

The Data Says... What?

How to Increase Readability Without Sacrificing Information

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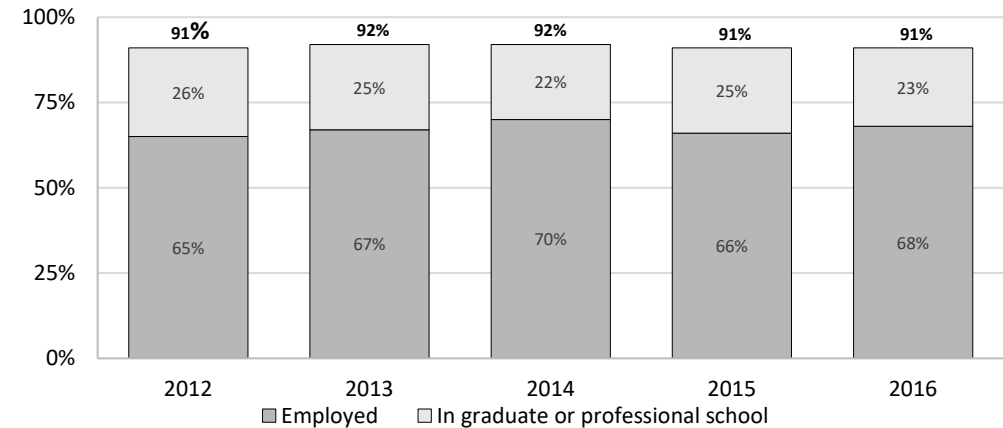
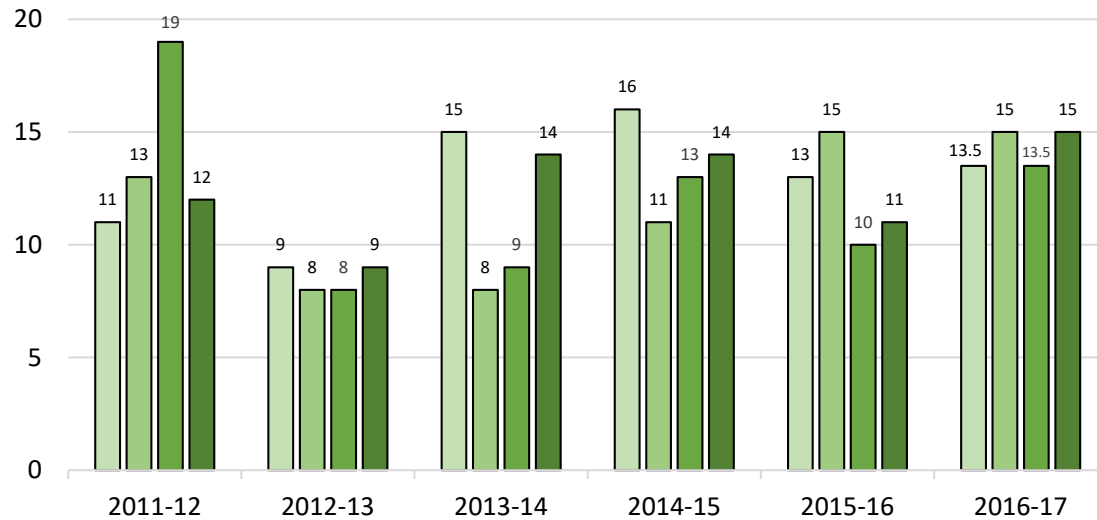
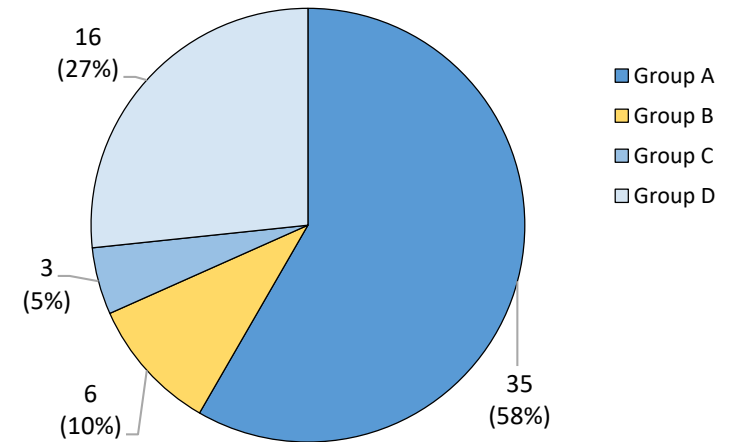
Agenda

- Why this topic?
 - Effectively communicating data is a key part of IR
 - With technology anyone can create graphics
 - No mainstream training in how to create good, readable graphics
 - Quick fixes to increase readability
 - Best practices for color, borders, font, and lines
 - Artistic interpretation exists in any formatting decision
 - Graphics are *visualized data* not a piece of fine art
- Additional resources and Questions

A Graphic is a pictorial representation of data

Degree Majors Awarded 2011-12 to 2016-17

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Business	32	32	30	37	33	60
Communication Studies	23	29	19	24	29	41
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History	20	14	15	12	8	10
Kinesiology	9	11	8	12	12	33
Religion	4	1	8	3	1	4



Graphics should

- Show the data
- Get the viewer to think about the data
- Reveal trends and conclusions (if there is one)
- Serve a reasonably clear purpose
 - Describing a fact, exploring a trend, used as decoration on a report next to text?
 - Why does this graphic need to exist?

Anscombe's Quartet

All four datasets have nearly identical descriptive statistics

Mean

$$X = 9$$

$$Y = 7.5$$

Variance

$$X = 11$$

$$Y = 0.816$$

Linear regression follows equation

$$y = 0.5x + 3$$

I		II		III		IV	
X	Y	X	Y	X	Y	X	Y
10	8.04	10	9.14	10	7.46	8	6.58
8	6.95	8	8.14	8	6.77	8	5.76
13	7.58	13	8.74	13	12.7	8	7.71
9	8.81	9	8.77	9	7.11	8	8.84
11	8.33	11	9.26	11	7.81	8	8.47
14	9.96	14	8.1	14	8.84	8	7.04
6	7.24	6	6.13	6	6.08	8	5.25
4	4.26	4	3.1	4	5.39	19	12.5
12	10.8	12	9.13	12	8.15	8	5.56
7	4.82	7	7.26	7	6.42	8	7.91
5	5.68	5	4.74	5	5.73	8	6.89

Anscombe's Quartet in graphical form

Mean

$$X = 9$$

$$Y = 7.5$$

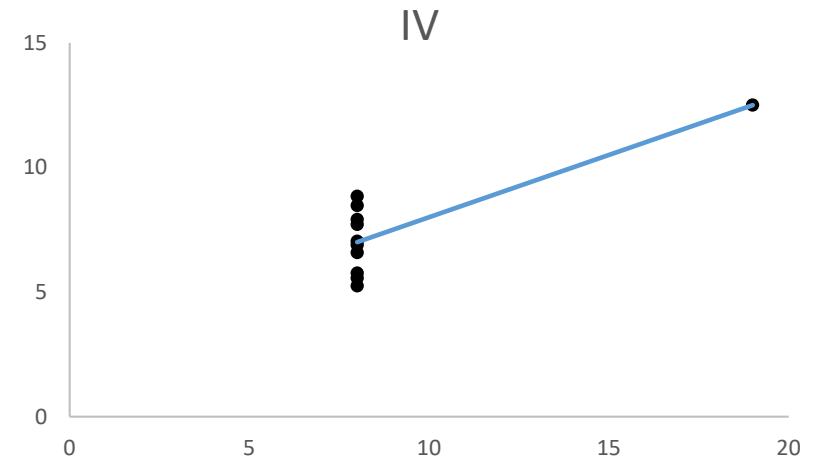
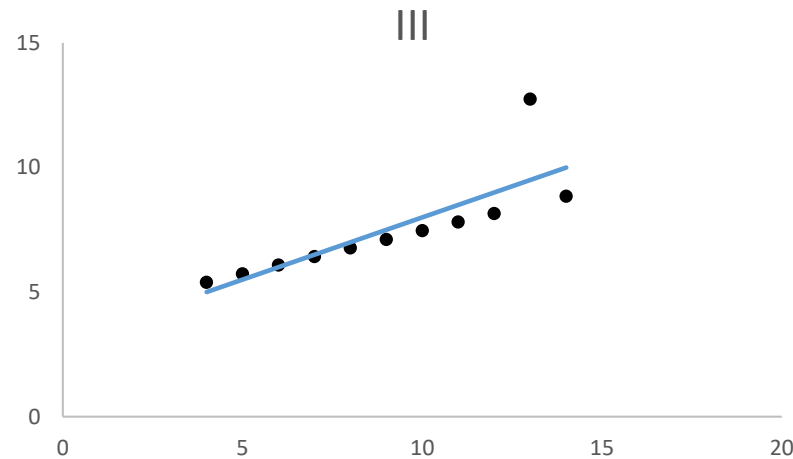
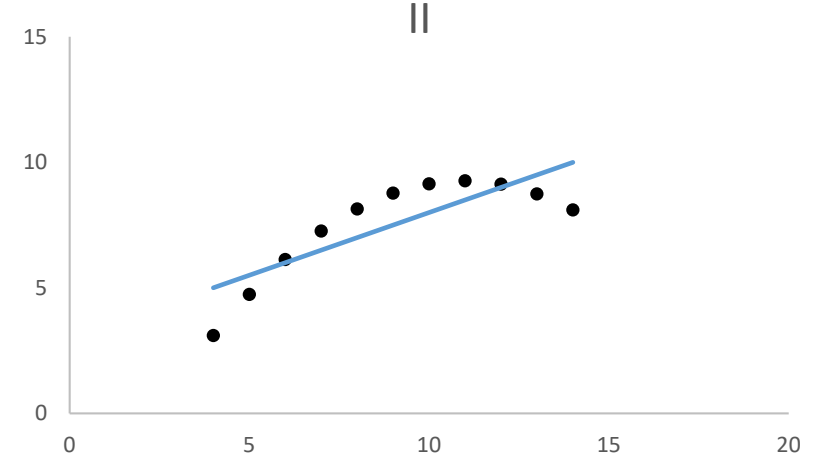
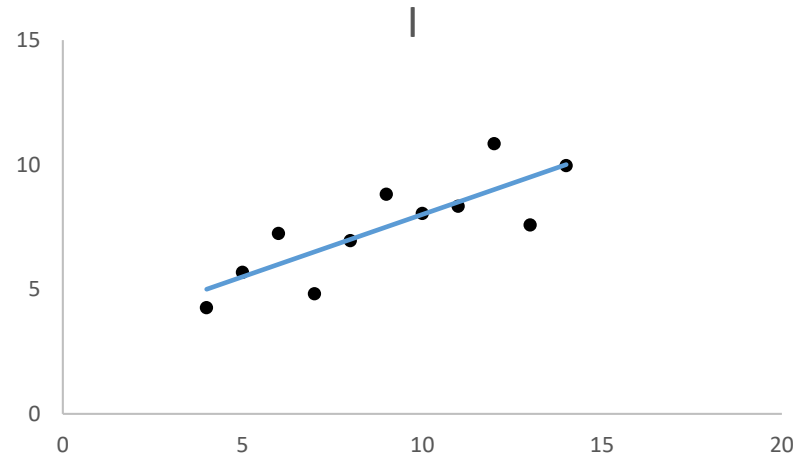
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**Linear regression
follows equation**

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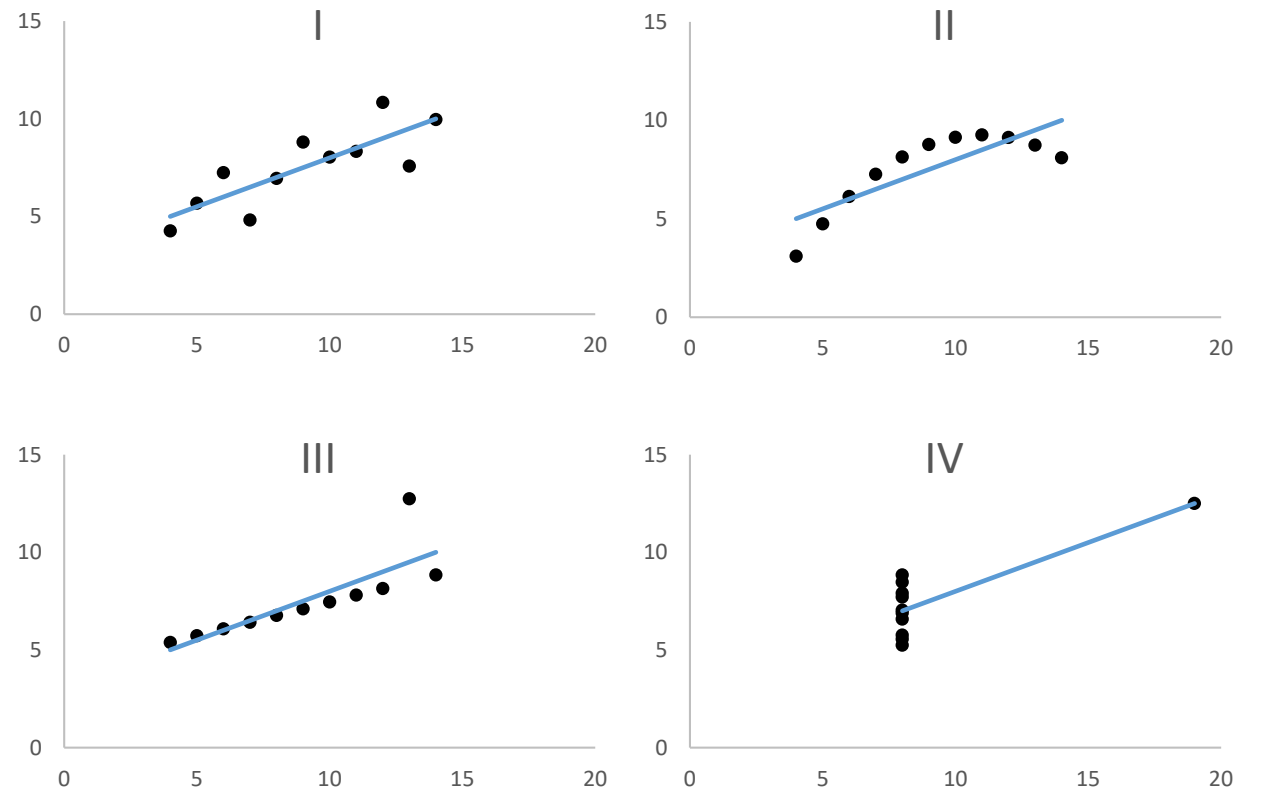


