Replacing Textbooks with Video and State Standards in the K-12 Classroom

The Results of a Nationwide Survey of U.S. Middle School Science Teachers

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Executive Summary

Today there is a real opportunity for K-12 educators in the U.S and worldwide to leverage standardized state curriculum frameworks and free Open Educational Resources (OER) to replace textbooks. Ideally, classroom teachers could knit together high-quality OER content to provide instructional materials to students. This would result in significant cost savings to school systems, make instructional materials accessible to low-income students and provide content that closely matches state standards and students' preferred learning styles.

Press coverage, however, often reports low teacher compliance with state standards and a lack of awareness and usage of OER resources, especially video.

Contrary to these reports, individual teachers using the educational technology application JogNog reported using OER and state standards in their classrooms. However they found it challenging to do so. The promise of OER was compelling but the burden of finding and coordinating instructional material, that used to be provided by textbook publishers, was now falling to the teachers. Teachers reported not having the time or the required skills for authoring textbook replacements for their classes. Just the task of finding relevant OER video content often took a considerable amount of time for teachers (20-40 minutes to find a single relevant educational video).

Recent research from Gorman confirms this trend. They report that teachers now spend an average of seven hours each week searching online for instructional materials such as videos, articles, worksheets and assessments. This search time has been increasing over the last decade and tracks with an overall decline in textbook usage and a rise in the availability of high-quality, free web materials (OER). These trends can be attributed to the need for teachers to both accommodate shifting student learning styles, which now require more entertaining and shorter instructional materials, and also for materials to match state standards for curricula. While OER is often considered to be "free" by administrators, teachers are spending increasing amounts of time trying to find it. This is especially true for finding OER video content.

The arrival of OER video presents a tremendous opportunity for improving education but more research is needed to understand how teachers can successfully utilize it. In January of 2018, G7 Research LLC (the makers of the K-12 learning platform JogNog) commenced research to answer four questions:

1. Are science teachers still using printed textbooks in the classroom?
2. Are science teachers using OER video in the classroom?
3. Are science teachers following state standards to organize the OER?
4. Are science teachers utilizing education technology in combination with OER and state standards to deliver a viable replacement to the printed textbook?

To answer these questions we partnered with undergraduate researchers at the Massachusetts Institute of Technology (MIT) and conducted a nationwide survey of middle school science teachers. We found the following results:

1. 100% of teachers knew and used their state standards.
2. Most teachers used short OER videos in their classrooms.
3. Textbooks were being replaced by a combination of OER, standards, and educational technologies.
4. Teachers spent a lot of time searching for OER videos.

Research Design

We chose to survey 176 middle schools, which were selected at random and weighted by state population. We reached out to 526 teachers from 163 cities, with at least one school in each state. Seventy-eight teachers

responded to our questions regarding the use of textbooks, OER video, state standards, and educational technology in their classrooms (see Addenda).

Video Usage is Common and Increasing

Of the 78 teachers we interviewed, 64 answered our question regarding how often they show videos in the classroom. These teachers typically showed one to three videos each week to their students. These were typically short video clips, no longer than five minutes each. Common reasons teachers cited for using these short videos were: to introduce topics, as a hook to start a lesson and engage student curiosity, to wrap up a topic, to refresh knowledge, to solidify a point, and to review for a test. These teachers also showed videos to demonstrate real-life applications of science concepts, or to give students a chance to observe something that the school did not have the tools to demonstrate in the classroom.

Videos per Week	Teacher Responses
less than 1	10
1	13
1-2	6
2	6
2-3	9
3	9
3-4	2
4	3
more than 4	6

YouTube is the Most Popular Source for OER Videos

The most popular source for such science videos was YouTube. More than half of the teachers interviewed said that YouTube offered a convenient way to search for videos on a specific topic. The next most popular source of science videos was BrainPop. Of the 78 teachers who responded to the question, 16 had found videos on BrainPop. In addition, nine teachers reported that they showed Bill Nye videos in the classroom. However, one teacher mentioned that while these videos are high-energy and engaging, they are outdated, which makes it difficult for students to take the content seriously. Other sources include NOVA from PBS.org, Crash Course Kids, TED Ed, and SAFARI Montage.

Video Sources	Number of Mentions
YouTube	46
BrainPop	16
Bill Nye	9
NOVA from PBS	7
Crash Course Kids	4
TED Ed	3
SAFARI Montage	2

Other sources mentioned (once each) included Physics Girl Channel, SciShow, Nature Tech, Amoeba Sisters, Steve Spangler, and Bozeman Science.

