

Getting the JITERs: Just-In-Time Educational Resources as a Mode of OER-enabled Pedagogy

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These slides can be found at <https://poritz.net/j/share/JITERsOct19>

The “ideal OER platform of the future” question

What platform do you think would be the most ideal for OER, going forward?

[Almost certainly not an exact quote!]

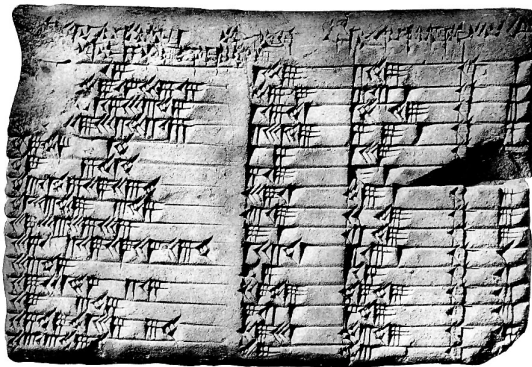
Question posed to me almost exactly thirteen months ago by
Jessica Stevens, Global Network Representative for CC Australia
and PhD Candidate in the Intellectual Property and Innovation
Law Research Program at QUT in Brisbane, Australia

The “ideal form of OER” question

What is the most ideal form for OER, going forward?

What are some forms of educational resources that have been successful in the past?

Maybe the earliest educational resource for mathematics



"Plimpton 322, Babylonian tablet listing Pythagorean triples," circa 1800BCE. In the public domain. Downloaded from https://commons.wikimedia.org/wiki/File:Plimpton_322.jpg

I think it's safe to say this is fairly primitive edtech, and unless this is some early precursor of a spreadsheet, or at least a numerical table, it has not left much of a mark on the history of educational resources.

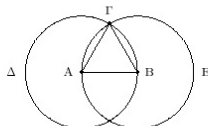
Euclid, the great stylist

Ἐπὶ τῆς δοθείσης εὐθείας πεπερασμένης τριγώνων ἰσόπλευρον συστήρασθαι.
Ἐστω ἡ δοθείσα εὐθεῖα πεπερασμένη ἡ AB.
Δεῖ δὴ ἐπὶ τῆς AB εὐθείας τριγώνων ἰσόπλευρον συστήρασθαι.



Oxyrhynchus papyrus (P.Oxy. I 29)

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Κέντρο μὲν τῷ A διαστήματι δὲ τῷ AB κύκλος γεγράφτω ὁ ΒΓΔ, καὶ πάλιν κέντρον μὲν τῷ B διαστήματι δὲ τῷ ΒΑ κύκλος γεγράφτω ὁ ΑΓΕ, καὶ ἀπὸ τοῦ Γ σημείου, καθ' ὃ τέμνουσιν ἀλλήλους αἱ κύκλοι, ἐπὶ τὰ A, B σημεία ἐπεσχεύωσαν εὐθεῖαι αἱ ΓΑ, ΓΒ.

Καὶ ἐπεὶ τὸ A σημεῖον κέντρον ἐστὶ τοῦ ΓΔΒ κύκλου, ἴση ἐστὶν ἡ ΑΓ τῇ AB· πάλιν, ἐπεὶ τὸ B σημεῖον κέντρον ἐστὶ τοῦ ΓΑΕ κύκλου, ἴση ἐστὶν ἡ ΒΓ τῇ BA, ἐδείχθη δὲ καὶ ἡ ΓΑ τῇ AB ἴση· ἐκαστέρα ἄρα τῶν ΓΑ, ΓΒ τῇ AB ἐστὶν ἴση, τὰ δὲ τῷ αὐτῷ ἴσα καὶ ἀλλήλους ἐστὶν ἴσα· καὶ ἡ ΓΑ ἄρα τῇ ΓΒ ἐστὶν ἴση· αἱ τρεῖς ἄρα αἱ ΓΑ, AB, ΒΓ ἴσαι ἀλλήλους εἰσιν.

