Supporting Statistical Literacy with GeoGebra

Matt Roscoe

The University of Montana

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Technology: Why and What Purposes?

"Anyone who presumes to describe the roles of technology in mathematics education faces challenges akin to describing a newly active volcano" (Kaput, 1992, p.515)

Technology: Why and What Purposes?

Advantages	Drawbacks
Dynamism	Time Commitment
Exploration	Complicated
Supports Conceptual Growth	Fragments Instruction
Argumentation	Always Changing

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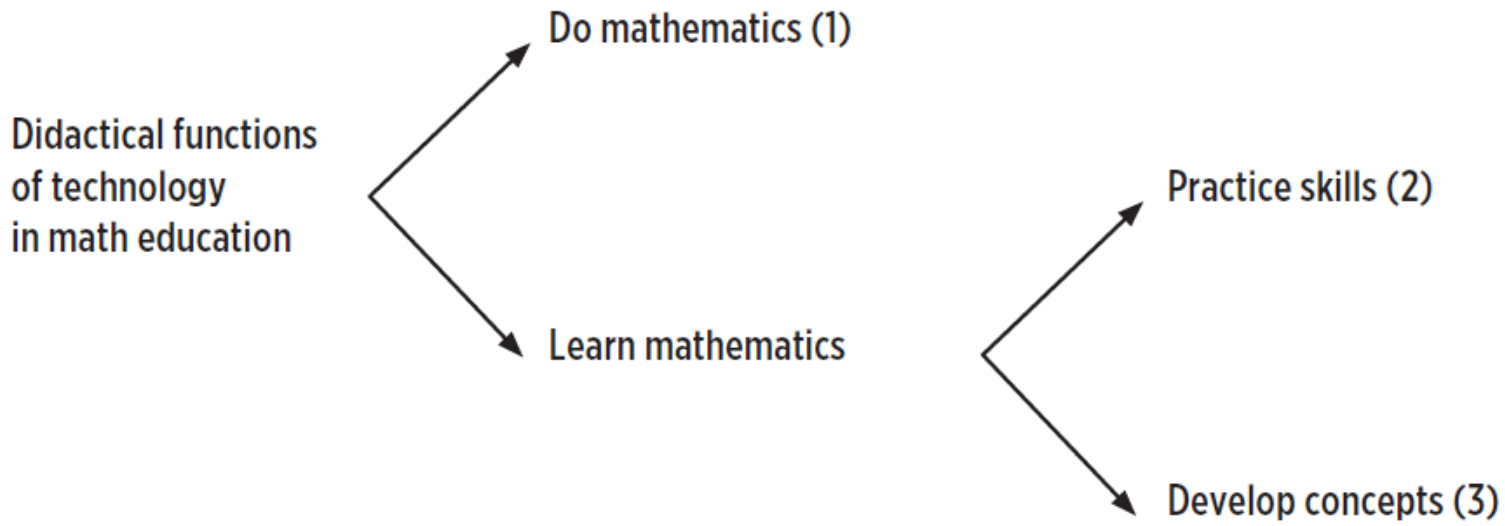
Technology: Why and What Purposes?

Three purposes for using technology in mathematics education. (Drijvers, 2012)



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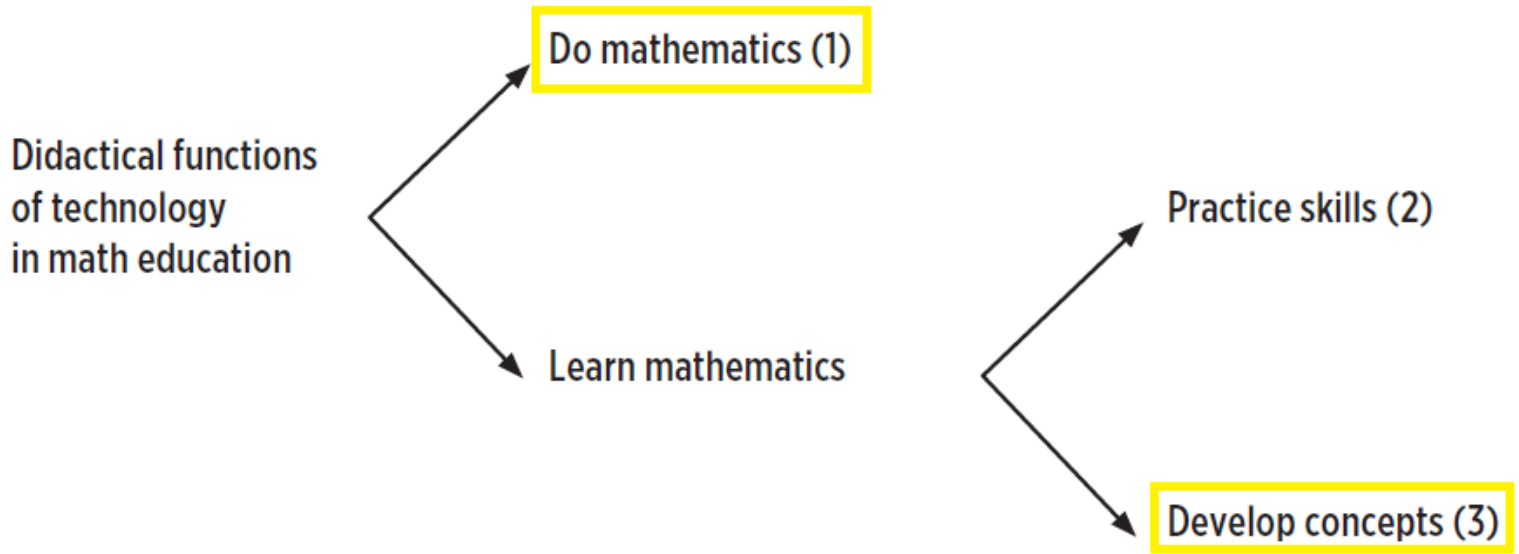

