution, is the most effective pedagogical approach to facilitating students' development of 21<sup>st</sup> century skills and deep learning dispositions (e.g., life-long learning, critical thinking, authentic knowledge-building, digital literacies and communications competences, experiences of self-efficacy).

In chapter 2, we review the existing literature, educational theory and empirical research relating to TLE aims, values, and practices: particularly, the literature on IBL and one-to-one technology use in schools. On the basis of our review, we concluded that the TLE vision and rationale are supported by the research and policy literature, as well as by policy directives and professional learning resources published by the Ontario Ministry of Education.

According to the research, IBL can improve learning outcomes for students. Further, recent literature also suggests that IBL methods and outcomes can be further enhanced by innovative uses of technology; combining IBL with technology can significantly redefine and transform educational purposes and practices, particularly in relation to new literacies and digital media competences.

Pervasive research and emerging policy frameworks in and outside of Ontario indicate that TLE is not only on firm theoretical ground, but forward-looking. In our review of the literature, we found that the integration of IBL with one-to-one iPad use offers significant opportunities to increase student engagement and the development of 21<sup>st</sup> century literacies and learning.

However, we signal in this chapter (and elsewhere in the report) that IBL methods and practices must be implemented in ways that stay true to the principles of the method; the gains of IBL pedagogies can only be leveraged when IBL in all its phases is optimally implemented in classrooms. The extant research strongly indicates that administrators and teachers will not be able to realize TLE's aims simply by equipping their students with iPads: meaningful inquiry-based learning must be enacted in order to maximize the opportunities of 1:1 technology distribution.

## Research methodology

A multi-dimensional case study approach was used to capture the detail, nuance, and context of how the TLE initiative was implemented in the 7 North schools we studied, and how and why teaching and learning were impacted.

Structured, open-ended interviews were conducted with 14 randomly selected teachers, 5 key informants in leadership roles for TLE at the school and system level, and focus groups were held with students from the classes of the teachers interviewed. For both teachers and students, the questions

asked addressed the use and impact of IBL and iPads tool use on teaching, learning, student engagement, and 21<sup>st</sup> century skills development. Key informants were asked about the processes and outcomes of TLE implementation, and school district documents were consulted to source data on TLE's theory of action and implementation plans. Data from district surveys of students and teachers were also used to assess the degree of IBL adoption and iPad utilization in the classroom, teacher perspectives on IBL and iPad applications to learning, and their impacts on students.

Student work sample sets from grade 4 through grade 8 classes were examined and assessed on the extent to which students fully engaged in deep inquiry learning and demonstrated 21<sup>st</sup> century learning skills. The assessment process had two elements: a holistic quantitative rating of student samples (grade 4-8) using an established rubric for assessing 21<sup>st</sup> century learning; and a detailed qualitative analysis that was undertaken of a subset of that work. The qualitative analysis used, as sources for its assessment criteria, the HWDSB document *Transforming Learning Everywhere*, as well as key documents from the Ontario Ministry of Education, including *Achieving Excellence: A Renewed Vision for Education in Ontario* and documents from the Ministry's *Capacity Building Series* on inquiry-based learning. In addition, we evaluated tasks and technology applications by utilizing the well-known SAMR (Substitution, Augmentation, Modification, Redefinition) model, and cross-referenced these findings with work by Michael Fullan on inquiry pedagogies and innovative technology use supportive of deep learning and the demonstration of 21<sup>st</sup> century competences.

The holistic quantitative analysis focused on three sample sets (from grades 4, 7, and 8). Samples of student work were selected from those schools where at least three or more projects on the same topic were available for coding *and* where the projects were relatively substantive, requiring a minimum of one week to complete. The sets of student works were rated using criteria developed by SRI International to specifically assess student work product for evidence of 21<sup>st</sup> century learning competences.

## Putting TLE into practice

In this chapter, we examine how HWDSB has mobilized resources and strategically acted, administratively and organizationally, to put TLE into practice, and to further refine key TLE aims during the 2015-2016 school year.

Working from the intended activities laid out in the TLE action plan, we investigated (1) professional support for teachers, (2) professional support for administrators, (3) digital hardware and software provisioned to classrooms, (4) technical support for schools and teachers, (5) evidenced-based feedback on implementation collected within the district, and (6) funding from the board and the Council of Ontario Directors of Education (CODE). To assess TLE actions and outputs at the system level, we focused on three key drivers of organizational change – competency drivers, organization drivers, and leadership drivers.

**Competency drivers** consist of the formal and informal professional learning opportunities and supports provided to (and by) administrators and teachers.