Ἰσόπλευρον ἄρα ἐστὶ τὸ ΑΒΓ τρίγωνον, καὶ συνέσται ἐπὶ τῆς δοθείσης εὐθείας πεπερασμένης τῆς AB.

[Ἐπὶ τῆς δοθείσης ἄρα εὐθείας πεπερασμένης τριγώνων ἰσόπλευρον συνέσται:] ὅπερ ἔδει ποιῆσαι.

A proof from Euclid's Elements (Book I, Proposition I)

The original uploader was Bcrowell at English Wikipedia. [GPL]

Euclid's style still dominates

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TODD A. DRUMM AND JONATHAN A. PORITZ

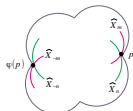


FIGURE 4.1. $\hat{X}_n^0 - \hat{X}_m^0$ is a single point

We now turn our attention to tangency of X_n 's. This turns out only to be an interesting issue for loxodromic generators γ , so we shall assume we are in that case for the remainder of this section. Further, since all X_n 's are centered on $\hat{\mathbb{C}}$, any point of tangency will also lie on $\hat{\mathbb{C}}$. So we shall also now restrict our attention to $\hat{X}_n$'s and $\hat{X}_m$ objects which lie on $\hat{\mathbb{C}}$.

Our conventions for loxodromic γ imply that 1 is in the interior and 0 the exterior of $\hat{X}_n$ when $n > 0$. Thus if $\hat{X}_n$ and $\hat{X}_m$ are externally tangent, then n and m must be of different signs. If $\hat{X}_n$ is internally tangent to $\hat{X}_m$, then n and m are of the same sign and $|n| > |m|$.

It is convenient to make the following

Definition 4.6. A point $p \in \partial\hat{\Delta}$ is a *smooth point of the boundary* if p lies in the interior of a side.

It is possible for a smooth point p of the boundary to be in the interior of two sides S_n and S_m which are externally tangent at p . It is also possible that p is a cusp and a smooth point of the boundary, such as when there exists an X_n which is internally tangent to a side at p .

Proposition 4.7. Suppose γ is loxodromic.

- (a) If $\hat{X}_m$ is internally tangent to S_n at a smooth point p and $m > n > 0$, then $m = 2n$.
- (b) If S_k is externally tangent to S_n at a smooth point q , then $k = -n$ and $q = \frac{1}{2} \in \hat{\mathbb{C}}$.

Furthermore, if either one of these cases occurs, then the other one also occurs and $\gamma^{-n}p = q$.

Proof. Suppose that $m > n > 0$ and $\hat{X}_m$ is internally tangent to the side S_n at a smooth point p .

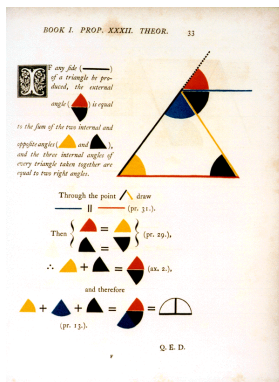
By Proposition 4.3, $\hat{X}_{-n}$ is internally tangent to the side S_{-n} at the smooth point t which, by Proposition 4.2 must be the point $\gamma^{-n}p$. Further, $q = \gamma^{-n}p$ is a smooth point on S_{-n} . $\gamma^{m-n}t = q$ and by Proposition 4.1 this implies that $q \in \hat{X}_{m-n}$ and $t \in \hat{X}_{n-n}$. Since t is a smooth point of S_{-n} , either $\hat{X}_{n-n}$ contains or is internally tangent to S_{-n} ; see Figure 4.2. The latter is impossible, since either

Drumm, Todd, and Jonathan Poritz. "Ford and Dirichlet domains for cyclic subgroups of $PSL_2(\mathbb{C})$ acting on $\mathbb{H}_{\mathbb{R}}^3$ and $\partial\mathbb{H}_{\mathbb{R}}^3$." *Conformal Geometry and Dynamics of the American Mathematical Society* 3.8 (1999): 116-150.