Anscombe's Quartet

As a summary statistic

I		II		III		IV	
x	y	x	y	x	y	x	y
10	8.04	10	9.14	10	7.46	8	6.58
8	6.95	8	8.14	8	6.77	8	5.76
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As a set of graphics



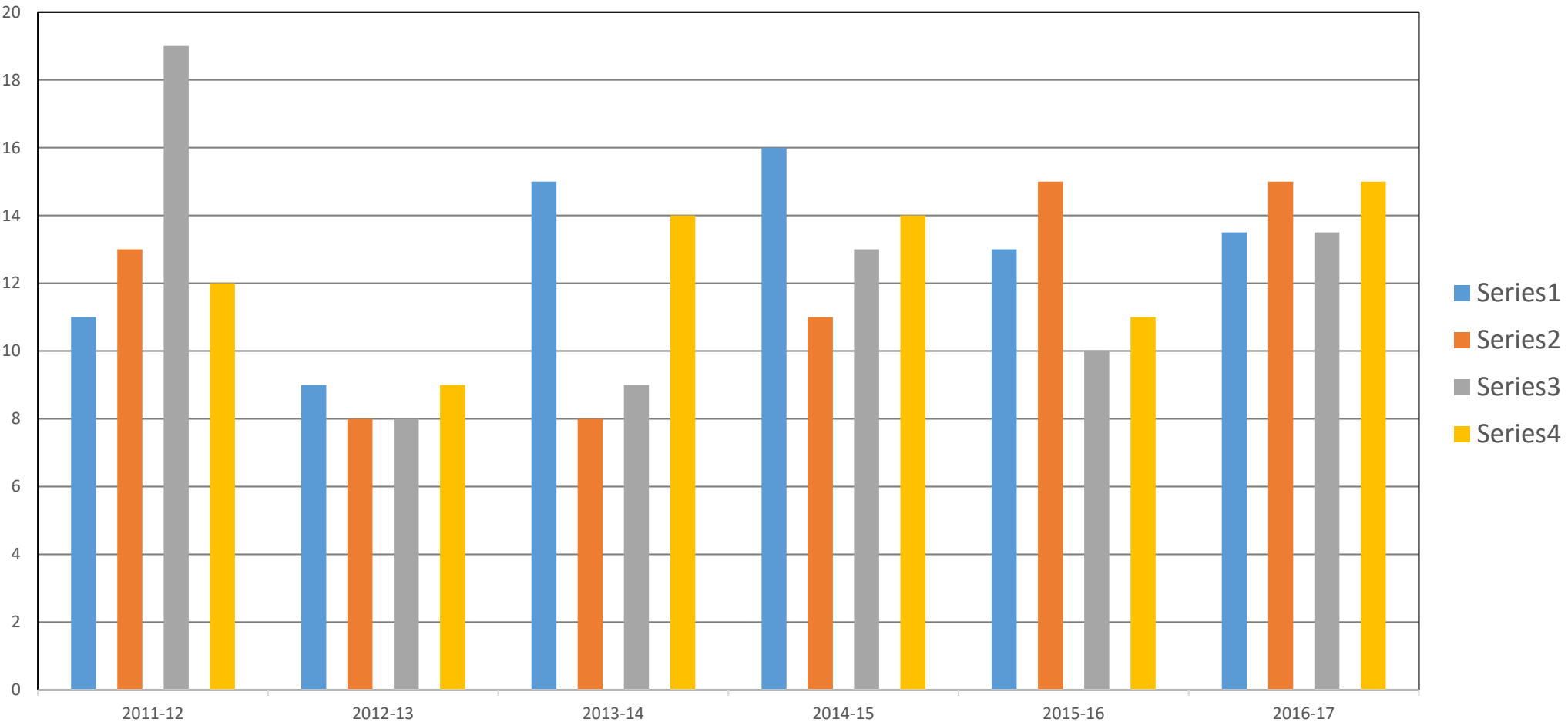
One makes the data and conclusion jump out at you

One lets the data just sit there

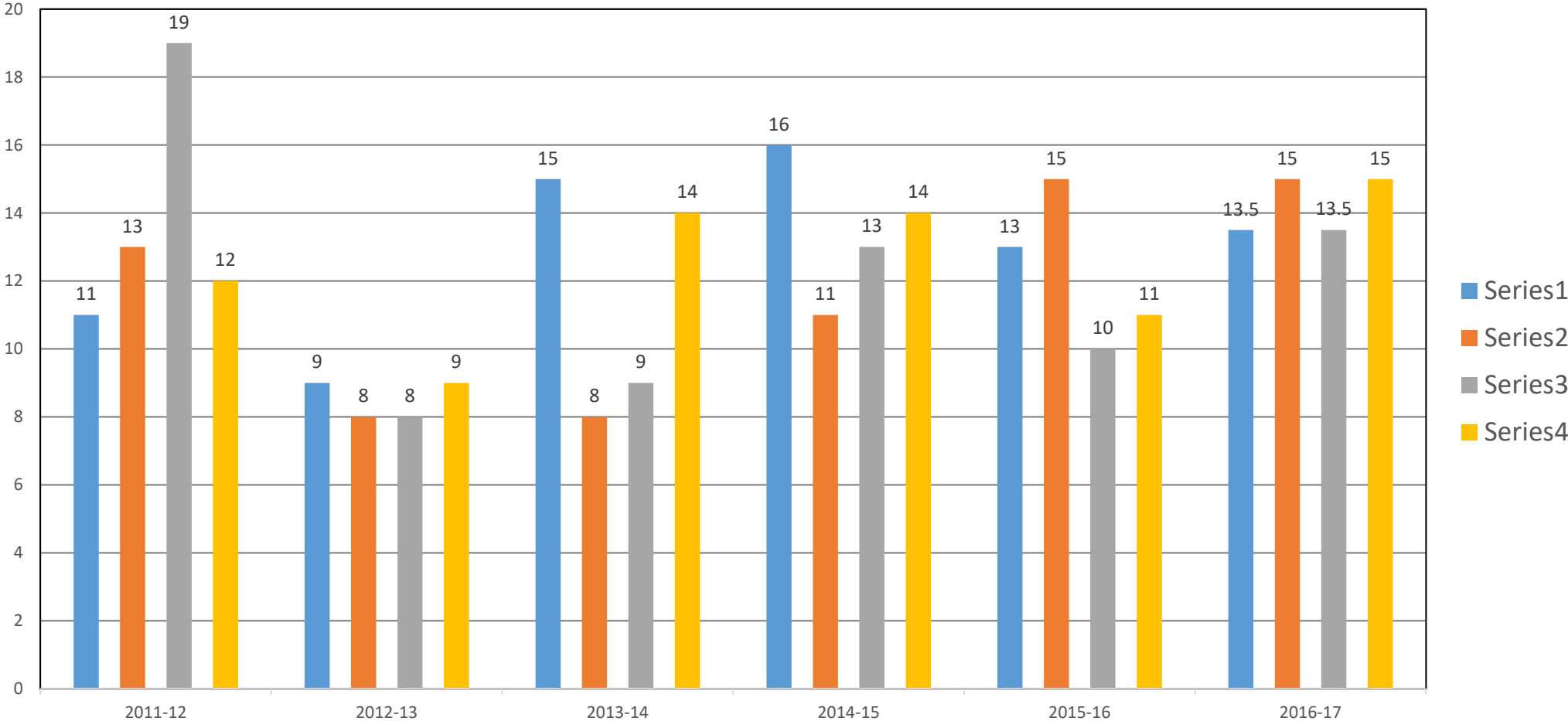
Steps for creating a graphic

- Research
- Edit
 - filter or format data
 - identify key message
- Plot
 - chose chart type
 - fix scale, colors, and labels
- Review
 - check chart against data
 - use judgement to evaluate whether your chart makes sense
 - look at the chart from your reader's perspective

