Teaching in a digital age: How educators use technology to improve student learning
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Introduction
Research comparing the effects of digital learning to traditional classroom instruction has yet to show a consistent, significant advantage for digital learning. [1] Clark and Mayer [2] hypothesize this may be due to an emphasis on the technology itself, rather than how to use it in ways that promote learning. As Muir et al. [3] note, success is determined by how the technology is deployed in the learning environment as well as the pedagogical model that underpins the initiative.

Our study focuses specifically on how teachers integrate digital strategies to promote learning. Here we address the following questions:
1. How do teachers leverage technology to deploy instructional strategies?
2. To what extent are these strategies grounded in learning theory?

Methods
Using a case study approach, we interviewed administrators, held teacher focus groups, observed classrooms, and collected online survey data from teachers. Focus group and interview questions were based on the framework by Shapley et al. [4] and the online survey was adapted from SETDA.

7 sites participated (Table 1).

8 researchers and 2 State Teachers of the Year analyzed the data, identified themes and revised based on group consensus.
**Results**

The 7 participating sites are described in Table 1:

44 teachers, 7 building- and 6 district-level administrators, and one IT staff participated. Teachers’ responses to the technology use survey are shown in Figures 1 and 2. Teacher responses were similar across sites, unless otherwise noted.

### Table 1. Participating sites

<table>
<thead>
<tr>
<th>Location &amp; 2012/13 enrollment</th>
<th>% Econ Disadv students</th>
<th>Student/teacher ratio</th>
<th>Location</th>
<th>Type of Initiative</th>
</tr>
</thead>
<tbody>
<tr>
<td>California (550 students)</td>
<td>40%</td>
<td>16:1</td>
<td>Urban</td>
<td>2:1 laptops, school- but not district-wide</td>
</tr>
<tr>
<td>Michigan (649 students)</td>
<td>75%</td>
<td>16:1</td>
<td>Suburban</td>
<td>Flipped Learning, school-wide, working toward district-wide</td>
</tr>
<tr>
<td>Florida (6,600 full time students)</td>
<td>Est. 45%</td>
<td>Max of 150:1</td>
<td>Online</td>
<td>Virtual/online courses, school- and district-wide</td>
</tr>
<tr>
<td>Idaho (874 students)</td>
<td>35%</td>
<td>18:1</td>
<td>Rural</td>
<td>Blended learning adopted by some teachers (i.e. not yet school- or district-wide)</td>
</tr>
<tr>
<td>Maine (482 students)</td>
<td>8%</td>
<td>12:1</td>
<td>Suburban</td>
<td>1:1 tablets (formerly laptops), school- and district-wide</td>
</tr>
<tr>
<td>Pennsylvania (1056 students)</td>
<td>18%</td>
<td>17:1</td>
<td>Rural</td>
<td>1:1 laptops and BYOD (some teachers implementing a blended model but it isn’t a full school initiative), both school- and district-wide</td>
</tr>
<tr>
<td>Virginia (1,969 students)</td>
<td>14%</td>
<td>23:1</td>
<td>Suburban</td>
<td>Started with laptops &amp; transitioning to BYOD, school- &amp; district-wide from 3rd grade and up</td>
</tr>
</tbody>
</table>
Fig. 1  Teachers’ technology fluency & beliefs

Percent of "Very Much So" Responses

- Comfort teaching with tech
- Comfort learning new tech for teaching
- I have skills to learn new tech
- Tech enhances learning in ways not otherwise possible
- Seen positive changes in learning I attribute to tech
- I am a better educator when I use tech

Fig. 2  Barriers to technology use

Percent "Minor/No Issue" Responses

- Unequal access for students at home
- Don't get training I need
- Don't feel prepared for tech we use
- Classroom mgt more difficult with tech
- Unconvinced tech enhances learning
- Inadequate facilities at school
- Lack of admin support

Note: “Major issues” reported by 2 teachers each from CA and MI sites, with greatest proportion of economically disadvantaged students
Focus group, interview data and classroom observation data suggested 5 general themes regarding how teachers used technology to enhance student learning, depicted below.

**Figure 3. Five themes about technology use**

Specific technology integration strategies used by the teachers are summarized below.

**Table 2. Technology integration strategies**

<table>
<thead>
<tr>
<th>Instructional Strategy</th>
<th>Implementation Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication &amp; info management</td>
<td>Developing digital citizenship/responsible use</td>
</tr>
<tr>
<td></td>
<td>Share information with students and parents</td>
</tr>
<tr>
<td>Direct instruction of content</td>
<td>Teach &amp; reinforce how to use specific tech skills</td>
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<tr>
<td></td>
<td>Enhance/deepen/enrich learning experience</td>
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<tr>
<td></td>
<td>Provide direct instruction/lectures</td>
</tr>
<tr>
<td></td>
<td>Use digital representations &amp; information displays</td>
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<tr>
<td></td>
<td>Tutor or remediate a student</td>
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<td></td>
<td>Provide enrichment opportunities</td>
</tr>
<tr>
<td>Access &amp; Accommodations</td>
<td>Assist students with special needs</td>
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<tr>
<td></td>
<td>Adjust content to personalize learning</td>
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<td></td>
<td>Enable self-paced learning</td>
</tr>
<tr>
<td>Collaboration</td>
<td>Work with others, locally or globally, on projects</td>
</tr>
<tr>
<td>Research &amp; Exploration</td>
<td>Promote/facilitate creativity</td>
</tr>
<tr>
<td></td>
<td>Conduct internet research</td>
</tr>
<tr>
<td>Assessment &amp; Feedback</td>
<td>Conduct ongoing assessment to monitor learning</td>
</tr>
<tr>
<td></td>
<td>Provide immediate feedback to students</td>
</tr>
</tbody>
</table>
Conclusions
In the best cases observed in this study, educators were using technology in ways that Jim Collins, in the book “Good to Great,” refers to as an accelerator of growth: not as a means to an end, nor the catalyst, but rather as an enabler of the desired outcome.\(^5\) Acceleration occurs when teachers use technology in ways that align with learning science.\(^2\)

Some sites started with an instructional model and incorporated technology into it, as an enabler. Others started with the technology and let the teachers to integrate effectively into instruction. Although the latter is less optimal, we saw teachers using technology in creative ways at all sites, and in ways that were grounded in learning theory. Examples include:

- To provide immediate and ongoing feedback to learners\(^6,7\)
- To facilitate self-pacing or segmenting of learning\(^8,9\)
- To promote self-guided or “discovery” learning\(^10,11\)
- For collaborative and cooperative learning\(^12,13,14\)
- To facilitate student-centered, active learning\(^15,16,17\)

When technology is used to remodel learning routines, cognitive processes, problem solving, and teacher roles, our schools can realize the promise of technology to transform learning. If we remain focused on the technology itself, the cost is high. As Clark and Mayer observe,

\textit{From the plethora of media comparison research conducted over the past sixty years, we have learned that it’s ... the instructional methods that cause learning When instructional methods remain essentially the same, so does the learning, no matter which medium is used to deliver instruction (p. 14).}\(^2\)

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Literature Cited
Further Information

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Educator Learning & Effectiveness

http://researchnetwork.pearson.com/