Well, with some changes

The modern document has color and equations!

The technology for color already existed in the 19th century:

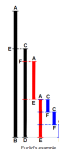


"The First Six Books of the Elements of Euclid in which coloured diagrams and symbols are used instead of letters for the greater ease of learners" by Oliver Byrne, London (1847). In the public domain. Downloaded from <https://commons.wikimedia.org/wiki/File:Byrne-33.png>

Equations were harder

The Greeks were far from equations, because apparently their idea of numbers was closely tied to geometry.

“English: Illustration derived from Heath 1908 showing Euclid’s algorithm for finding the greatest common divisor” by Wvbailey. Released under a Creative Commons Attribution 3.0 Unported License, <https://creativecommons.org/licenses/by/3.0/>.



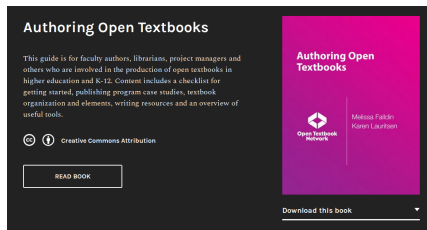
Equations came from the ideas of Muhammad ibn Musa al-Khwarizmi (c.780-850CE), but only took a form we would recognize now several hundred years later, in western Europe.

“English: en:Muammad ibn Ms al-wrizm.”, author unknown. This work is not an object of copyright according to article 1259 of Book IV of the Civil Code of the Russian Federation No. 230-FZ of December 18, 2006.



Monographs vs textbooks

I've learned from the Open Textbook Network's Pub101 Open Publishing Curriculum that textbooks are very different from monographs.

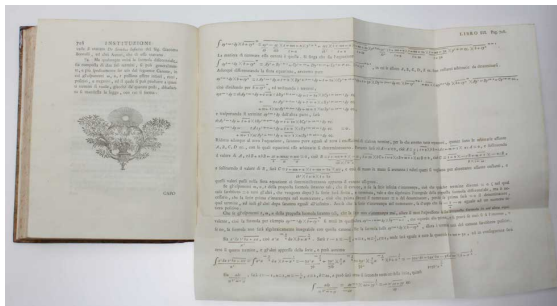


Cover page for *Authoring Open Textbooks* by Melissa Falldin and Karen Lauritsen. Released under a [Creative Commons Attribution 4.0 International License](#).

...Maybe not always? My research paper with Drumm is not to be expected to be in the same style as a good textbook. But it is in a strikingly similar style to Euclid's *Elements*, and we've seen that the *Elements* was used for a couple of thousand years as a textbook.

Maria Gaetana Agnesi, textbook author

One of the earliest calculus textbooks was by the remarkable Maria Gaetana Agnesi from Milano. It was solidly in the style of the modern monograph/research paper (with some paper-folding innovation!), it was definitely a **textbook**.



"Instituzioni Analitiche - Libro Secondo - Del Calcolo Differenziale" by Maria Gaetana Agnesi, Milano (1748). In the public domain. Downloaded from <https://giornalebibliotalamona.files.wordpress.com/2014/06/maria-gaetana-agnesi-5.jpg>

Other disciplinary styles through the years

Agnesi's textbook looks a lot like the books I learned from as a student, more than 100,000 years ago (base 2). It doesn't look much like today's textbooks.

Maybe today's books (even in mathematics?) look like textbooks of years past in other disciplines: different academic disciplines have different styles!

Interestingly, if you look at the styles used in ancient Greece, philosophy was often written in **dialogs**! This mostly died out before the present time, although Galileo wrote many works in dialog form (and he was a “scientist” from the time before that word was used, so he would have been called a “natural *philosopher*”!