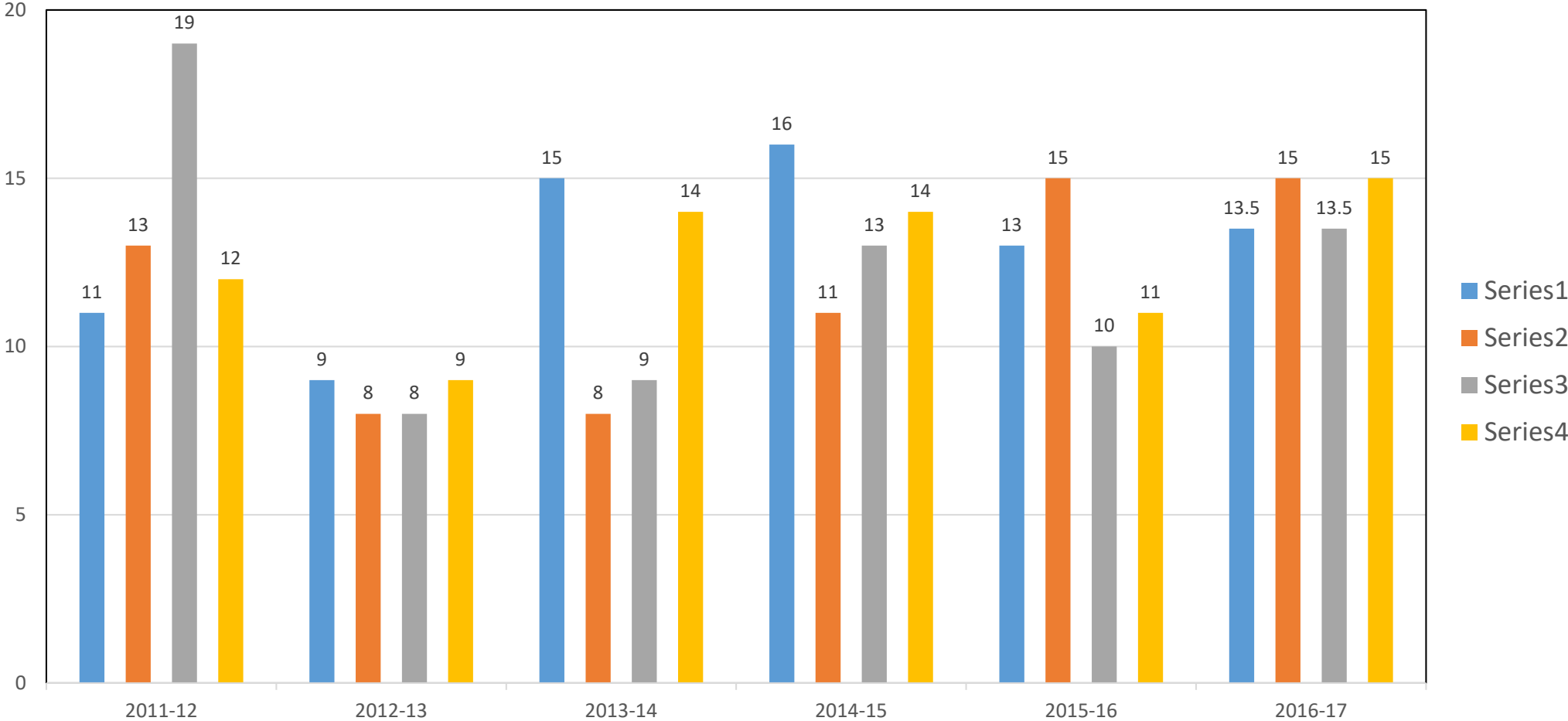
Example: Clustered column graphic



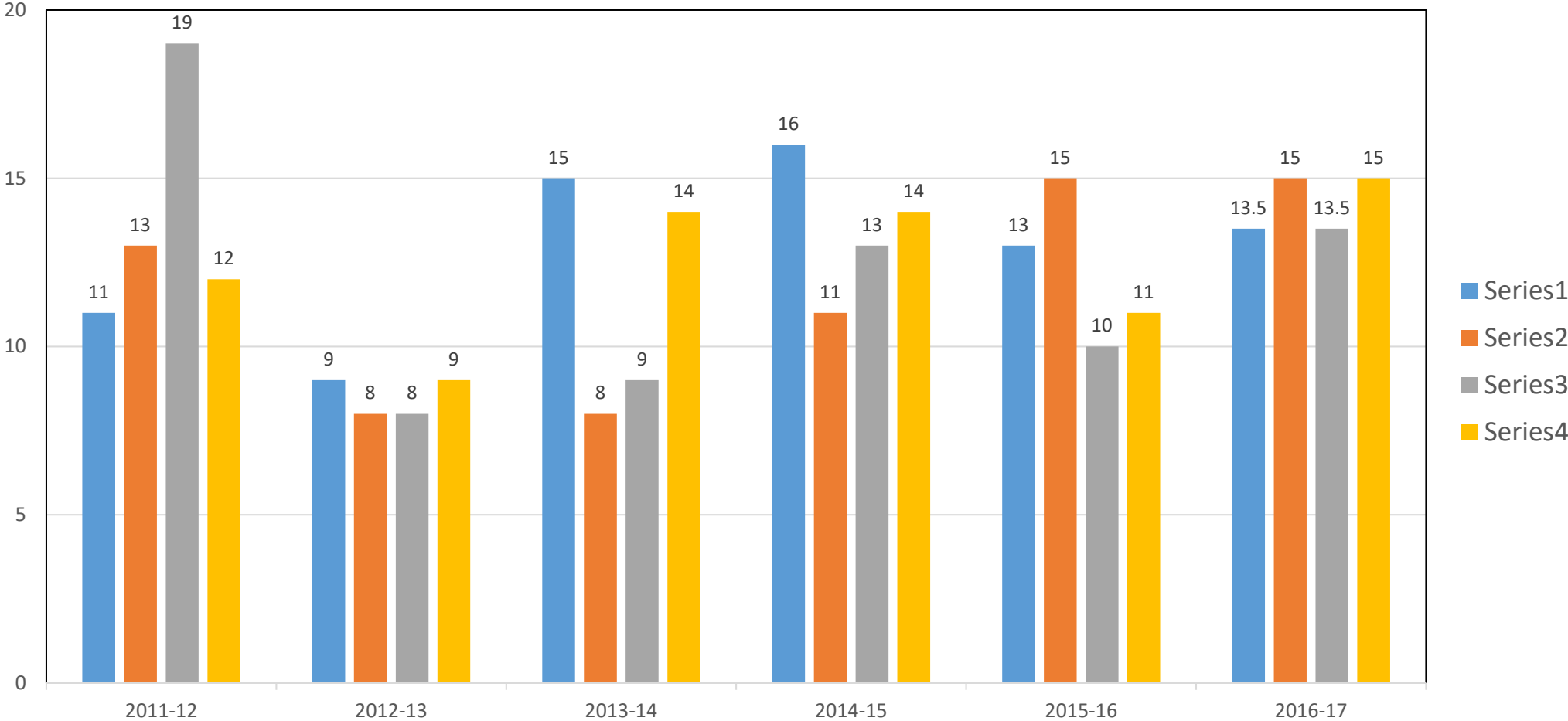
Add data labels



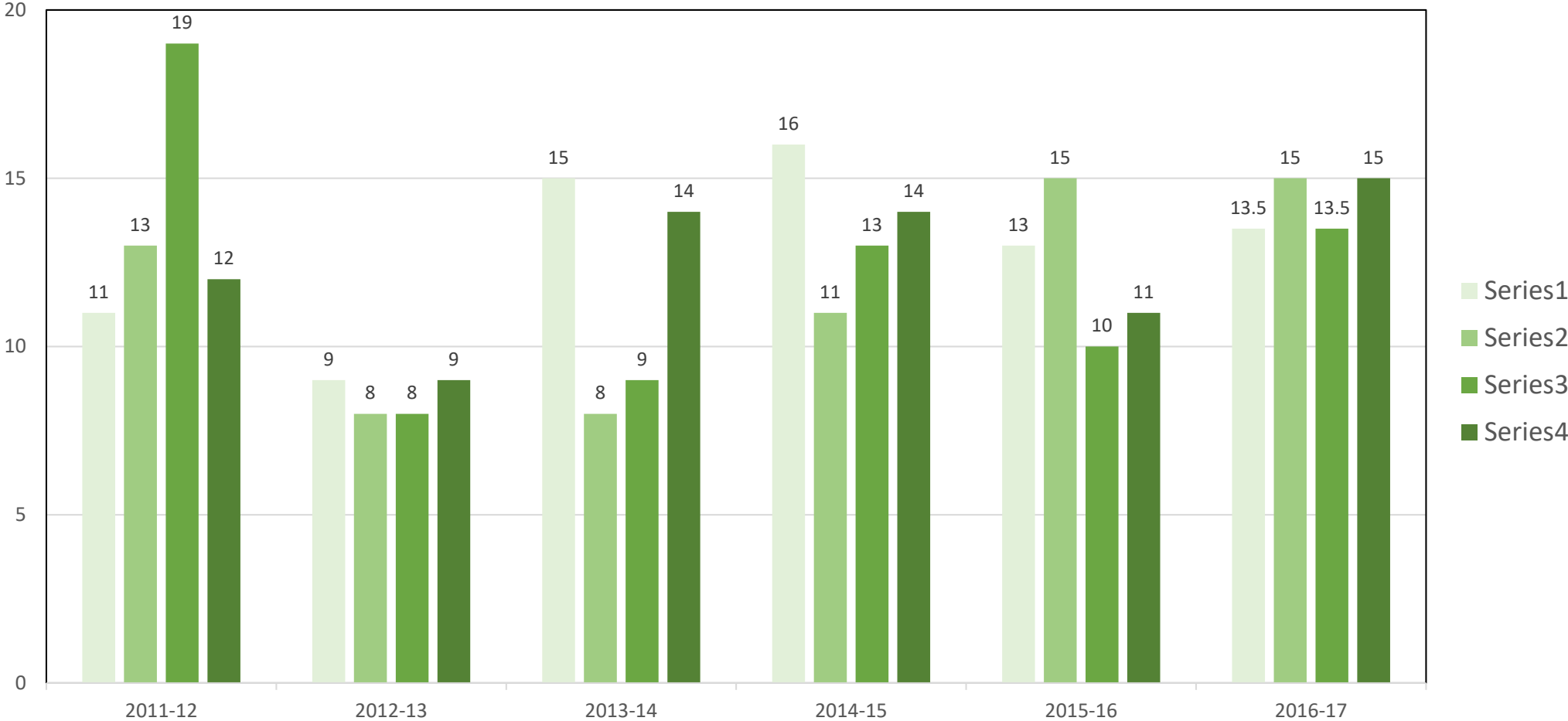
Thin and lighten gridlines



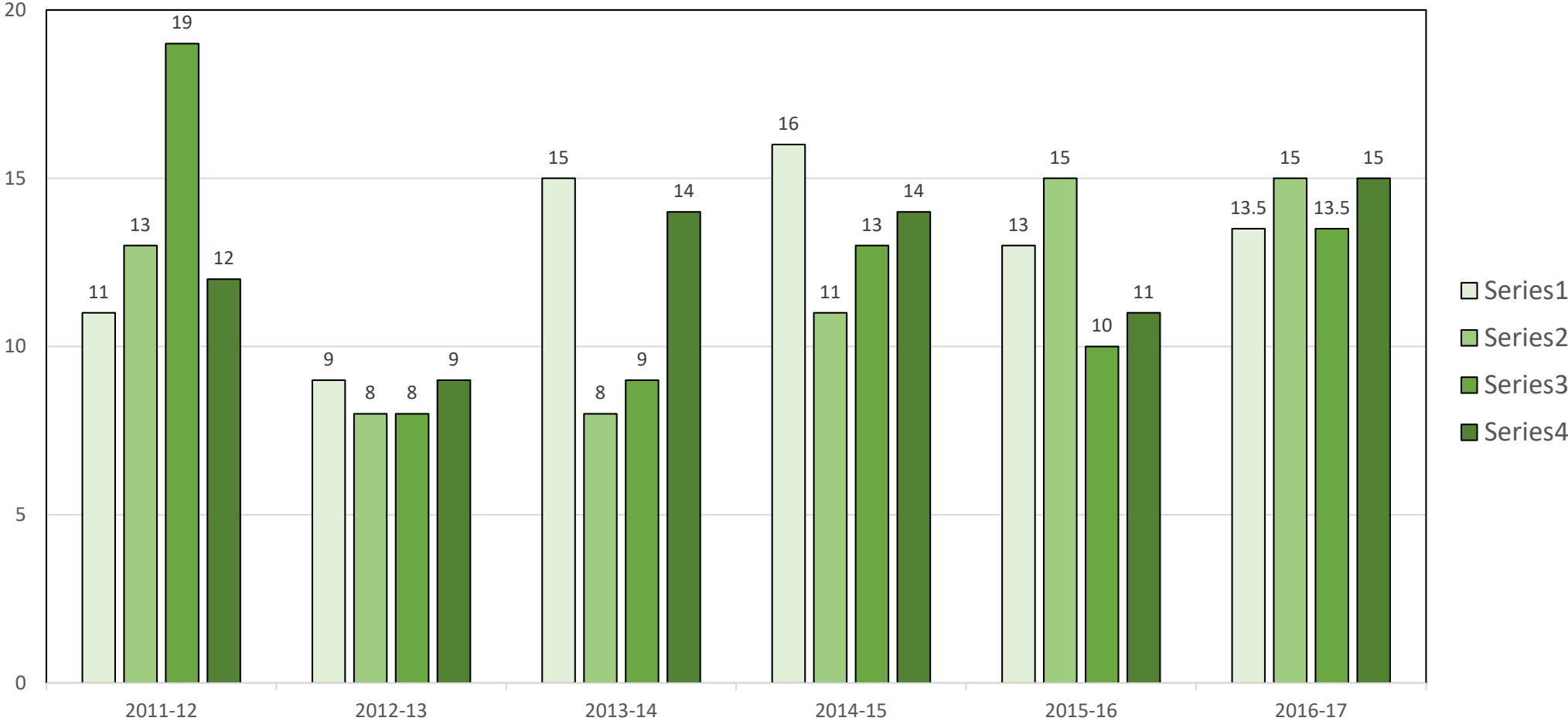
Widen data bars



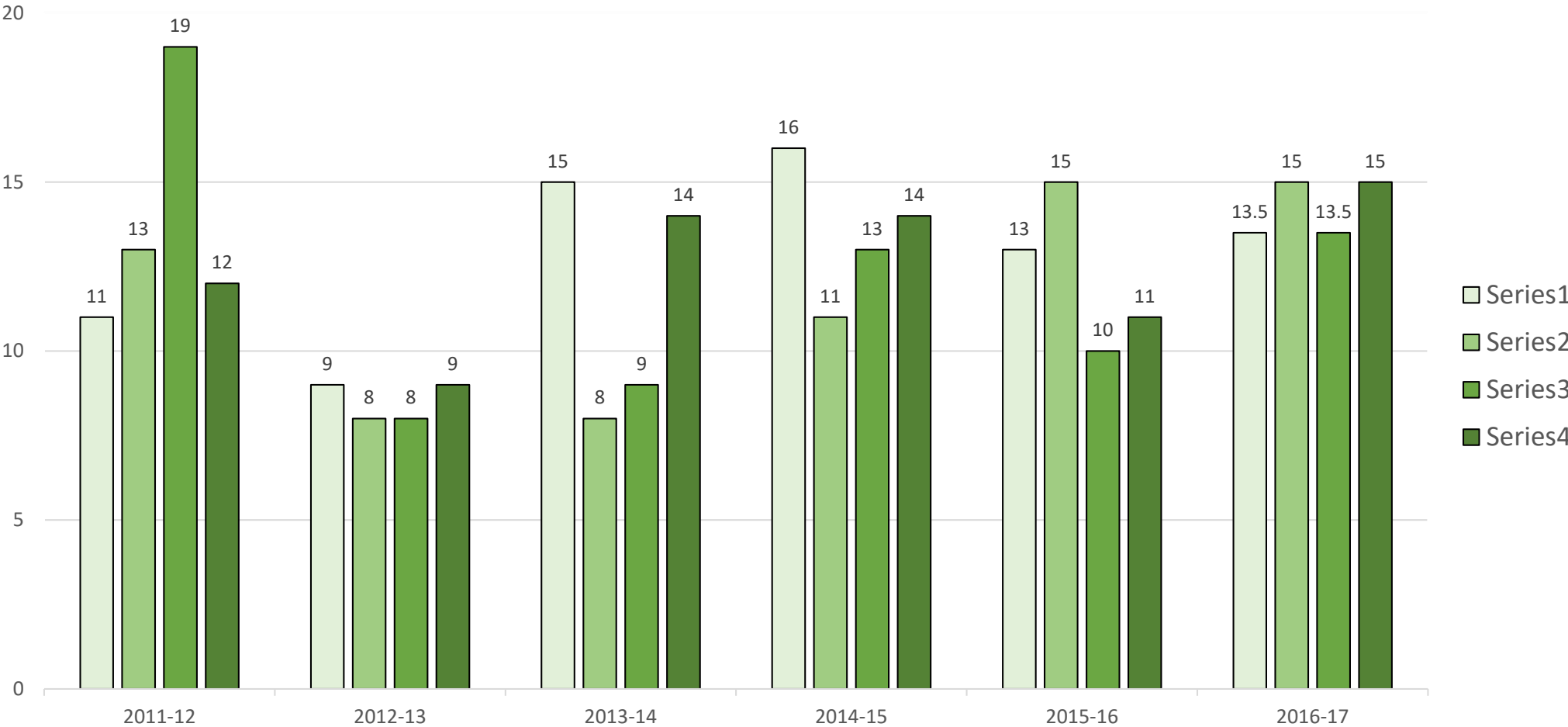
Pick a color scheme



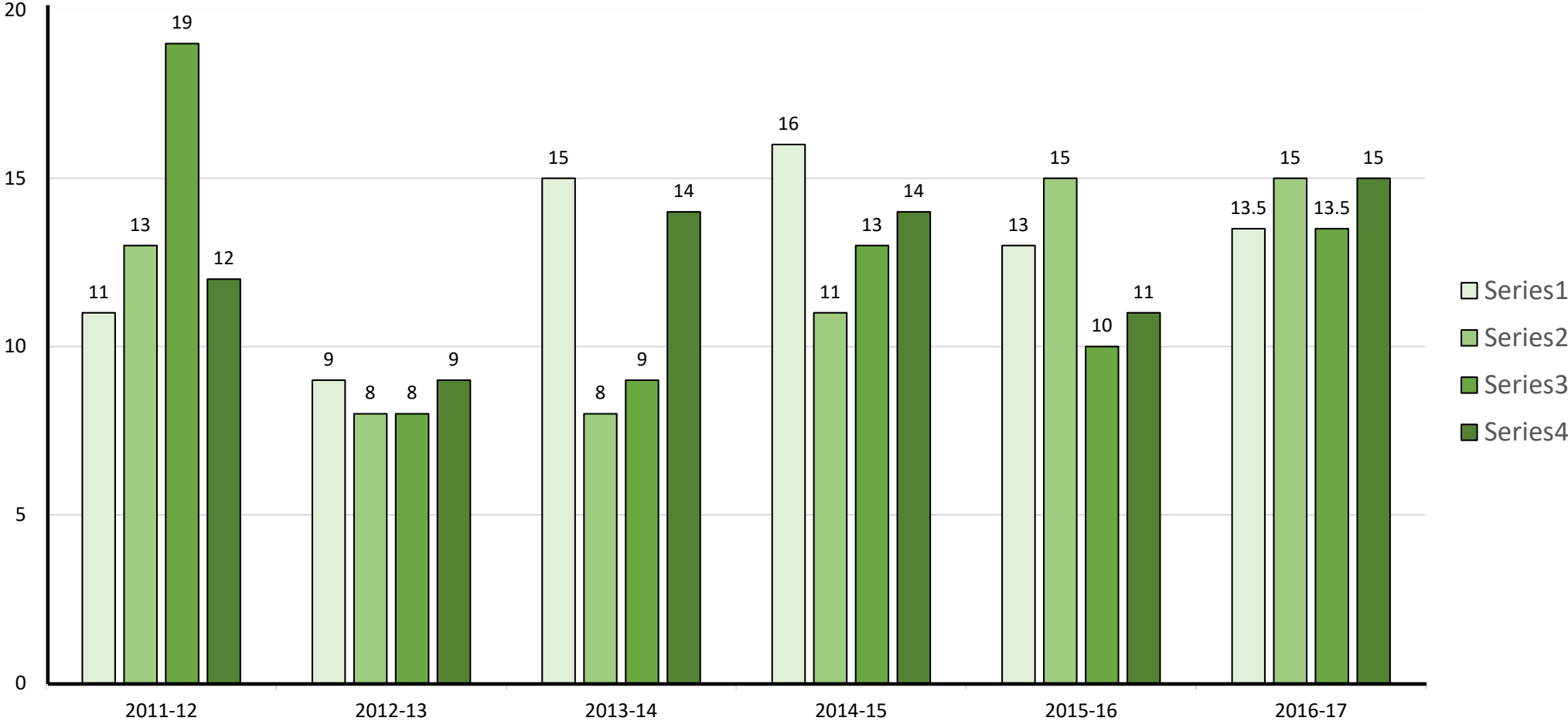