With regard to competency drivers, we identified a variety of formal professional learning opportunities, as well as a very healthy climate for informal, ad hoc collegial sharing (where teachers shared best practices, inquiry-ideas, methods, new apps, and so on). The forms of formal or organized professional development identified in our report are, in the literature, generally regarded as “best practices” for teacher development, and include PA day events; school-organized professional learning activities; lunch-and-learn sessions; formal or informal collaboration with external partners; and/or discussions at staff meetings and other knowledge-sharing opportunities. Embedded mentoring and coaching are also

identified as promising practices. While teachers indicated that they do not generally utilize or contribute to the internal Yammer social messaging system, some pursued informal professional development using Twitter and other social media tools.

While teachers reported a generally favorable climate in their schools surrounding TLE in terms of culture and administrative enthusiasm for the initiative, they also frequently indicated in interviews and their survey responses that more formal and intensive professional development focusing directly on integrated IBL and iPad uses were necessary to further advance and refine teaching practices.

**Organization drivers** are defined as the organizational and administrative components necessary to generate a culture and community that supports organizational change across the system. In the report, we examine TLE's technological systems and infrastructure, E-BEST's (the board's research department) role in TLE, and provide a brief overview of HWSDB fiscal support for TLE and what the board is doing to fund and further scale TLE.

With regard to the organization drivers, we found that the board has made a financial commitment to TLE significantly above and beyond the funding received from CODE. For the 2015-2016 school year, technical infrastructure and tech support had improved over the previous year, and the technology infrastructure is, for the most part, now sound. Teachers generally reported good to excellent network connectivity and technology support, but there were occasional wireless network latency and bandwidth issues and sometimes a significant wait time for onsite technology support.

Finally, while we see the value of E-BEST in providing both research and critical feedback on TLE, we found that many opportunities for mobilizing research to improve and refine and scale TLE may be lost when E-BEST is constrained by formal research protocols. Because E-BEST considers their monitoring of TLE to be a research activity as opposed to a program improvement undertaking, informed consent is required. For various reasons consent is always difficult to obtain, which results in poor response rates, hindering research scope and validity. We suggest that E-BEST find ways to rearticulate research aims in terms of program improvement, with a more direct focus on refining TLE aims and actions as the initiative scales up across the district.

**Leadership drivers** refer to the strategic actions taken by key TLE actors to transform systems, create and sustain change, and promote a culture where actors at all levels in the board can begin to take ownership for the initiative and maintain momentum as TLE is scaled across the board.

With regard to leadership drivers, we identified organizational structures and key actors that work to promote and refine TLE aims. A senior level steering committee manages the initiative, and monthly organizational leadership meetings are held for administrators. While these meetings may or may not focus directly on TLE, meetings often have a TLE component where administrators are able to share their own experiences with, and findings about, TLE, and TLE is sometimes used as a lens through which to discuss other policy and administrative objectives. We found that TLE is increasingly becoming an embedded and accepted feature of the pilot schools in our study. Moreover, there is evidence of longer-term strategic planning to scale up TLE throughout the district, and circulate TLE values, models, and practices. In order to scale TLE, the leadership agenda must encourage deep and sustainable change in actor practices and dispositions in the face of competing priorities and demands; the values and principles of TLE need be solidified in pilot schools (through continued professional development focusing on interweaving IBL and iPad tool use) as the initiative is extended to other HWSDB schools; and, finally, the TLE initiative needs to ensure schools and families of schools take ownership of initiative values, processes and practices.

Overall, TLE looks to be well positioned for scaling up across the board, especially given the fact that HWSDB now has feedback available about its initial rollout problems and shortcomings (vis-à-vis the pilot schools and projects). However the scaling of TLE must also be accompanied by continued formal and informal professional development with a focus on refining inquiry-based learning and promulgating innovative uses of technology throughout the inquiry learning cycle, including the use of formative assessment as and for learning.

### Inquiry learning in the classroom: Impacts and outcomes

We utilized data from multiple interview sources (teachers, administrators, TLE support, and student focus groups) as well as teacher and student district surveys to inform our research questions surrounding the implementation of inquiry-based learning in 1:1 pilot school contexts, addressing the possible effects and outcomes in classroom practice.

In assessing the adoption of IBL, we wanted to look at whether IBL was being implemented in ways that reflected or remained true to IBL best practices described in the literature. In examining the fidelity of implementation we aimed to determine not only if IBL was being utilized, but to what extent it was being adopted in optimal forms of practice – forms that might realize the potential of IBL to engage students, transform educational experience, and maximize learning outcomes and experiences of self-efficacy.