English: Title-page of Dialogo by Galileo Galilei (Florence, 1632), Museo Galileo - Istituto e Museo di Storia della Scienza. Released under a Creative Commons Attribution-ShareAlike 4.0 License, <https://creativecommons.org/licenses/by-sa/4.0/>.

Past styles ... what is the modern textbook style?

Poetry predates writing.

Probably so does the dialog form.

The style of modern history writing can apparently be seen already in Herodotus.

We've seen that Euclid laid down the style of mathematical writing which persists, almost unchanged.

So what is the antecedent of the style of modern textbooks?

The modern textbook style is **noisy**

To me, the modern textbook looks like a thick, expensive version of a **tabloid** or **glossy magazine**: full of noisy, distracting ads, the main stories broken into little bits with panels giving some bit of “human interest,” the succession of articles seemingly fairly random and not driven by the reader’s sequence of intellectual curiosities, ...



Radio Show by Joe Haupt. Released under a Creative Commons Attribution-ShareAlike 2.0 License, <https://creativecommons.org/licenses/by-sa/2.0/>.



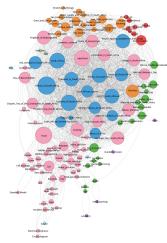
Times Square by Matt Wade. Released under a Creative Commons Attribution-ShareAlike 3.0 License, <https://creativecommons.org/licenses/by-sa/3.0/>.

An alternate modern mode of expression

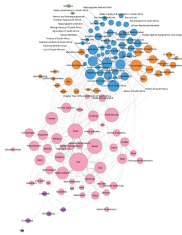
Another very modern form of expression might be a better model on which to base the structure of modern educational resources: the World Wide Web, or a subnetwork of the whole WWW.

The modern Euclid who created this form was Tim Berners-Lee who came up with the idea of a hyperlinked set of documents and resources when he was working at CERN in 1989.

Articles network



August 2015



August 2017

"English: Comparison of articles network in August 2015 and August 2017" by G.prof - Wikipedia Primary School. Released under a Creative Commons Attribution-ShareAlike 4.0 License, <https://creativecommons.org/licenses/by-sa/4.0/>.

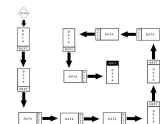
Features of highly networked information resources

Resources modeled on the WWW, or parts thereof, often have some features in common:

- They are highly linked, internally and externally.
- They often show many different styles, have different authors, incorporate different media types, *etc.*
- They can have a non-zero number of errors!
- Especially after Web 2.0, they are often responsive to their users, changing their connections and content in response to user actions.
- When operated by for-profit entities, they can become the instruments of surveillance capitalism.

Comparison to traditionally structured electronic textbooks

In this model, a traditional electronic textbook is an ordered sequence of items, each linked to the next, and fixed in its immutable form before the instructor and students begin their time together.



“Linked List” by Vhcomptech, released into the public domain.

The OER I’ve written which look more like “textbooks” have been these ordered sequences of items – usually created (at least the first time) one step (or a little more, or sometimes a little less!) ahead of where the students in my class were working as they followed the syllabus and the classroom activities or lectures.

Even though they were produced in this “one step ahead of the class” fashion, these were really static textbooks matching a static syllabus, merely being built by someone with very poor project manager skills and no idea of best practices for publication programs.

But it's more thrilling to go “Just-In-Time”

When I've known the subject I'm teaching really, really well, including knowing where to find resource fragments all over the Web, I've been able to put aside a static, predetermined syllabus and lower the window of time between what the class was working on and where I was working on new edge of the networked resource *to nearly zero*.

This is where the **Just-In-Time-Teaching** [JITT] approach comes into play.



A JITT course

Imagine building a scaffolded experience for a class meeting, with links to readings and other resources all over the Web, or containing newly adapted or created such resource fragments.