Add borders to the data bars



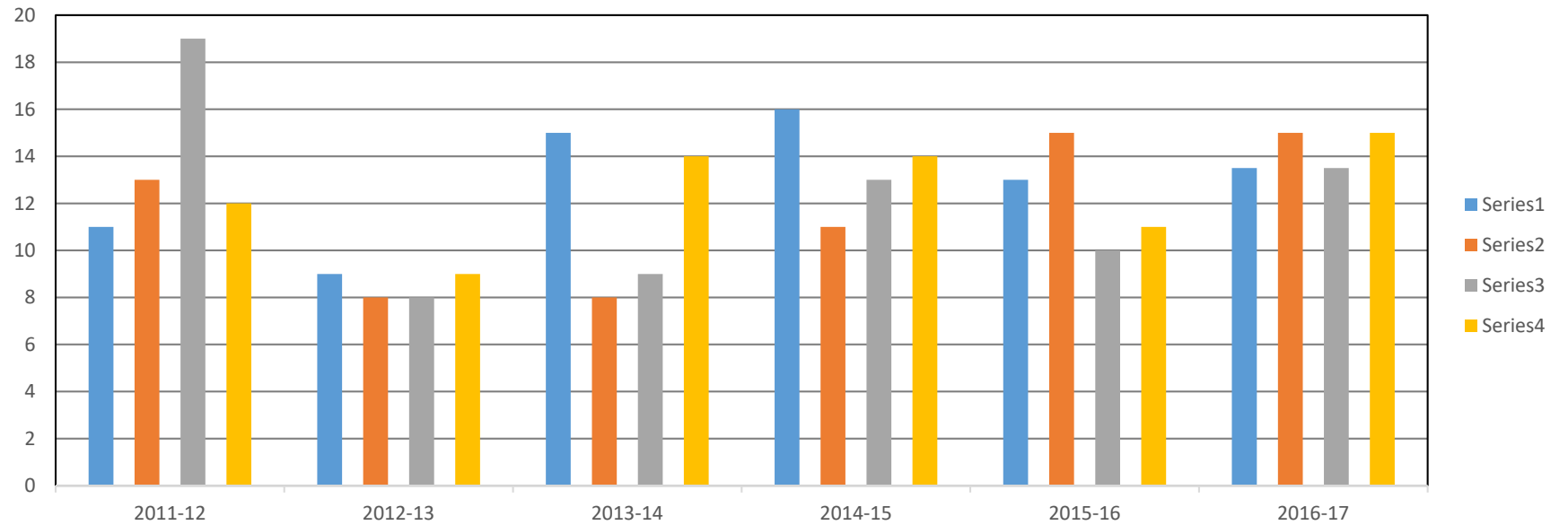
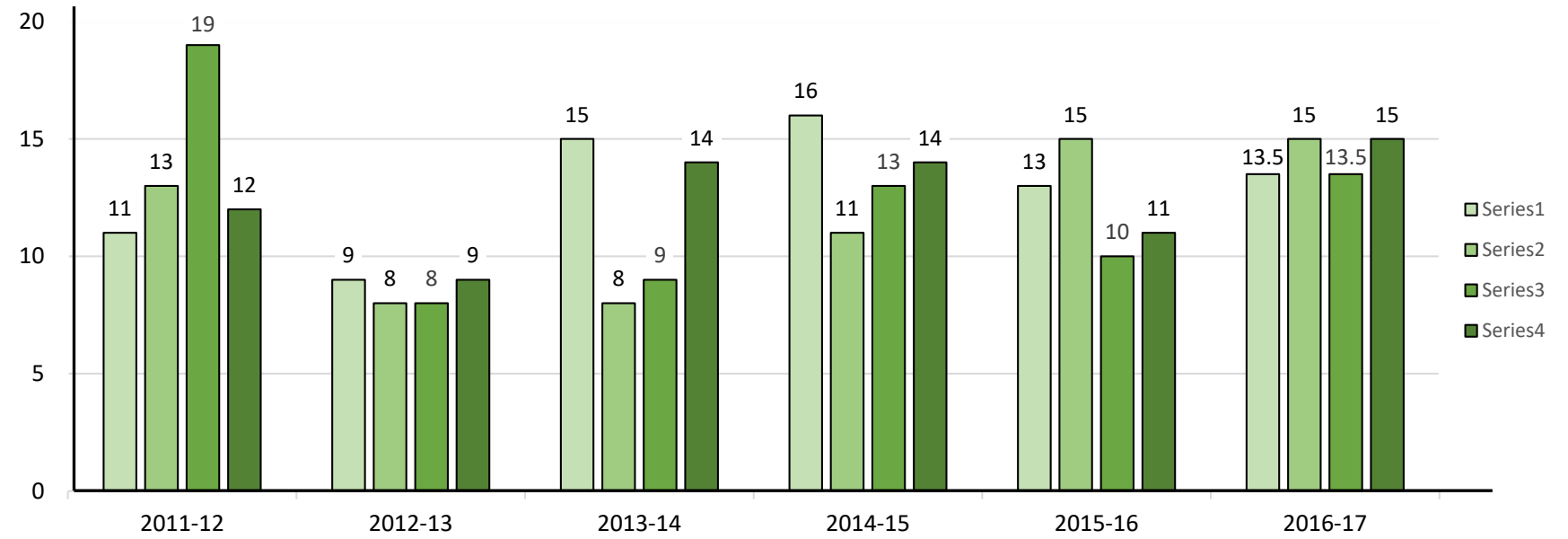
Remove boarder from the graphic



Add a line to the X and Y axis



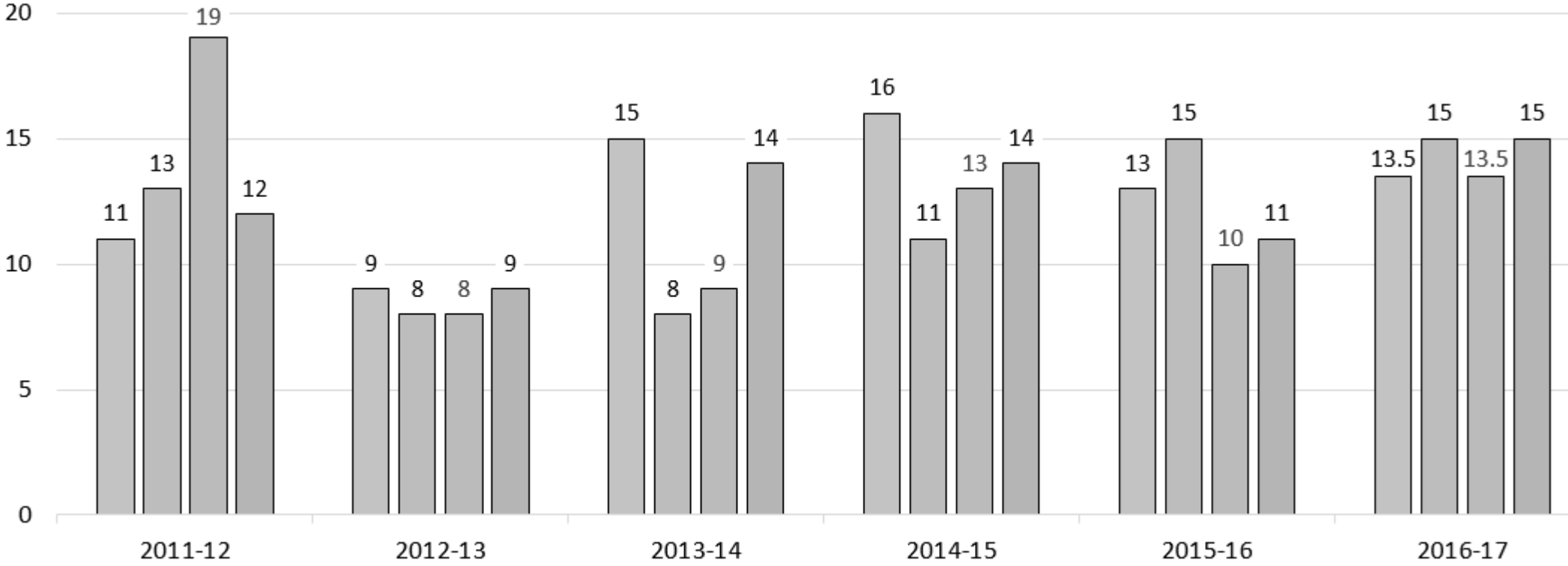
- Add data labels
- Thin and lighten gridlines
- Widen data bars
- Use gradient or similar colors
 - Avoid zebra pattern
 - Consider contrast
- Add line to x and y axis