We defined optimal IBL practice based on the Ministry of Education’s Capacity Building Series documents on IBL for educators. In these, IBL is described as a student-directed inquiry process that is both teacher-supported and informed by phases of provocation (stimulating curiosity, or sense of wonder); conceptualization (student question-posing, hypothesis formulation, connecting research to “big ideas” in the curriculum); the selection of appropriate research resources and technology tools; the marshaling of evidence through planning, investigation, experimentation and interpretation; collaborative sharing of student-constructed knowledge; and critical reflection on inquiry processes and products of learning. IBL can also provide rich opportunities for creative student agency and collaboration, interdisciplinary learning and the construction of authentic knowledge for real-world audiences

**Fidelity of implementation:** Among the teachers we interviewed, the fidelity of implementation of IBL pedagogy varied. According to teachers, the time devoted to IBL in any form ranged from 33% to 50% of class time; students, alternately, reported the proportion of time dedicated to IBL as being between 5% and 40%.

Teachers found mathematics to be a hard “fit” for IBL; the majority of IBL projects were enacted in science, history, and social studies classes, as well as the arts. In many cases, teacher were able to connect IBL to “big ideas” in the curriculum that also intersected with concerns and controversies in the real-world (such as ecology and global warming), and there was some evidence of student agency in investigating their own research questions.

Teachers frequently mobilized videos, visual texts, newspaper articles to stimulate interest or wonder, and then followed up with class discussion and support for developing research questions. We found that teachers varied greatly in the degree of guidance and the latitude they gave students to formulate questions and pursue self-directed research trajectories. Some teachers allowed more room for students to personalize research, to make wider connections, and to extend their learning. However, many of the projects were highly constrained by teachers in advance, and in teacher interviews we found that the expectations for some projects (both in terms of activities and work product) were predetermined and managed to such an extent that they would not qualify as IBL.

When conducting formative assessment, some teachers made use of innovative forms of “success criteria” in the form of rubrics and checklists that enabled students to plan, monitor and self-assess their learning and work products as they moved through the IBL process. In some cases, success criteria were co-developed with students, which we found to be a valuable enactment of IBL, giving students agency in determining and reflecting upon the standards for success and good work.

Teacher assessment typically shifted away from a primary focus on student work products to a more process-oriented examination of student thinking as well as their learning and work processes. Educators made more use of observational evidence in both formative and summative assessment, and the amount of formative assessment they undertook increased. Only in a minority of cases did student presentations have any audience beyond the teacher and classmates, but students clearly valued these opportunities when they arose and were highly motivated by them. Community action stemming from inquiries was very rare.

Students’ IBL research was principally conducted using iPads connected to vetted online resources, Hub-based sources, and, in several cases, governmental and institutional sites. Research activity was frequently directed to teacher-provided links (although in many instances latitude was allowed for more self-directed research navigation).

iPads proved very useful for including ELL populations and students with special needs in IBL project work, as the iPad-based assistive technologies such as translation “read aloud” and speech-to-text functions enabled students and teachers to overcome language and literacy barriers. This enabled a wider range of students, including those who may have formerly been excluded and even stigmatized by peers, to participate in whole-class learning processes, and had a notable impact on their levels of engagement.

There was strong evidence of peer collaboration and knowledge-sharing in students’ IBL work. Teachers reported that both individual and group inquiry-projects were supported by different forms of informal collaboration, and in some cases collaboration was made a formal and integral part of IBL phases.

We found that culminating projects (a key element of the IBL cycle) were nearly always presented to the class. Culminating presentations or showcases provided opportunities for peer assessment as well as teacher assessment and critique, and for students to assume a teaching role when presenting their works and sharing findings and knowledge with others. Teachers reported that the affordances of the technology (iPads, projectors, network connectivity, Google Drive, blogs, and apps that permitted shared document access and editing) made collaborative work and knowledge sharing much easier and more productive.

For culminating projects, we found that students were typically permitted to choose the forms (tools, modalities, and media) through which to design their work artefacts and present their learning. Students demonstrated a strong preference for using digital, multimedia tools. (e.g., Explain Everything, iMovie, multimodal slide shows).

The changes in student outcomes reported for IBL work were several and significant:

- *Student engagement:* Teachers and students reported substantially higher levels of student engagement in IBL relative to most other forms of learning. This held true for both high-performing students and students who typically struggle. Many teachers stated that this higher degree of engagement fostered student agency, initiative-taking, and a greater willingness to persist through challenges.