Much of the work students then do in class or as their next “homework” (depending upon whether the instructor wants to run this as a flipped class or not) is exploratory, based on the new material they have just consumed, but going out to investigate questions of their own interest on the Web, or to state and then to solve problems in which they are interested (related to the new material ... at least somewhat, presumably).

The scaffolding, adapted or created materials, and links both internal and external, together form what what could be called a

Just-In-Time Educational Resource [JITER]

A JITER won't look much like a textbook. Instead, it will look like a wiki or web site, or maybe somewhat messy PressBooks book.

Requirements to get the JITERs

Making JITERs is time-critical, all-encompassing, exhausting work. For it to succeed, the stars must be aligned properly:

- There must exist a vast (findable!) network of OER [or, at least, openly licensed resource fragments] out on the Web.
- The instructor/JITER author must be
 - extremely comfortable with their subject matter
 - equally comfortable with tools to create engaging, linked, appropriate resource fragments
 - in constant contact with their students, seeing how they are making out in their work and acquisition of skills/knowledge.
- The course material must be amenable to a very active, Inquiry-Based Learning approach. [I am comfortable with this for computer science, because CS is so interactive. Likewise for math, because it is in my blood. I have no idea how to do this in other disciplines, but I imagine my skilled colleagues will immediately know what to do in their home disciplines.]

Sidebar: communication with students

For the constant contact part, it helps to have the students do some work or reading and then have a required communication with their instructor.

I usually call these “T&Qs”, which stands for “Thoughts and Questions.”

The Thinker by Auguste Rodin, photo by Joe deSousa. This file is made available under the Creative Commons <https://creativecommons.org/publicdomain/zero/1.0/deed.en>.



After every reading or unit of work, the students must send me a T&Q, no more than 24 hours and no less than one hour before the next class. That way, I can adapt the new material to what they have thought of on their own, or what questions they still have after recent classes and readings or activities.

Side-sidebar...

**The Thinker was Dante,
contemplating the Gates of Hell!**

Gates of Hell (1900), photo by Rodney. This file is made available under the Creative Commons <https://creativecommons.org/licenses/by/2.0/>.



Some examples of JITERs

The end points of a class organized around a JITER tends to look like a very long and detailed class schedule with lots of information and links mixed in.

Here are three I've built in the last few years:

- For **CSUP Math 242: MATLAB Computation**
 ~> JITER [here](#).
- For **CSUP Math 411: Introduction to Topology**
 ~> JITER [here](#).
- For **RU Computer Science 850-CYCR: Cryptocurrencies**
 ~> JITER [here](#).

These all tend to look like insanely detailed schedules or homework/project assignment lists, which I suspect is in the nature of first editions of JITERs.

Back to the ideal platform question

The ideal platform for JITERs is probably the bare web, in the hands of someone comfortable with authoring in that environment – institutions with **Domain of One's Own** programs are well set up for this. Otherwise, a platform like PressBooks is also a good alternative, although the restrictions it places on which FLOSS tools one will be able to deploy may start to chafe.

At the end of a course organized around a JITER, there will be a somewhat messy web site [or other, complex, highly linked web object]. It will be hard to share this back out to the community, and it is unclear what kind of repository can hold these “finished JITERs.”

In short, JITERs belong on the platform-less platform.

Apology and sheepish call to action

The work of fantastic groups like [Open Stax](#), [The Open Textbook Library](#), and many others, is amazing and wonderful – high quality open textbooks are clearly the gateway drug to a life of servitude to OER.

But it is possible that the future of OER is not high quality, zero cost versions of a hundreds or thousands of years-old approach to education – textbooks – but rather a messy, constantly changing, highly hyperlinked JITER, looking (in a way that makes today's students quite comfortable) like a piece of the modern Web.

I think of this as **The Beauty of Ugly OER**.

Questions, comments? Contact. Getting slides [links!]

Questions? Comments?

Email (feel free!): jonathan@poritz.net ; Tweety-bird: [@poritzj](https://twitter.com/poritzj) .

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