

# Sage at the University of Northern Iowa

## Lessons in Failure

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Background Information

Lessons Learned

Changes Coming

A Big Question

# My Course

## Linear Algebra

Gaussian elimination; matrix algebra; vector spaces, kernels, and other subspaces; orthogonal projection; eigenvalues and eigenvectors.

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## Linear Algebra

Gaussian elimination; matrix algebra; vector spaces, kernels, and other subspaces; orthogonal projection; eigenvalues and eigenvectors.

## Place in the Curriculum

The **only** linear algebra course we offer.

Aimed at sophomores.

All things to all people.

# My Students

## UNI

- ▶ Medium size (15000) regional comprehensive university
- ▶ UNI has a long history of training future teachers. [History as Iowa State Normal School.] Approximately 175 secondary ed majors.
- ▶ Successful actuarial science program. About 75 act sci/stat majors.
- ▶ Approximately 30 "pure math majors."

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## In my course

Fits general profile above, missing the usual complement of a few physics and economics majors, instead there was one biology student. Two CS majors.

A little over 20 students, about half freshman.

Low comfort and low experience level with computers and programming.

By the way...

I encouraged students from my dynamical systems course to try using Sage, too.

# My Materials

## Texts

- ▶ Woodruff & Grout text (in progress open source book)
- ▶ Schaumm's outline (suggested, but not required).

## Sage worksheets

- ▶ A "Sage Beginner's Worksheet" that I wrote
- ▶ Several Sage-based assignments



## What went well?

I made a “making an account for dummies” handout.  
The beginner’s workshop worked well for those who attended.

`https://www.dropbox.com/s/gyejtvjw1xpwfey/  
SageNewAccountInstructions.pdf`

`http://uni.sagenb.org/home/pub/0/`

Focus was on basic worksheet manipulation and getting help. Tab completion and use of documentation figure prominently.

# What did not go as well?

The students need more support.

"Think of the most technologically disinclined student you can. Now think of a class where that person is the most comfortable with a computer of all of your students. Plan for that."

The beginner's workshop was helpful. But they need something like it every time there is a new command.

## Focused Sage Instruction

My Sage assignments were too few and too long. Students became discouraged and frustrated. (Procrastination plays a big role here.) Sage needs to be taught in small pieces, a little bit every day.

# What did not go as well?

Give thought to your physical space limitations

Computer On, Brains Off.

# What did not go as well?

## Choice of Class Structure

I haven't taught a traditional "lecture based" course in a few years, and I sorta forgot how to do it.

# What did not go as well?

Woodruff & Grout Text not a good fit for me.

The approach spirals through the material.

I ended up with a "Let's cover it once without understanding and then redo everything."

# My Observations

A few students took to Sage. Most did not. Most saw it as an ~~impediment to learning~~ an extra set of hoops to jump through, rather than a useful tool.

## From a mid-semester feedback session

"We hate using Sage"

"We wish you would just tell us what to do, show us how to do it, and then check that we can do it."

"Give us more homework."

For First Time Experimenters: Do a midsemester feedback, as formal as you can muster. I did a SGID.

## From the standard course evals

Only two mention Sage:

**“My learning would have improved in this course if the instructor had:”**

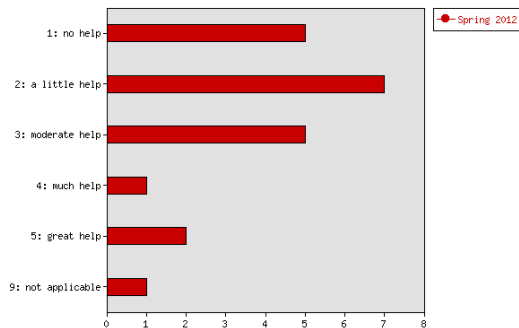
“Not used Sage.”

“Not used Sage for homework assignments. I highly suggest not using Sage for homework assignments and I suggest that if he wants to use a computer for homework then find a textbook with an access code like MyMathLab.”