- *Deeper learning*: Teachers reported that students learned more deeply when involved in IBL projects, and that IBL provided opportunities for students to demonstrate more sophisticated competences and learning than through traditional forms of instruction.
- *Planning, research skills, and self-regulation*: While student research, planning and self-monitoring skills were observed by most teachers to improve with IBL, some reported that these skills were still underdeveloped in a substantial proportion of their students.
- *Analytical skills, critical thinking, and inference making*: Most teachers reported that there was little evidence of enhanced analytical skills or critical thinking (including drawing inferences and original hypothesis development) in students as a result of the IBL method of learning. (As we discuss below in our analysis of student work, this may be the result of teachers' over-regulating the IBL experience by tightly managing both IBL processes and outcomes through defined research templates with fixed sets of expectations.)

While there is a great deal of teacher support and even enthusiasm for adopting IBL, several enthusiastic teachers reported that they were to some extent still struggling with implementing IBL in a manner that would realize its full potential. The teachers' sense of their own competence in utilizing IBL was not always strong; a substantial minority of teachers surveyed had some reservations about their levels of mastery, and there were some concerns expressed about how well IBL served to cover off the full range of curriculum expectations in the topics it was used to address.

A small minority of teachers expressed sharper reservations about IBL, or a reluctance to implement IBL fully, which suggests that TLE aims and values have not been unanimously embraced by all educators. We address this issue in the recommendations section.

IBL situates student interest, agency, and self-direction at the centre of the learning experience, and teachers reported mixed degrees of anxiety and enthusiasm about "letting go" of their traditional teacher roles as curriculum authority and director of learning, and letting students co-determining their own course of inquiry and learning. While some teachers signaled their concern about this pedagogical shift, many teachers found the opportunities it presented to be exciting and promising, and saw significant benefits of students doing so.

## An iPad for every student: Impacts and outcomes

Here we examine the applications and impacts of 1:1 iPad use, including iPad use in both IBL and non-IBL instructional contexts. (As we consider how iPads were used in these classrooms, it should be kept in mind that at the time of our data collection, the grade 4-8 teachers at the seven North schools we studied had nearly two years of teaching experience in classrooms with 1:1 iPads).

Our findings indicate that teachers employed iPads for diverse aims and in a range of educational processes and learning tasks. On one hand, teachers often utilized iPads to uphold conventional instructional forms (frequently as a substitute for print media) or mobilized the iPad to augment traditional practices, with modest degrees of transformation in pedagogy, process, task design, and student knowledge demonstration resulting. But it was also true that most teachers – to varying degrees and extents – were leveraging the affordances of the iPad and associated technologies, including Google Drive and presentation hardware like Apple TV, to promote new kinds of learning tasks, and support novel and meaningful forms of knowledge construction and sharing, through such practices as peer presentation or blog publication.

Not surprisingly, given the 1:1 iPad distribution, most teachers and students reported that much of daily class time involved some kind of iPad use across a wide range of teaching, learning, and communicative tasks, from direct instruction and practicing basic skills to collaborative problem solving and pursuing



research inquiries in groups or individually. The iPad was “the platform of choice” for most of the student research carried out in science and social studies.

Common uses of the iPad included:

- *Research*: iPads were employed in accessing and navigating research and multimedia sites, including external research sites, vetted resources (provided by way of teacher links), and videos, models and simulations. One-to-one device distribution made spontaneous pursuit of inquiry questions feasible (while eliminating arguments over access to limited technology tools for research or other tasks).
- *Writing*: Most student writing activities were conducted using the iPad and the suites of provided apps supportive of traditional writing tasks and multimodal production (combining written text, images, graphics, and audio).
- *Digital games*: Educational games and gamified drill and quiz apps were used with some degree of frequency by teachers, usually to practice basic literacy and numeracy skills. Some teachers reported more sophisticated uses of games and simulations, including using Minecraft for construction-driven learning.
- *Mathematics*: Many teachers utilized iPads to model and practice numeracy skills and math principles, and some teachers utilized math drills, quizzes and games, as well as virtual manipulatives. In some cases, teachers leveraged the affordances of the iPad and tools such as Explain Everything to create shared spaces for modeling and sharing student problem solving in real time, and as a platform for students to share their rationales when solving equations or other problems.
- *Project work*: Students utilized iPads to demonstrate learning (for IBL and other purposes), using diverse apps, as well as combinations of apps, to demonstrate knowledge and learning through multimodal digital artifacts.
- *Interdisciplinary work, art, and design*: iPads were sometimes used as a creative and dynamic medium for artwork and music composition, as well as to facilitate multimodal artefact creation in interdisciplinary work for demonstrations of knowledge.

Further, as iPads provided a wide spectrum of multimodal resources, they were found by teachers to better accommodate students who favoured learning styles where traditional print literacy did not dominate or in some cases even play a significant role. Significantly, iPads were also used to bridge language boundaries for ELL students as well as support special needs students in overcoming textual and linguistic learning barriers through these multimodal and multimedia functionalities.