Several teachers also mentioned that, while entertained by the videos, students sometimes do not pay attention. To keep students focused on and engaged with the video, teachers often asked their students to complete worksheets or short interactive quizzes after viewing the video to ensure that they followed along and understood the material.

State Standards are Embraced and Used

Of the 78 teachers interviewed, every teacher (100%) used state standards to guide their lessons. All teachers were able to report the exact standards they were working on for that week. Of these teachers, 25 reported that they use the Next Generation Science Standards (NGSS).

Many Teachers Don't Use Printed Textbooks

Of the 24 teachers who responded to our queries about textbook usage, ten (42%) used printed textbooks, nine (38%) used digital textbooks, and five (21%) used no textbook at all.

Educational Technology Isn't Solving the Search Problem

Educational technologies should be invaluable in finding and tying OER into lesson plans that support the school's curriculum and the state standards. Though widely used, and mostly viewed positively, educational technology sometimes proved challenging for teachers. This research showed that there were no good existing tools to help teachers to save time in searching for OER videos, mapping them to state standards or integrating them into coherent curricula. Teachers saw this as unsatisfied need as OER usage increased.

The most popular educational technology in the classroom among teachers in the study was Kahoot!. Some teachers said that they found it valuable when reviewing before quizzes and tests, but others expressed concern over behavioral management problems inherent in the platform. Teachers cited distractions from the technology such as the students' ability to create their own usernames and "over-excitement" about the game rather than about learning.

Google Suite was the next most frequently mentioned educational technology. Thirty-three teachers said that they use Google Classroom and other Google applications frequently. Quizlet was the third most popular technology with 22 teachers using it as a review tool. Other educational technology platforms were represented, but only by a handful of teachers. BrainPop is a popular platform because of its brief yet engaging overviews of science topics. PhET interactive simulations help students to visualize challenging concepts. Khan Academy, Canvas (a learning management system), Discovery Education, Schoology, Quizizz, and StudyJams were also popular among teachers.

Ed Tech App	Responses
Kahoot	35
Google Suite	33
Quizlet	22
BrainPop	16
PhET Simulations	9
Khan Academy	8
Canvas	8

Discovery Education	8
Schoology	7
Quizizz	7
Study Jams	5

Other websites and platforms that were mentioned fewer than five times included Nearpod, Edpuzzle, GoFormative, Newsela, IXL, BioBasics, ExploreLearning, Socrative, Spiral.ac, Poll Everywhere, Freerice, Prezi, Edmodo, MobyMax, Legends of Learning, Wizer.Me, Pear Deck, Blendspace, AnswerGarden, Flipgrid, Screencastify, and USATestprep.

Teachers are Challenged by the Complexity of Educational Technology

The teachers interviewed for this project encounter a variety of classroom challenges including an increasing amount of time spent searching for OER video content and keeping students focused on learning and not distracted by the educational technology.

Several teachers pointed to the poor user interface of many educational technologies. Educational technology applications are often perceived to be difficult to use, as teachers feel they are often designed by engineers rather than educators. Teachers would like to see an improved user experience with more intuitive tools that promote easier interactions and that keep students focused on learning.

Another common problem cited by teachers was the overwhelming number of educational platforms and technologies available. Determining how to use and integrate a tool into a lesson is time-consuming, and sifting through enormous quantities of sources means that it takes even more time to find quality, useful sources.

Several teachers also mentioned the difficulty of monitoring students. Students are frequently off task, playing games, iMessaging during class, and abusing digital devices. Teachers expressed the wish that educational technology could keep kids on task and monitor their activities.

Teachers also raised a variety of concerns beyond the scope of this research. These included the lack of access to computers for the whole class, the lack of internet and technology access in students' homes, limited WiFi bandwidth, malfunctioning Chromebooks, and broken chargers. In addition, a significant number of teachers either abstained from describing the problems they faced, or said that they did not have any problems that could be solved by educational technology.