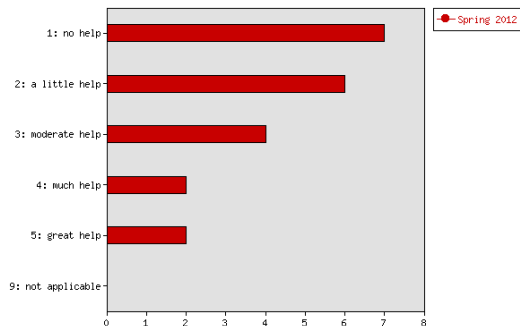
# From the SALG instrument

How much did your instructor's use of Sage for in-class demonstrations help your learning?



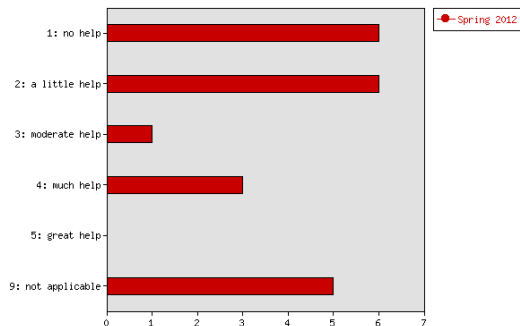
# From the SALG instrument

How much did your use of Sage on your own help your learning?



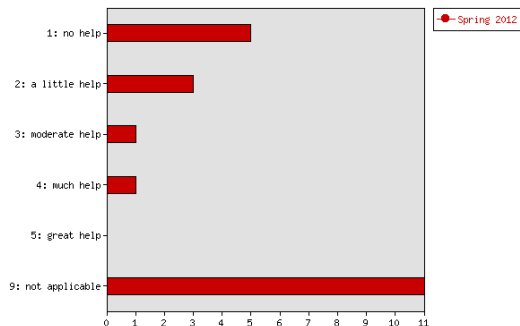
# From the SALG instrument

How much did the digital Sage textbook help your learning?



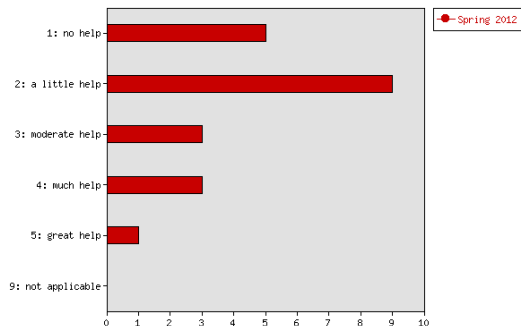
# From the SALG instrument

How much did the paper Sage textbook help your learning?



# From the SALG instrument

How much did the online Sage documentation help your learning?



## From the SALG instrument

I'll collect the themes from the written responses here. There were one or two positive viewpoints, but this is the general sentiment:

it made learning the material twice as hard to comprehend, because instead of spending time actually learning the content on homework, i would just get frustrated and learn nothing, because i had no idea how to make sage work, i'm not a computer programmer, i don't plan on being one and sage to me just made the material twice as hard to understand the info, because like i said all of my time was wasted trying to figure out how to make sage work

## From the SALG instrument

Sage is helpful for really large problems, but I would rather do work by hand because i usually knew how to do it by hand but couldn't figure out how to make commands in Sage.

[Sage is] Similar, but matlab and mathematica (in my experience) have more documentation and are generally easier to use

It was very difficult to learn Sage.

The learning curve seemed quite sharp, but it only took a few times to figure it out. It probably helps if you have a programming background.

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- ▶ I will give tasks as Sage worksheets, with some sample commands at the head of each. (mini workshops on topics!)
- ▶ I will use Schaum's as a safety net text. I will rewrite and "Sage enhance" my own course notes from a (very theoretical, pencil and paper) version taught six years ago. Then I will write my sequence of tasks on top of and around these.

What I really want to figure out is this:

## Big Issue

How does one teach the students to use the computer as an investigative tool?