For most students, the preferred apps for demonstrating learning and knowledge were those that supported multimodal expression, allowing the integration of text, visual elements (images, maps, infographics, video) and audio voice-over and/or music. These iPad apps were mobilized to design and create many types of products and documents, including slide shows (sometimes converted to PDF or movie formats), eBooks, Explain Everything multimedia documents, iMovie video projects and trailers, as well as animations and virtual models.

**Pedagogical shifts and roles:** Teachers indicated that the extensive use of iPads encouraged or induced a general shift away from more traditional forms of direct instruction due to the new affordances and capabilities they brought into the classroom. The iPads were seen to support and facilitate more student-directed, collaborative and project-based learning, including IBL, and teachers indicated that they were assuming new roles as co-learners and moving away from traditional roles as directors of learning and conduits of expert knowledge. And teachers were likely to see students assuming new roles

as knowledge-makers, and sometimes as teachers (e.g., when presenting culminating works and findings to peers).

**Engagement and agency:** Teachers and students both indicated that iPads increased student engagement, especially when students were involved in creating learning demonstrations using multimodal tools and apps. When iPads were in play, students also were more likely to persist when confronted with obstacles, and were also seen to display greater autonomy and agency, taking initiative or directing their own learning.

**Formative assessment:** iPads (both on their own and in combination with IBL) had an impact on assessment, particularly formative assessment, with teachers using iPads and related tools such as Google Drive and commenting features in apps to provide more timely feedback and formative assessment to support learning processes. Some teachers found the Sesame Snap app was instrumental in this process; it was used for taking observational notes or video, and developing assessment checklists and rubrics which could then be easily shared out to students, revised when needed, and readily applied to uploaded student work.

**Collaboration and sharing:** The sharing of student learning with peers, which is an important element of both IBL and other pedagogies, was facilitated by iPads (in conjunction with other classroom technology tools). Teachers frequently indicated that students would share work in progress for discussion or present final projects. Moreover, iPads were seen to facilitate collaboration, work-sharing, cross-commenting, ad hoc research, and real-time modeling of ideas or processes.

**Digital literacies and research:** Teachers reported a gradual increase in students being able to research, develop good “search questions”, and navigate websites, and evaluate the reliability of information and sources of information. Some teachers reported, however, that they had several students who needed ongoing structure for and guidance in these practices.

iPad use frequently had a major impact on teachers’ own pedagogical perspectives and their reported professional growth. Among all the teachers we interviewed, ongoing professional development was seen as key to the successful integration of iPads into classroom practice, and most of the teachers signaled the need for continued, ongoing formal and informal professional development and support to scale up their own TLE-fostered practices. We found evidence of a great deal of informal and improvised professional sharing among most of the teachers, especially the enthusiastic ones who were eager to maximize the potential of iPads and IBL in student learning. Several teachers reported that iPads – in conjunction with new pedagogies – had significantly enhanced their capacity to provide richer and deeper learning opportunities for their students, with some signaling that the technology (or TLE more generally) was enabling them to become the teachers they wanted to be.

## Descriptions and analysis of student work

We conducted an in-depth analysis of student work samples from the six TLE schools where we conducted student and teacher interviews, looking at whether and how student project work samples reflected or enacted TLE objectives, and how the TLE action plan inputs may have generated the desired student outcomes. Specifically, we examine if, how, and to what extent the student work samples provided evidence of effective inquiry-based learning practices, and to what extent the affordances of technology and 1:1 iPad distribution were effective in supporting deep learning and the acquisition of 21<sup>st</sup> century competences.

In the first part of this examination of student work, we undertook a qualitative assessment of student work samples using, as criteria, principles of IBL as laid out in TLE and Ontario Ministry of Education documents. In addition, we made use of the well-known SAMR model for classifying the degree of

innovation observed in student work, cross-referencing this simple heuristic model with Michael Fullan's writings on deep learning, new pedagogies, and new technology tools. In the second part, we undertook a holistic quantitative analysis of three sample sets from three TLE pilot schools using a research rubric.

We begin with a discussion of the quantitative analysis first, as the qualitative discussion provides insight into the results of the quantitative analysis.

### ***Qualitative Analysis of student work***

In this section we briefly distil observations from our analysis of the student work samples, and on that basis highlight possible areas of focus for refining TLE goals and better supporting IBL practices and innovative tool use.

