Supporting Statistical Literacy with GeoGebra

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1 Technology: Why and What Purposes?

2 My Situation

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4 GeoGebra: Doing Mathematics

5 GeoGebra: Developing Concepts

6 GeoGebra: Interest-Driven Mathematics

7 GeoGebra as a Developmental Stepping Stone
“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?

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamism</td>
<td>Time Commitment</td>
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<tr>
<td>Exploration</td>
<td>Complicated</td>
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<tr>
<td>Supports Conceptual Growth</td>
<td>Fragments Instruction</td>
</tr>
<tr>
<td>Argumentation</td>
<td>Always Changing</td>
</tr>
</tbody>
</table>
Three purposes for using technology in mathematics education. (Drijvers, 2012)
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Technology is emerging as a setting for interest-driven mathematical learning (Blikstein, 2013)
Technology: Why and What Purposes?

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

GeoGebra is an interactive Geometry, Algebra, 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
M301 Investigation 1 - Studying Missoula Temperature Variation

Pedagogical Target: GeoGebra Statistics Editor

Content Target: Univariate Statistics/Graphical Displays
Temperature Data

GeoGebra Web Page
Student Work Sample
GeoGebra: Developing Concepts

M234 Applet Supported Interactive Lecture

K-12 Content Targets: Univariate Statistics and Displays
Mean and Median Explorer
### GeoGebra: Developing Concepts

#### Some Interesting Results (N=15)?

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<th>Round</th>
<th>Actual</th>
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<th>Actual-Guess</th>
<th>SD</th>
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</table>
M301 Project 1 - Studying Area Rivers

Pedagogical Target: GeoGebra Statistics Editor

Content Targets: Univariate and Bivariate Statistics/Graphical Displays
Student Work Sample
GeoGebra: Interest-Driven Mathematics

GeoGebra Resources
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...
GeoGebra as a Developmental Stepping Stone

Excel < GeoGebra << R
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.