More Research is Needed

This research was designed to be as accurate and unbiased as possible, but several limitations should be noted:

- **Small sample size.** Because fewer than one hundred teachers responded to the inquiry, there will be some sample bias in this study. The strong signals of the data (e.g. 100% of teachers knowing their state standards), however, are unlikely to be directionally reversed.
- **Biased responders.** As over 500 teachers were randomly selected, but fewer than 100 teachers responded, it is likely that there was some self-selection among responders. For instance, teachers who are organized and good planners would be most likely to respond to the survey and because of this also be likely to use their state standards for curriculum planning.
- **Reporting bias.** It is possible that the respondents aimed to provide the "right" answers to the survey. For instance, most teachers believe that it is important to know and use their state standards, and might respond affirmatively even if they had not actually used the standards that

week. The personal relationships that the interviewers built with the teachers attenuated this issue, but it could still have an effect. Other questions about textbook and video usage seem less likely to encourage teachers to modify their answers, as the questions did not have "right" or "wrong" answers. However, teachers might, for instance, underreport the usage of video in the classroom if they associate video usage with less-rigorous teaching skill.

The solutions to these limitations may be difficult to implement. Creating a large response pool could help to confirm these results. To achieve this, we might seek a higher percentage of teacher responses by contacting school principals and asking them to require a randomly-selected teacher to participate in the survey. However, this method would make the survey more formal, and even if the survey results remained anonymous, teachers might modify their responses to match the answers they thought their principal would want to hear.

It should, however, be possible to assess general teacher tendencies, such as believing that video usage in classrooms is associated with less-rigorous teaching practices, or the association between awareness of state standards and good teaching practices. This approach could at least bound the amount of bias we might expect from these results.

A Bright Future for OER if Search Can be Improved

Our research has shown that OER videos, state standards, and educational technology together play an increasingly important role in the classroom. All teachers interviewed for this study used their state standards, and virtually all teachers used educational videos and educational technology to support their lessons. The average teacher shows one to three short videos per week, and utilizes several forms of educational technology.

State standards play a key role in shaping the lesson plans of these teachers. All the teachers in this study rely on state standards to guide their lessons, while printed textbooks play a diminishing role in the shape of curricula and in overall instruction.

In the future, new educational technology could better support the use of OER videos and state standards in the classroom to save teachers time and align their curricula with state standards. We suggest the following:

1. **To save teachers time in finding OER videos:** A website where a teacher could select any state standard and be provided a list of recommended educational videos that support that standard.
2. **To keep students on task when viewing OER videos:** A website where a teacher could paste a link to an educational video (such as on YouTube) and be provided an interactive quiz game that matched the vocabulary contained in that video.
3. **To simplify educational technology for teachers:** Educational technologies should be integrated with preferred and familiar Learning Management or Student Information Systems (e.g. from Google, Microsoft, Clever). This would simplify access and user interfaces for the teachers.

We conjecture that teachers' movement away from printed texts and towards video is likely part of a larger social phenomenon that reaches beyond the classroom. We look forward to the development of better tools that make it easier and faster for teachers to find high-quality OER and integrate them into strong curricula that support state standards.

References

Goldberg, M. 2016. Classroom Trends: Teachers as Buyers of Instructional Materials and Users of Technology. www.mdreducation.com.
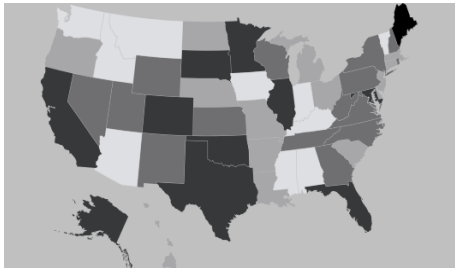
Gorman, N. 2017. Survey Finds Teachers Spend 7 Hours Per Week Searching for Instructional Materials. EducationWorld.com.

Addendum 1: Survey Populations

Number of Teachers Contacted by State (darker colors indicate more contacts)
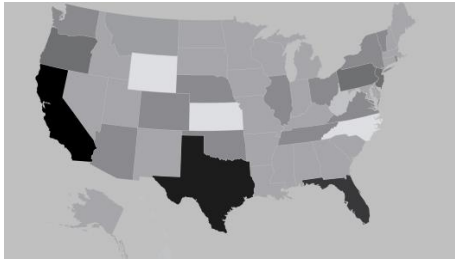
Number of Responses by State (darker colors indicate more responses)

Addendum 2: Selected Teacher Quotes from Survey

Videos replacing textbooks in the classroom:
1. "I follow state standards, not a textbook." - River Trail Middle Schools, Georgia
2. "We have textbooks but I use them as a resource not my central teaching aid. I go off the NGSS standards instead." - Dunlap Valley Middle School, Illinois
3. "If I show 3-5 minute videos I may show up to three in one class, but if I show a 25-30min video I may only show one per week." - Paw Paw Middle School, Michigan
4. "I rely on technology to replace textbooks that were outdated." - Madison Middle School, Ohio
5. "No more textbook - only NGSS standards" - Forest Park Middle School, Wisconsin