Our analysis of student work samples, together with notes provided by teachers, indicates that TLE aims for enhanced student learning were most likely to be enacted when and where: 1) teacher-provided task templates did not predetermine student learning or solicit propositional statements, short answers, or the conventional reproduction of static facts; 2) dynamic digital media tools were applied to support *all* of the different phases of the IBL cycle, including formative assessment; 3) students assumed authentic roles, using authentic media tools, as producers of knowledge, demonstrating learning through the creation of dynamic products for real-world audiences; 4) digital research, knowledge production, and the application of communications literacies were exercised within tasks that were driven by student concerns, and related to the extended world (and its issues and controversies) outside of the classroom.

In several cases, student sample sets did not display evidence of these features or processes, particularly in the grade 7 and 8 samples, where IBL methods and project work seemed largely constrained by templates and traditional knowledge reproduction (restating facts found on research websites, in some cases, in copy and paste form).

**Evidence for IBL fidelity of implementation:** What was absent in many samples was evidence of student agency in the initial work planning processes, in refining inquiry questions, or in extending and deepening the scope of related research beyond the provided templates. We suggest that students could have more directly involved in the initial planning phase, and invited to notice, wonder, and ask questions that might have shaped and reshaped the research questions through the ongoing process. We reference in this regard TLE documents and the Ministry of Ontario *Capacity Series* on IBL, which encourage student agency in the initial planning stages and, further throughout the entirety of the inquiry-learning cycle.

For 7<sup>th</sup> and 8<sup>th</sup> grade samples, we did not see evidence of students being enabled to co-generate knowledge in ways that enact deep, interdisciplinary learning in which new knowledge is connected to the world in meaningful ways.

In the 4<sup>th</sup> and 5<sup>th</sup> grade samples, we saw more evidence of IBL in action, and of innovative tool use as well. For example, the "Poetronica", "Government Letter", and "Wildlife Habitat" projects displayed greater evidence of student involvement, with students able to create knowledge in ways that engaged research competencies. Interdisciplinary learning occurred in these projects, with new knowledge being extended or holistically connected in meaningful ways. Across all of the grades, however, our work analysis findings signal a need for refinement of IBL practices.

**Application of technology:** While the use of digital tools for research and knowledge demonstration was present in almost every sample, not all of the sample tasks modeled transformative uses of technology to support new pedagogies. Again, pre-given templates appeared to determine outcomes and constrain the use of technologies to locate information and apply it in dynamic ways. In the 7<sup>th</sup> and 8<sup>th</sup>

grade samples, there was too frequent evidence of copy and paste, and little evidence of knowledge synthesis or connection to real world issues and big ideas (except in perfunctory ways). In these cases, iPads were used to simply duplicate traditional learning tasks in digital or online contexts, with little or no significant transformation of curricular forms and classroom practices.

At the same time, we do see evidence in some student work of emerging iPad use where teachers are using the technology to substantially modify and even transform how teaching and learning takes place. Here we see evidence of innovative teaching and learning in the contexts of IBL, formative assessment, digital literary acquisition, and multimodal communications practices supportive of deep learning and 21<sup>st</sup> century competences.

The most pedagogically transformative uses of technology were present in 4<sup>th</sup> and 5<sup>th</sup> grade sample sets, where teachers were integrating multiple tools to support deep learning *throughout* the IBL process as a whole. Teachers used videos to stimulate curiosity and wonder, employed interactive virtual walls to model techniques and support real-time collaborative learning, and utilized interactive polling tools to encourage discussion on topics.

This use of multiple media tools throughout the inquiry process (in 4<sup>th</sup> and 5<sup>th</sup> grade samples) also facilitated more dynamic culminating projects. In these projects students were more likely to engage in real-world problem solving and designing knowledge for real-world audiences (e.g., iMovie products and letters posted to public-facing blogs). At the same time the projects showed evidence of interdisciplinary learning.

Innovative formative supports and assessment methods were also employed in the grade 4 and 5 samples. In one project, well-defined “success criteria” were used to formatively encourage, rather than delimit, student agency and the creative application of learning. In this case, success criteria drew student attention to opportunities and possibilities for creative production and knowledge design. In another project, formative feedback was conducted as an “ongoing conversation” with students (using Google Doc comments). In still another project, forms of student self-assessment were nested into the final digital Explain Everything document, requiring students to document evidence of learning and critically reflect on the learning process.

The 4<sup>th</sup> and 5<sup>th</sup> grade samples also evidenced a greater degree of student critical reflection on IBL processes and products of learning, and in these cases (based on teacher task descriptions) students were more likely to take collaborative roles sharing and teaching one another using digital presentation media.

### ***Holistic quantitative analysis of student work***

There is not space in this summary to present the details of our methodology for this analysis, or the limitations of our sample, but some brief context is needed. Samples of student work were selected from schools where at least three or more projects on the same topic were available for coding *and* where the projects were relatively substantive, requiring a minimum of one week to complete. The sample sets we obtained represent project work from grades 4, 7, and 8.