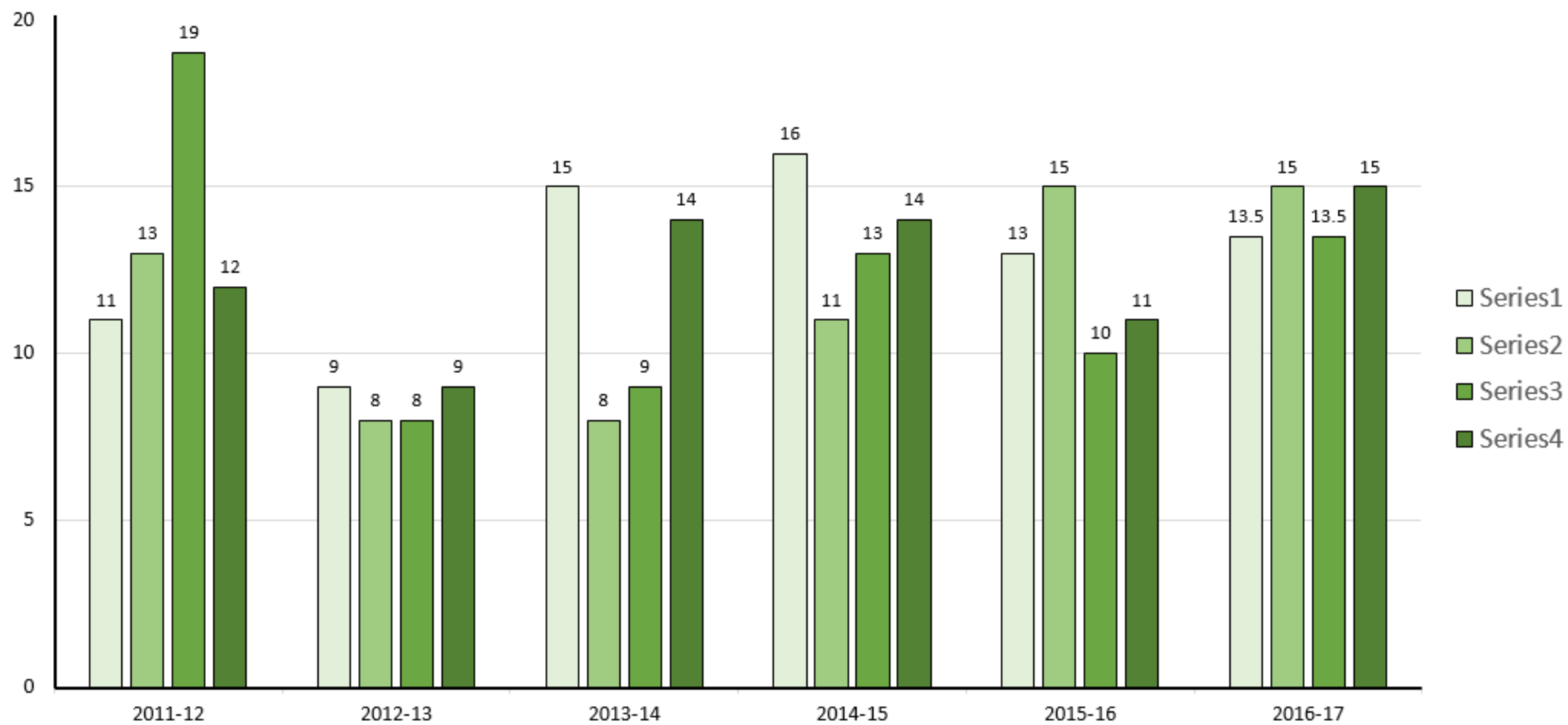
Bad contrast:



Bad contrast:



Good contrast:



Good contrast:

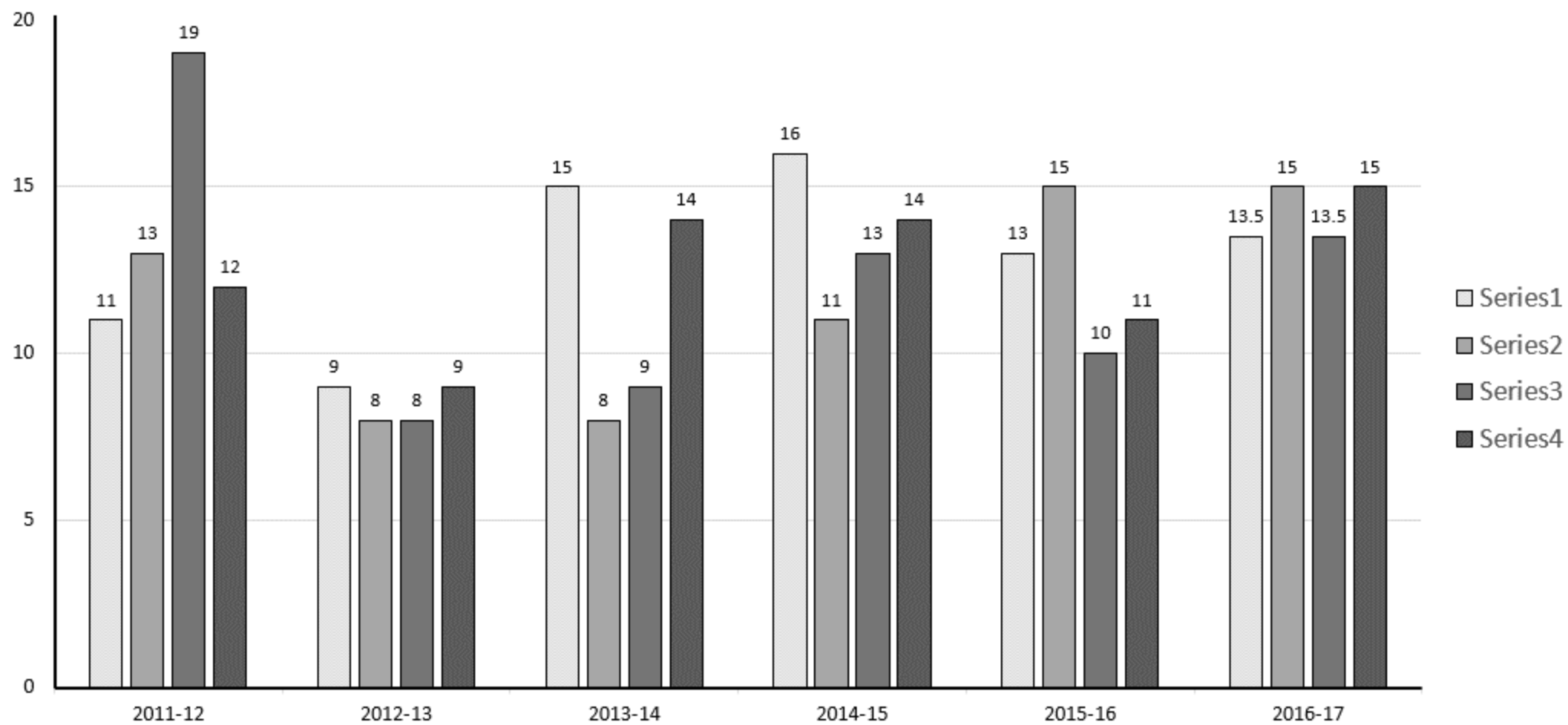


Table:

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Remove ALL CAPS, **bold**, *italics*, and different font sizes

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Remove borders

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Add lines below title and every third row

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Left justify first column, center justify everything else

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Add title to table

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Shade column to emphasize data (optional)

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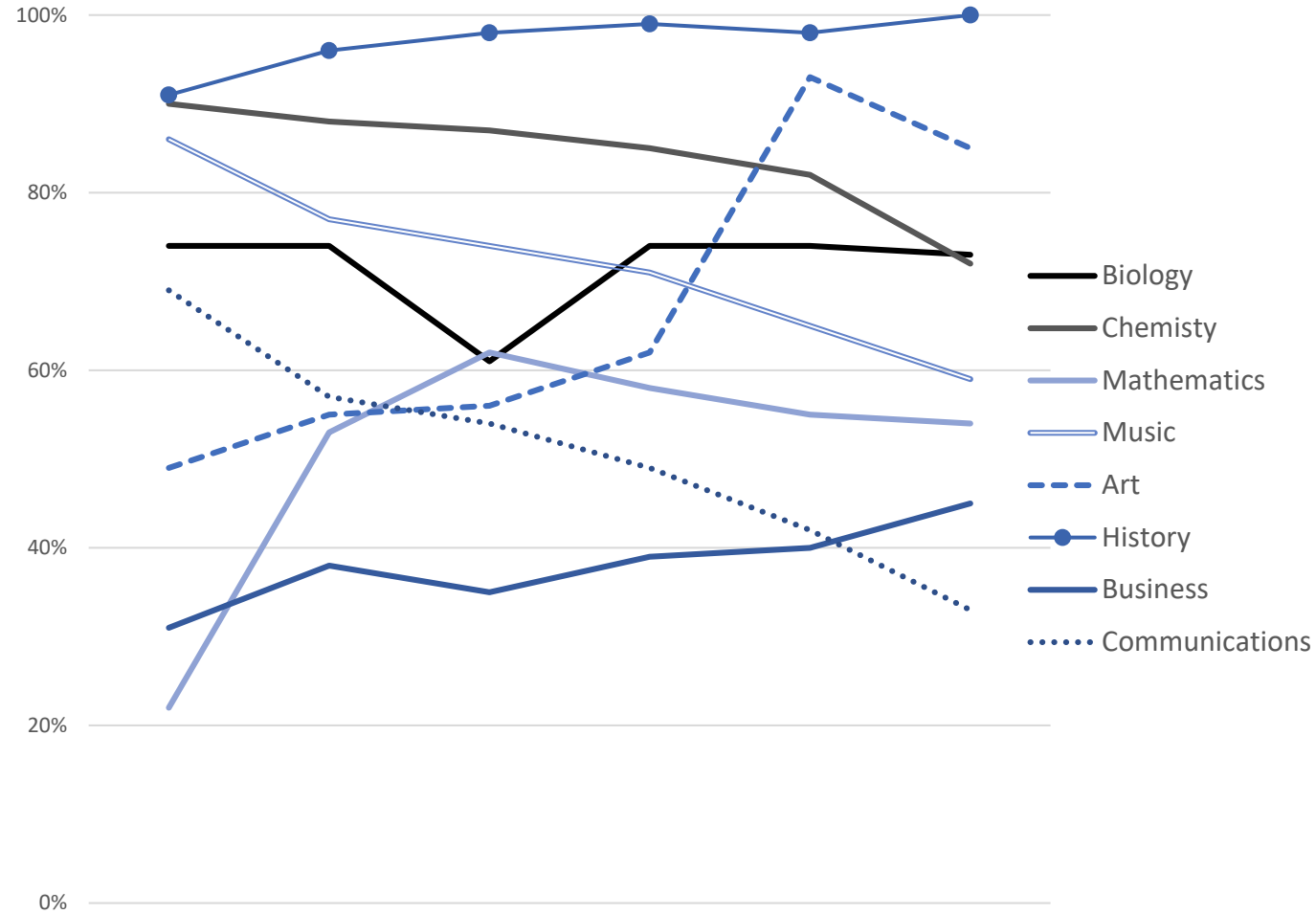
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- Remove all borders
 - Put a thick line at top, thin lines every 3-4 rows
- Minimize use of **different** font size, ALL CAPS, **bold**, or *italic*
- Shade a row to emphasize that data (optional)
- Left justify first column, center everything else
- Add description of table under title (if necessary)