Technology: Why and What Purposes?

Technology is emerging as a setting for interest-driven mathematical learning (Blikstein,2013)

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Technology: Why and What Purposes?

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My Situation

M301 - Teaching K-12 Mathematics with Technology

Upon completion of this course, a student will be able to:

1. Explain the modeling process;
2. **Apply technology for graphing, computing, organizing, and investigating,**
3. Identify and solve problems involving continuous and discrete models,
4. **Identify and solve problems using simulation**, and
5. **Evaluate models using goodness of fit measures.**

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My Situation

M234 - Higher Mathematics for Elementary School Teachers

Upon completion of this course, a student will be able to:

1. Apply algebra in many forms (e.g., as a symbolic language, as generalized arithmetic, as a study of functions, relations, and variation) and use algebra to model physical situations and solve problems;
2. Explain proportionality and its invariant properties;
3. Apply number theory concepts and theorems, including greatest common factors, least common divisor, properties of prime and composite numbers, and tests for divisibility;
4. **Represent, analyze and interpret data;**
5. **Simulate random events and describe expected features of random variation;**
6. **Distinguish between theoretical and experimental probability and describe how to use one or both to determine a probability in a given situation.**

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GeoGebra?

GeoGebra is an interactive **Geo**metry, al**Gebra**, statistics and calculus application, intended for learning and teaching mathematics and science from primary school to university level. (Wikipedia)

GeoGebra?

Some details...

- Available for multiple OS: Windows, macOS, Debian, Ubuntu, Red Hat Linux, openSUSE, Android, iOS
- Available as desktop application or web app(s)
- Interactive Geometry in 2D and 3D
- Built-in CAS
- Built-in Spreadsheet and Statistics Tools
- Built-in calculus tools
- Allows scripting (i.e. custom tools)
- Manages public sharing of resources
- Responds to user feedback

GeoGebra: Doing Mathematics

M301 Investigation 1 - Studying Missoula Temperature Variation

Pedagogical Target: GeoGebra Statistics Editor

Content Target: Univariate Statistics/Graphical Displays

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GeoGebra: Doing Mathematics

Temperature Data

GeoGebra Web Page

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GeoGebra: Doing Mathematics

Student Work Sample

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GeoGebra: Developing Concepts

M234 Applet Supported Interactive Lecture

K-12 Content Targets: Univariate Statistics and Displays

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Mean and Median Explorer

GeoGebra: Developing Concepts

Some Interesting Results (N=15)?

Round	Actual	Mean|Actual-Guess|	SD|Actual-Guess|
1	6.45	1.829	2.281
2	11.75	1.533	2.977
3	12.19	2.244	3.707
4	9.3	1.590	2.479
5	5.1	1.977	1.604
6	11.06	2.086	2.819
7	4.05	1.307	1.087
8	3.05	1.332	2.262
9	7.05	1.223	1.888
10	4.65	1.632	1.131

GeoGebra: Interest-Driven Mathematics

M301 Project 1 - Studying Area Rivers

Pedagogical Target: GeoGebra Statistics Editor

Content Targets: Univariate and Bivariate Statistics/Graphical Displays

GeoGebra: Interest-Driven Mathematics

Student Work Sample

GeoGebra Resources

GeoGebra as a Developmental Stepping Stone

GeoGebra is certainly an example of...

- technology for doing mathematics,
- technology for supporting concept development,
- technology that supports interest-driven mathematics

but why should I consider using it over other alternatives?

GeoGebra as a Developmental Stepping Stone

Just like learning mathematical content, learning to use technology to support statistical literacy has its own developmental progression...

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GeoGebra as a Developmental Stepping Stone

Excel $<$ GeoGebra $<<$ R

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GeoGebra as a Developmental Stepping Stone

GeoGebra is appropriate technology for students as they begin the path towards statistical literacy - offering a suite of well-known statistical measures and displays as well as random sampling and hypothesis testing and simple programming...as such it can be viewed as a developmental stepping stone to fully programmable technology.