Sample sets were rated using a student work product assessment rubric developed by SRI International that was specifically designed to evaluate evidence of 21<sup>st</sup> century learning competences. The SRI International rating scales provide four dimensions for assessing student learning as evidenced in their work: knowledge building, applied ICT use, real-world problem solving and innovation, and communication skills. The SRI International rating scales were selected for this report as they consist of dimensions that closely align with TLE objectives for student innovative digital tool (ICT) use, deep learning tasks, and learner-centred pedagogies like IBL. The rating scheme scoring ranges from 1 to 4,

where a score of 1 indicates that the student work demonstrates no evidence of the skill to a high of 4, which indicates a very high skill level is evident.

Our analysis of the sample sets indicated that the mean scores on each of the dimensions were above the mid-point of the scale in most cases (rating between 2 and 3 on the scale, across all four dimensions noted above). None of the samples scored on the high end of the scale on any dimension (the 3 or 4 rating on the SRI scale), a score which would indicate a high level of skill or competency on that dimension. It was evident that there was room for significant improvement across all of the four dimensions of the scale. However in comparison to an international group of students these scores were above average; SRI International reported that in their *Microsoft Partners in Learning* international study, over 50% of student work samples were scored 1 on every dimension (and student work samples in our study scored, on average, higher than that).

## Summary and recommendations

Here we structure our findings in accordance with the TLE logic model articulated earlier, organizing our summary statements and conclusions around our anchoring research questions across three category levels: board, teacher, and student.

**Board level findings:** Our literature review, interviews with key actors and TLE leadership staff, and analyses of the TLE action plan and related TLE policy documents indicate that the HWSBD has developed an initiative that is supported by the research and literature, including Ministry documents and directives. Extensive research within and outside of Ontario and Canada suggests that IBL, supported by 1:1 technology tools, provides an excellent footing for supporting 21<sup>st</sup> century literacies and competences. There is of course the need to ensure that 1) there is fidelity of implementation when IBL is put into practice, and 2) technology tools are used in innovative ways that encourage deep learning and are not used to merely reproduce traditional instructional forms.

The board has made significant progress in rolling out TLE beyond the initial pilot schools and plans to continue expanding it in 2016-17 to include all grade 9 classrooms with 1:1 iPads, shared kits of iPads for all grade 6 classrooms, and 1:1 iPads for grade 10s in two secondary schools. We estimate that this expansion will result in about 24% of students having their own iPad. The board has also made a significant financial commitment to TLE and plans to increase total funding from \$540,000 in 2015-16 to \$990,000 next year, while the CODE grant is projected to decrease slightly from \$758,000 to \$745,000 year over year.

Based on our findings, we conclude that professional learning must continue to be supported for current and new teachers. There already exists a vibrant informal professional learning community supporting TLE within several of our schools, and so we urge the board to find some means of sustaining and enriching formal professional learning events and policies while, simultaneously, recognizing and energizing small-scale informal professional learning communities among its teachers both within and across schools.

We also offer a number of suggestions for the scaling and further roll out of the TLE initiative. Here, drawing on the work of Fullan and Donnelly, we provide empirically-grounded models and strategies for implementing and sustaining large scale system shifts. In particular, one suggestion is to encourage local clusters of schools that can take up ownership of the initiative, circulate its aims and values, and lead implementation. In addition, recommendations regarding E-BEST for retooling its research policies and practices to have a more direct and effective impact are provided.

**Teacher level findings:** Despite the concerns teachers expressed about their changing role we found evidence that they were, in fact, beginning to promote deep learning opportunities, particularly through inquiry-based methods and innovative uses of iPad technology. Our key findings at this level follow:

- The strongest evidence for IBL implementation in student work was found in the 4<sup>th</sup> and 5<sup>th</sup> grade student work samples where teachers integrated the innovative use of multiple digital tools throughout all stages of the inquiry-based learning process, and forged new learning contexts and collaborative partnerships.
- We found encouraging evidence of a shift to formative assessment practices, where teachers are providing feedback and co-developing success criteria with students (in some cases) and using technology tools to support assessment as and for learning.
- Whole-class sharing and peer assessment of student work is being conducted in most classrooms – a key feature of IBL that supports critical reflection on the process of learning.
- We see a need for considerable advancement in certain dimensions of the IBL implementation as currently found in the typical TLE 1:1 classroom. These include providing greater opportunities for student agency in the initial IBL planning processes, and in the refining of inquiry questions and the extending and deepening of related research beyond teacher-created templates; enabling students to create authentic products, and engage real-world problems; and providing real-world audiences for culminating student work.