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Multi-Series Line Chart



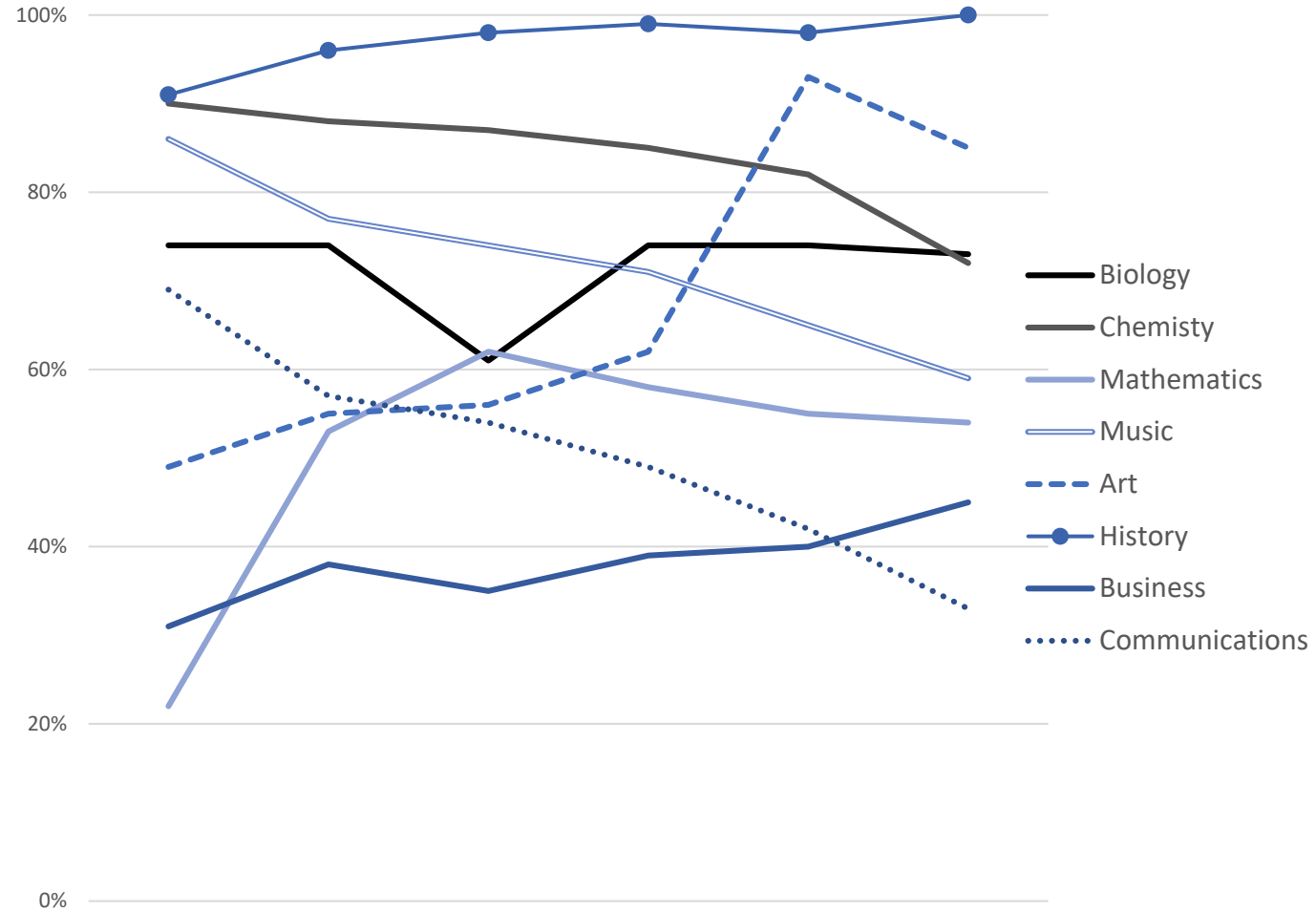
Great for comparing different sets of data

Too many lines on the graphic obscures key information

Question:

Which departments have scores that increased over the last five years?

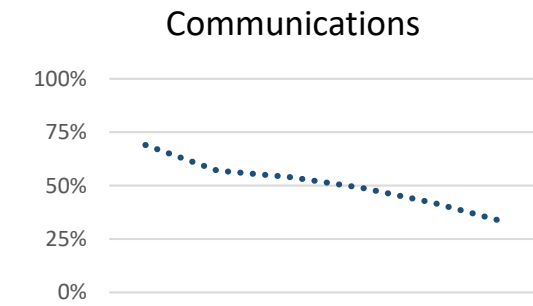
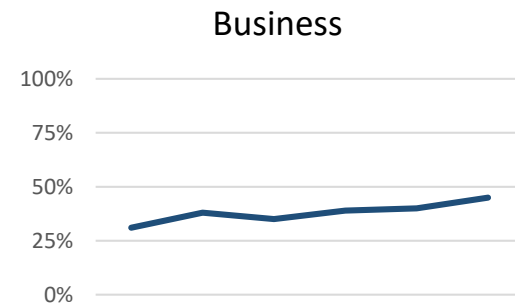
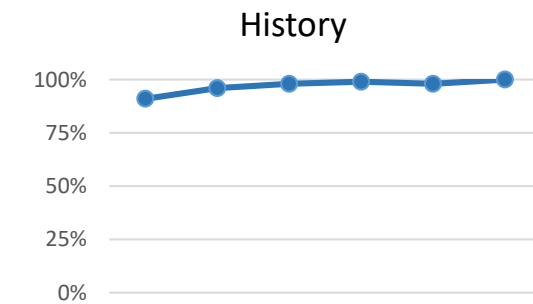
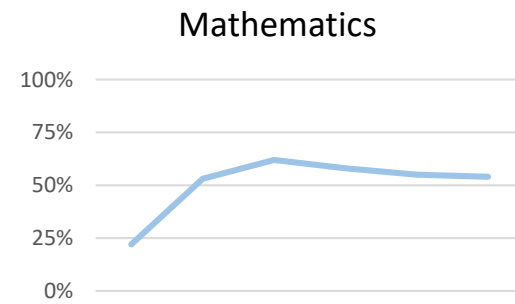
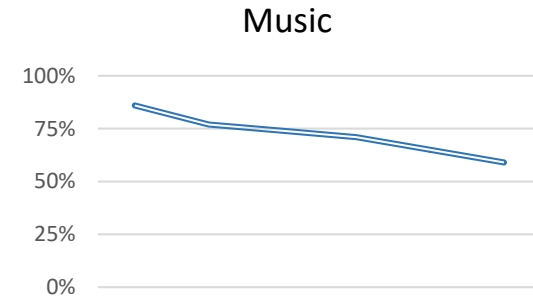
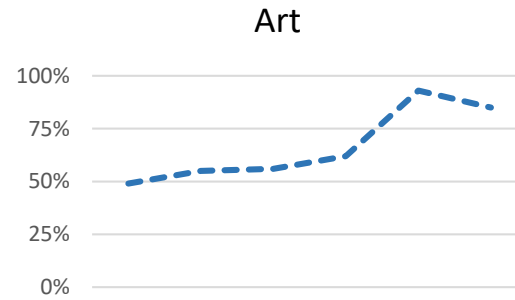
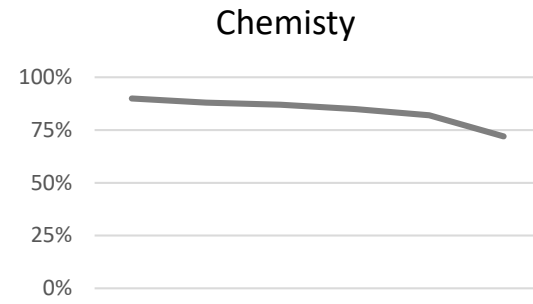
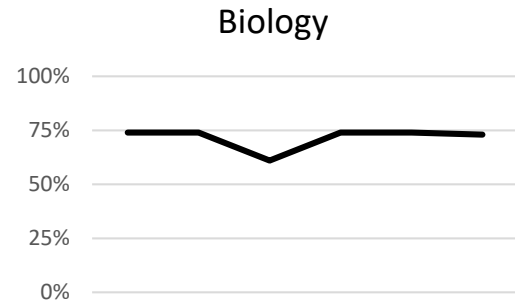
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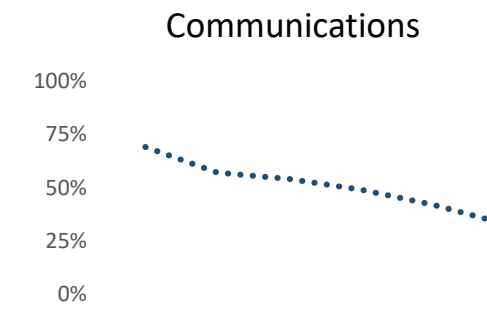
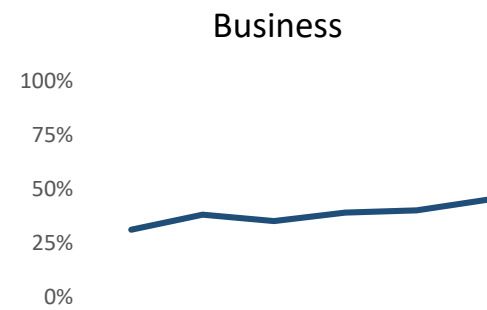
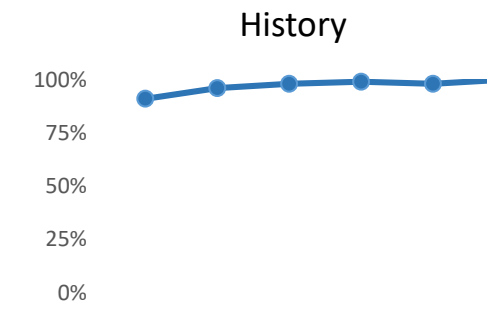
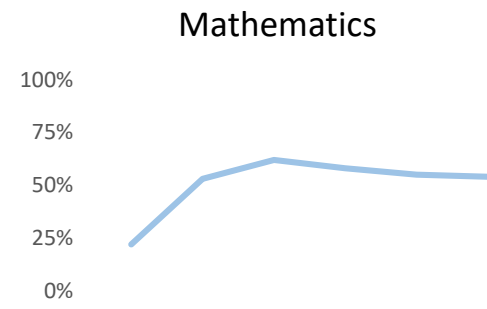
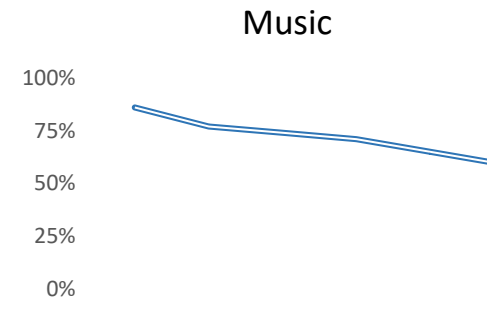
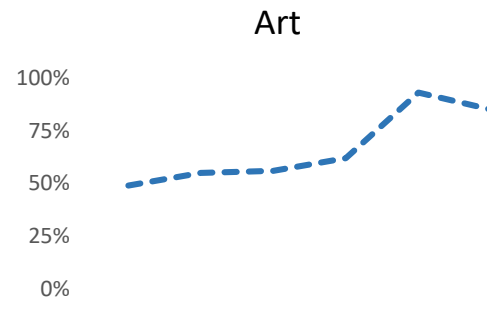
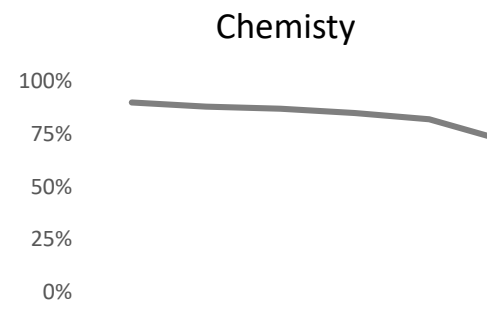
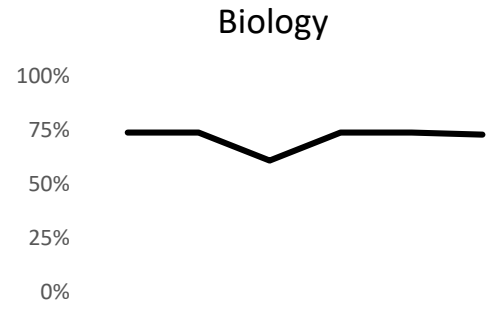
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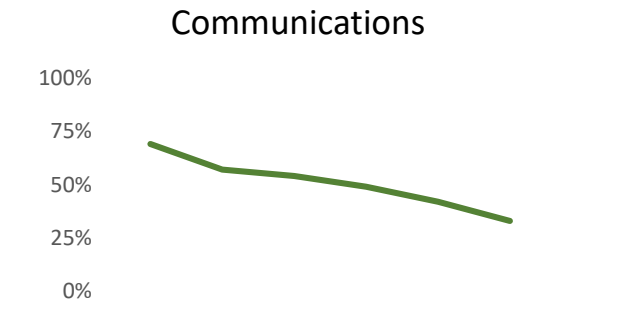
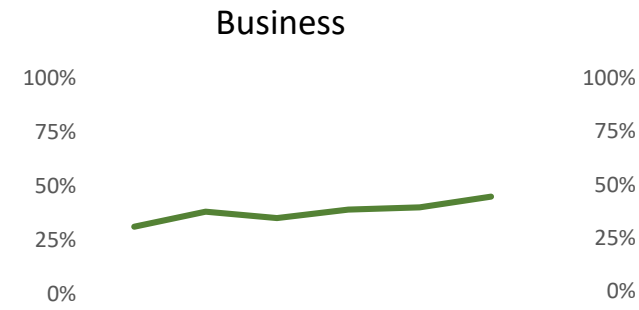
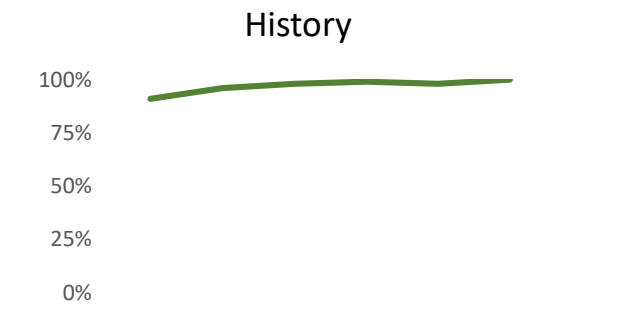
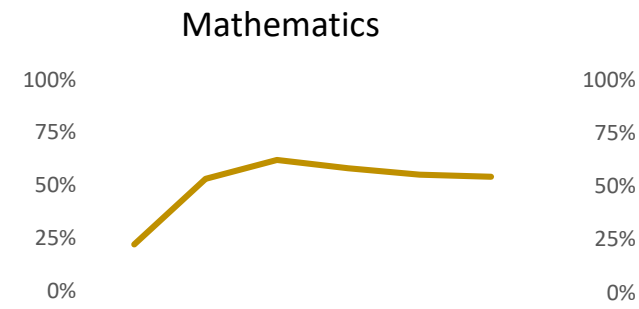
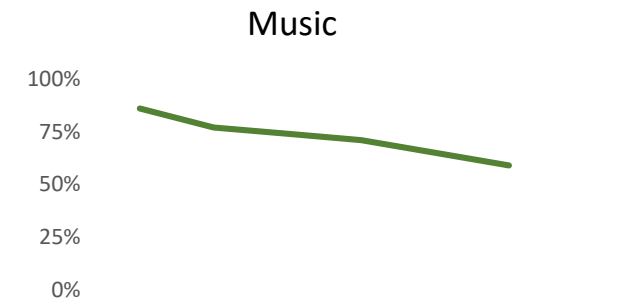
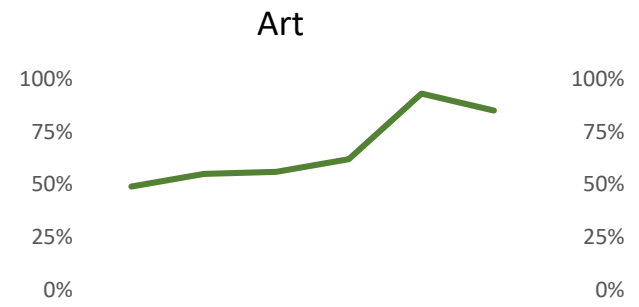
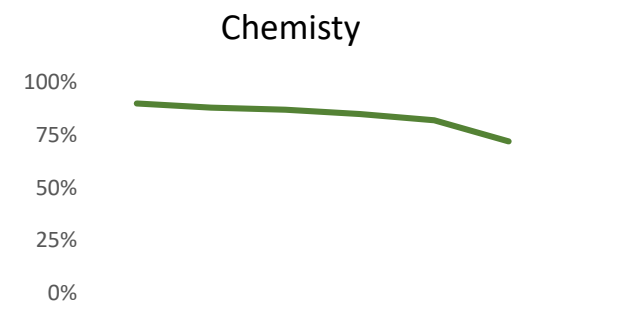
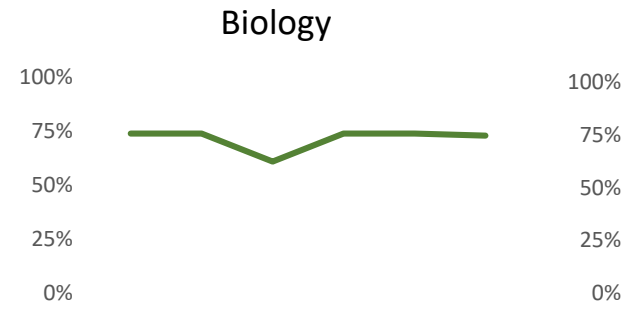
Split the chart up