Difficulties in finding quality OER videos
6. "There are too many resources to sift through to find useful material. I have a Specialist degree in Instructional Technology and it's still overwhelming, considering time/planning constraints." - Dickerson Middle School, Georgia
7. "I had issues finding a video that was exactly what I wanted my students to see." - Talley Middle School, Delaware
8. "Videos usually come from YouTube because it is easy, though our county subscribes to several edu media services that I sometimes pull videos from." - Westland Middle School, Maryland
9. "Something that could be improved is just updating of material. I do like Bill Nye because it is high energy and the material is good but it so outdated it is hard to get students to take it seriously sometimes." - Southwest Middle School, North Carolina
10. "The biggest problem I have is finding good sources. It takes so long for me to find a video to use and most of the time it covers slightly different material." - Simmons Middle School, South Dakota

Challenges in keeping students on task

11. "The biggest issue I come across is students playing games when they shouldn't or iMessaging during class. It's not the easiest thing to monitor in a large class." - Hornedo Middle School, Texas
12. "I use Quizlet and Kahoot! to review videos." - Southwest Middle School, North Carolina
13. "I think that it is a nationwide problem is that this is the first year that kids have a laptop at school, so they are frequently off task and it's hard to monitor what they're doing. I wish ed tech could help with how to keep kids on task." - Hornedo Middle School, Texas
14. "I love the idea of personalized learning and Universal Design Learning. I am finding that I am having a harder time processing the large quantities of data fast enough. I would love technology that has the capability to analyze data to 1) figure out what style of teaching has the most impact on individual students and 2) tells me the gaps in student knowledge." - Clarksville Middle School, Maryland

Addendum 3: Sample Emails & Teacher Response

Hello Ms. Smith,

I am a sophomore at MIT doing research on education in the US, specifically looking at middle school science classes. Your school has been randomly selected for my research, if you wish to participate. I was wondering if you would be willing to answer a few questions about videos and educational technology in your classroom? It should only take about 5 minutes, and can be done via email or phone.

Thanks in advance and looking forward to hearing from you!

Best,
Abby

> **Hi there!**
>
> **I would love to answer questions via email if that would be ok. Please let me know how I can help!**
>
> **Ellen**

Hi Ellen,

Thanks so much! Here are the questions. Feel free to answer as many questions as applicable, and depending on your answers, I may send a few more follow up questions.

1. What was the last video that you used in your classroom? When?
2. What are the state standards that you are working on this week?
3. What educational technology do you use? What problems do you have that education technology could help with?

Thanks again for the help, and please let me know if you have any questions.

Cheers,
Abby

> **Hi Abby,**

Sorry for the late response. Things here were a bit crazy the past few days!

1. The last video that I used in my class was today. We watched an activity where someone put camphor crystals into water and the kids had to observe and determine if that thought it was alive or not.

2. We are working on our Diversity Of Life Unit where we talk about living and non-living organisms. Our NGSS standards are: MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

3. The technology I used was my computer to project onto a smart board. The link was through youtube. I had issues finding a video that was exactly what I wanted them to see (if that makes sense). I wanted to possibly make the video and post it online so that I could have the students look for it and maybe embed it into my Schoology page. Technology is light at our school, so I try to incorporate it as often as possible.

Hope this helps!

Ellen

Hi again Ellen,

Thanks again for the response. Here are a few follow up questions regarding videos in class.

1.   Where did you find the last video?
2.   Did you show it to the entire class or let students view individually?
3.   What curriculum do you use? (Following a textbook, state standards, etc)
4.   How many different videos do you use in an average week in class?

You have been a huge help for this research project!

Take care,
Abby

Good morning!

1. I found it on youtube; https://www.youtube.com/watch?v=cdDzh1H3NAQ
2. We watched it as an entire class as a warm up question, "do you think this is living?"
3. We use Foss kits given through the state
4. Usually I use about 1, sometimes every other week depending on what I need to demonstrate to the students that I can't do in person.

Good luck with the project and let me know if you need anything else!
Ellen

Ellen,

Thank you so much! You have been a huge help to us.

Take care,