**Student level findings:** Teachers reported high levels of student engagement when iPads, especially in conjunction with IBL practices, were integrated into the learning process. The key findings at this level are as follows:

- Student engagement was noted to be higher in general during both IBL and iPad use, and was very robust when students were using iPad tools to learn from or create multimodal artefacts and multimedia documents integrating written text, voiceovers, music, images and/or video. Engagement was similarly strong when students were demonstrating learning through the production of iMovie films and trailers, or when they were creating animations and simulations (Minecraft), or music created with iPad apps. Students gravitated to these kinds of multimedia applications to demonstrate knowledge or design culminating projects.
- Strong student engagement with new media was not limited to high-performing students. The assistive affordances of technology tools and the availability of leveled resources led more students to engage and participate (including special needs students and English-language learners).
- Dynamic collaborative opportunities were facilitated with the iPads (and associated technology tools), supporting group work, knowledge sharing, ad hoc collaboration, and the presentation and showcasing of final works. Students welcomed taking the role of the expert and demonstrated both a capacity and willingness to share knowledge with peers and teachers.
- Teachers reported that students, when working with iPads, were more likely to persist in the face of challenges and demonstrate initiative, displaying greater autonomy and agency in relation to research and learning challenges. However, some students require more scaffolding and support for their self-monitoring and metacognition, and guidance in work planning.

We note, however, that the kinds of significant transformations that TLE is seeking to instantiate do not occur overnight, and challenges are to be expected, particularly in the short term, when 1:1 technology tools and pedagogies like IBL are first being engaged. Their applications can seem counter-intuitive to teachers accustomed to assuming conventional teaching roles and employing traditional teaching practices. That said, we find that a vital TLE culture is emerging in these schools, supported by many enthusiastic principals and teachers who have already taken ownership of TLE, and are beginning to

transform teaching and learning in ways that are significantly advancing the program's desired outcomes.

### ***Our recommendations***

#### **Professional learning recommendations**

- Continue to support teacher development in the pilot schools at the same time as supporting teachers in the schools that newly join the project.
- Provide support for new teachers assigned to TLE schools.
- Create conditions in schools to support a variety of formal and informal professional learning opportunities including coaching, peer mentoring, lesson observation, "lunch and learn," professional learning communities using social media (e.g., Yammer) and other similar kinds of opportunities.
- Address the formative and summative assessment of digital artefacts and presentations more fully in professional learning activities.
- Conduct an annual professional learning needs assessment and plan programming accordingly.
- Develop an FAQ that answers teacher questions on topics such as use of IBL in mathematics, student question formulation, multimedia project assessment, and how IBL relates to and can directly support EQAO preparation to aid in fostering a shared understanding of IBL and assessment strategies across all TLE schools .
- Produce exemplary demonstration videos of IBL in action, particularly in mathematics, and make them available in the Hub.
- Provide the opportunity for "learning walks" within and across schools participating in TLE to observe teaching and learning strategies and student products

#### **Scaling TLE recommendations**

- Make public the plan and rationale for expanding to other schools and grades.
- Provide financial projections on how TLE can become district-wide within a five-year timeframe.
- Seek additional funding above and beyond current levels to make TLE a demonstration initiative that can provide leadership for the province in development of 21<sup>st</sup> century learning.
- Encourage and provide mechanisms for clusters of schools to share and support each other.
- If home use is reinstated, provide support and training to parents so that they can better monitor and regulate their child's iPad use.
- Host a "celebration of learning" (in families of schools) for students, teachers, and community as an opportunity to showcase teaching and learning strategies and student exemplars.

#### **Hardware, infrastructure, and support recommendations**

- Consider supplying keyboards iPads or moving to laptops for intermediate/senior grades.
- Review the policy on students taking home iPads and develop policies based on taking them home being a privilege that is first earned, but can be revoked for misuse.
- Develop a district strategy for educating parents in the value of iPads in their children's education, and the standards of care and rules for use they should apply when their children bring them home.
- Address the network latency issues reported in some schools.
- Provide solutions for classrooms that do not have sufficient outlets for charging iPads.
- Consider giving new teachers and those in new schools the option of receiving iPad kits during their first year rather than a full class set.

### TLE evaluation recommendations

- Continue to refine and extend E-BEST research practices to more directly interface with and support professional learning to enable teachers to become active researchers and collaborators/contributors; encourage teachers to build this into their professional growth plans.
- Collect data from principals, teachers, students, and parents as a program accountability/improvement initiative that does not require informed consent, rather than considering it a research undertaking that does require consent.
- Make public internal analyses or reports on project outcomes to increase accountability.
- Provide references to internal analyses or reports in the annual reporting to the board to increase credibility.