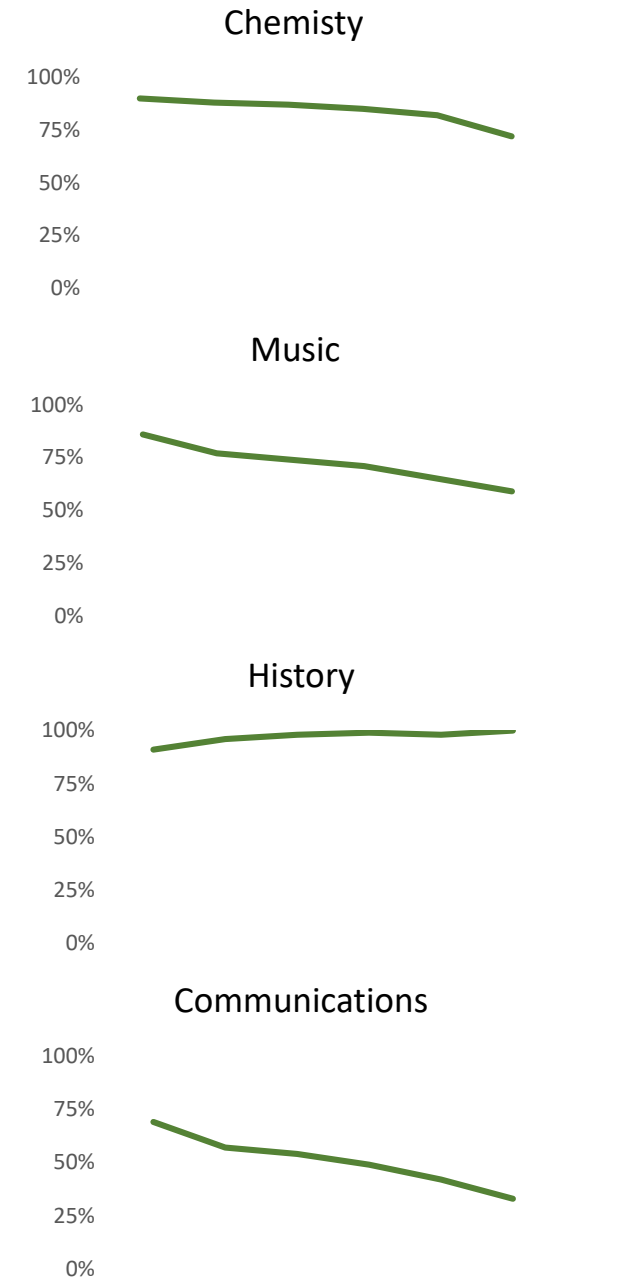
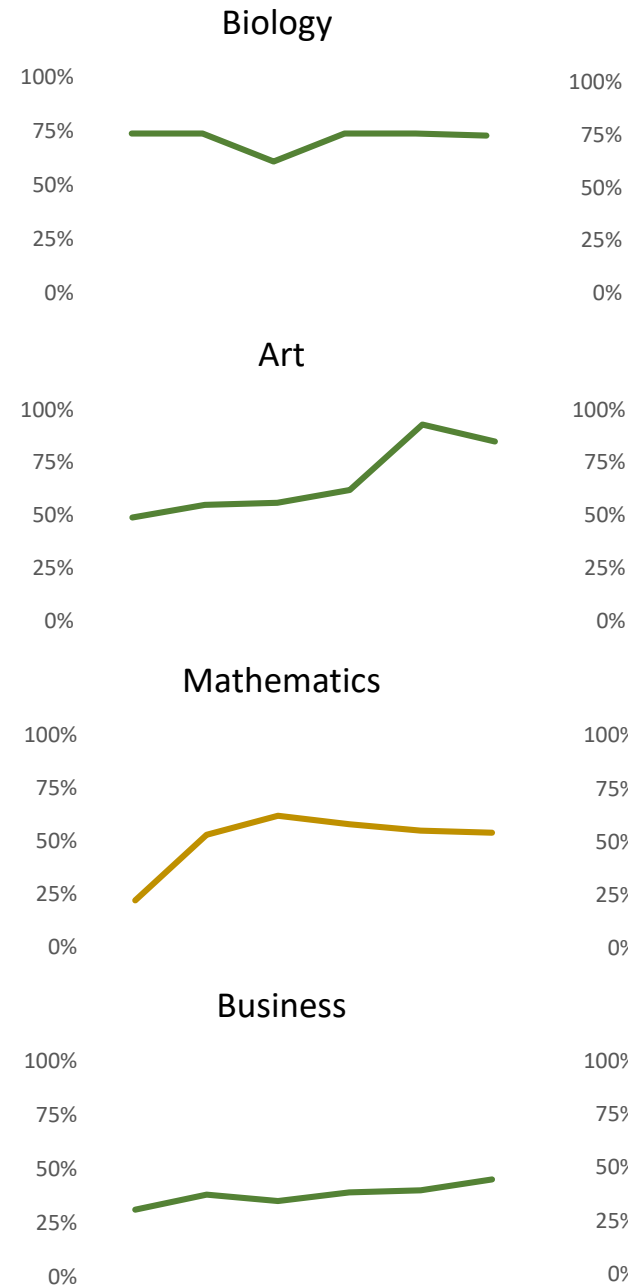
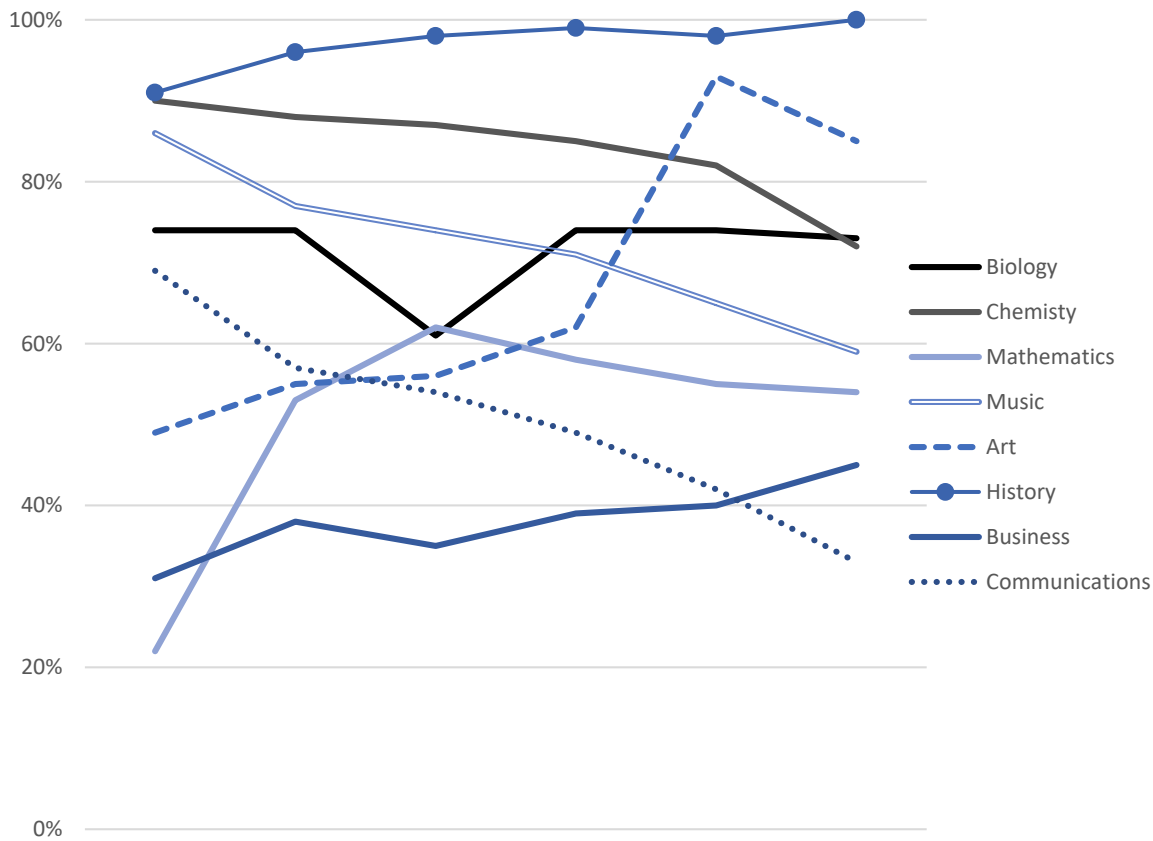


Remove gridlines



Uniform line
size, shape,
and color



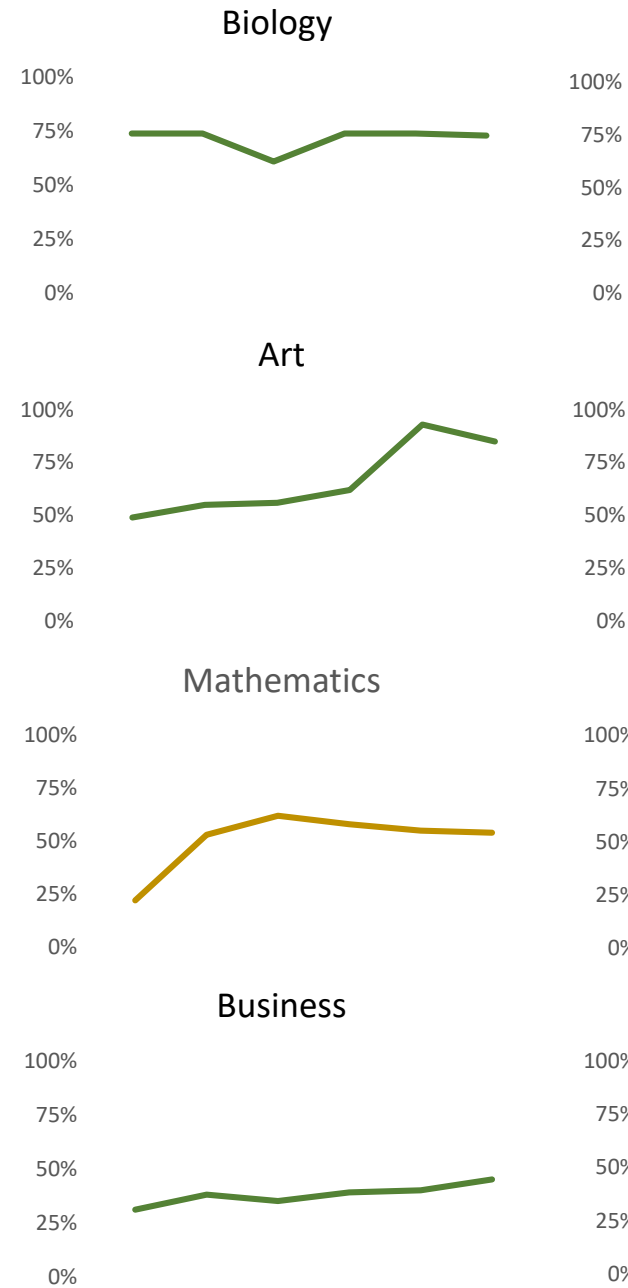
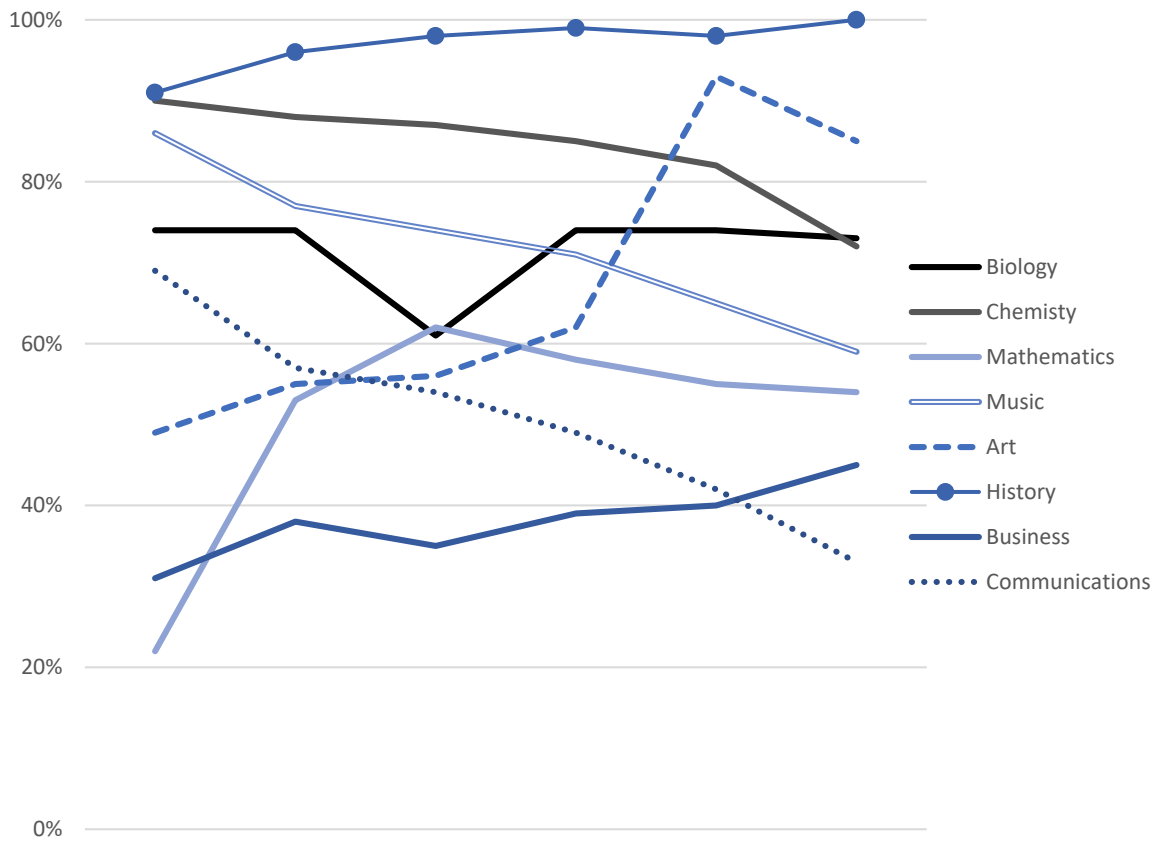


- If graphic has more than four lines, split it
 - Panel of charts or set of multi-series line charts

- Remove gridlines
- Use color to emphasize
- If using greyscale/gradient, most important piece of data should be the black line

Question:

Which departments have scores that increased over the last five years?



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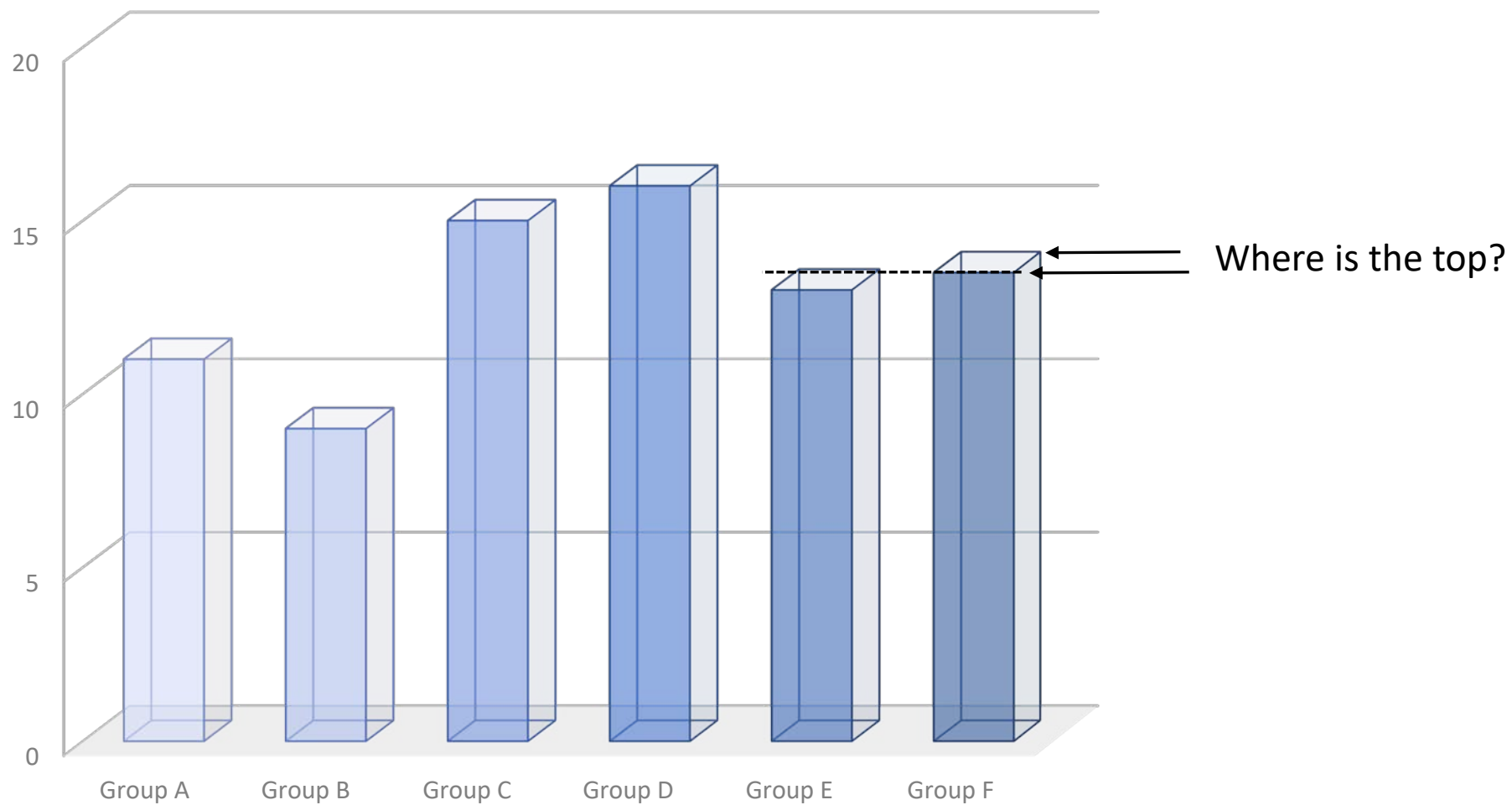
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Before you create a graphic

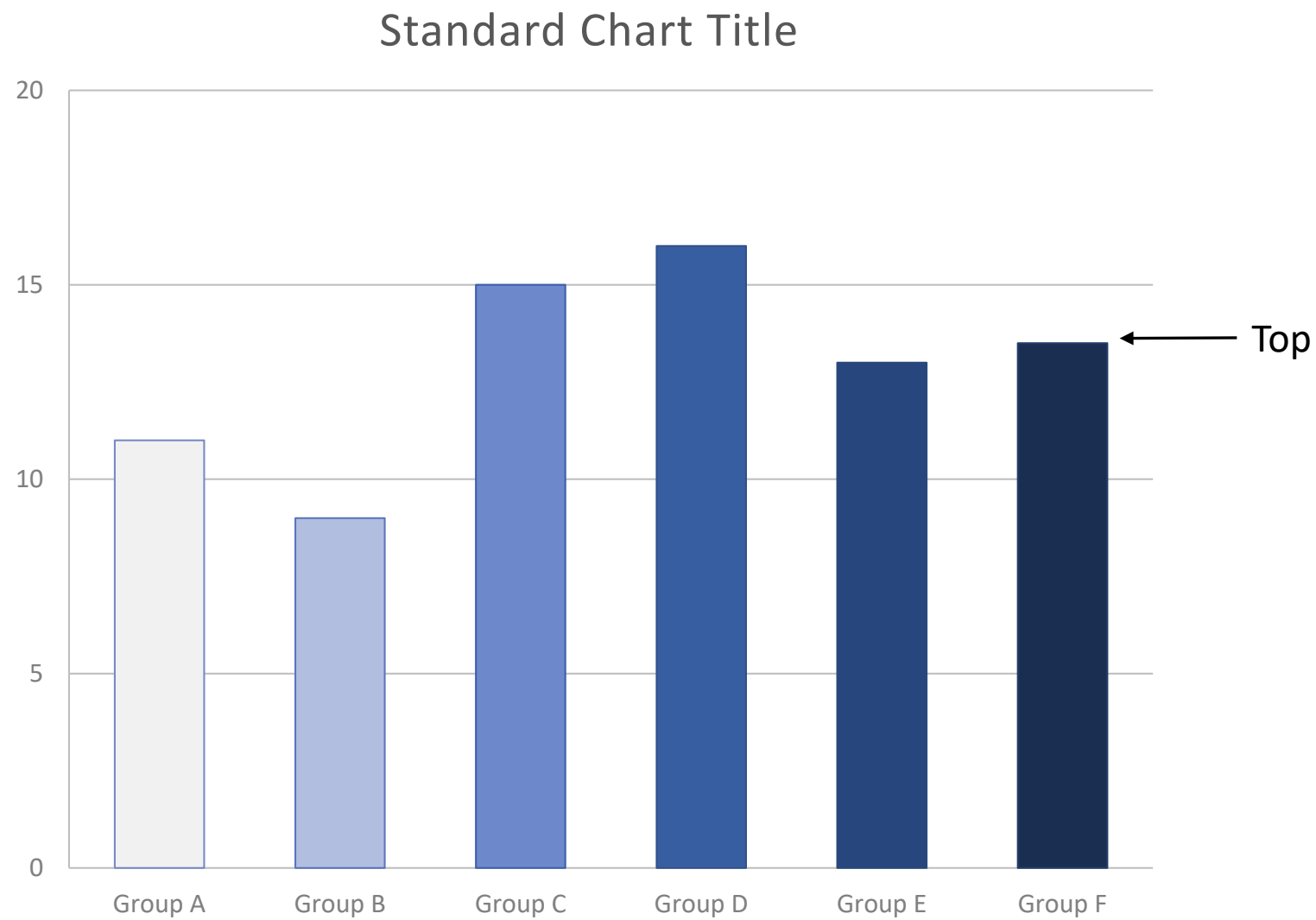
- Know your data, your purpose, and your conclusion
 - If you don't know what the data says, the reader definitely won't know
 - No one else will know the data as deeply as you do
- Throw data in different graphics until your conclusion pops
 - Also useful for identifying outliers
- Identify your purpose and think about your intended audience

3D Bar Graph

Standard Chart Title

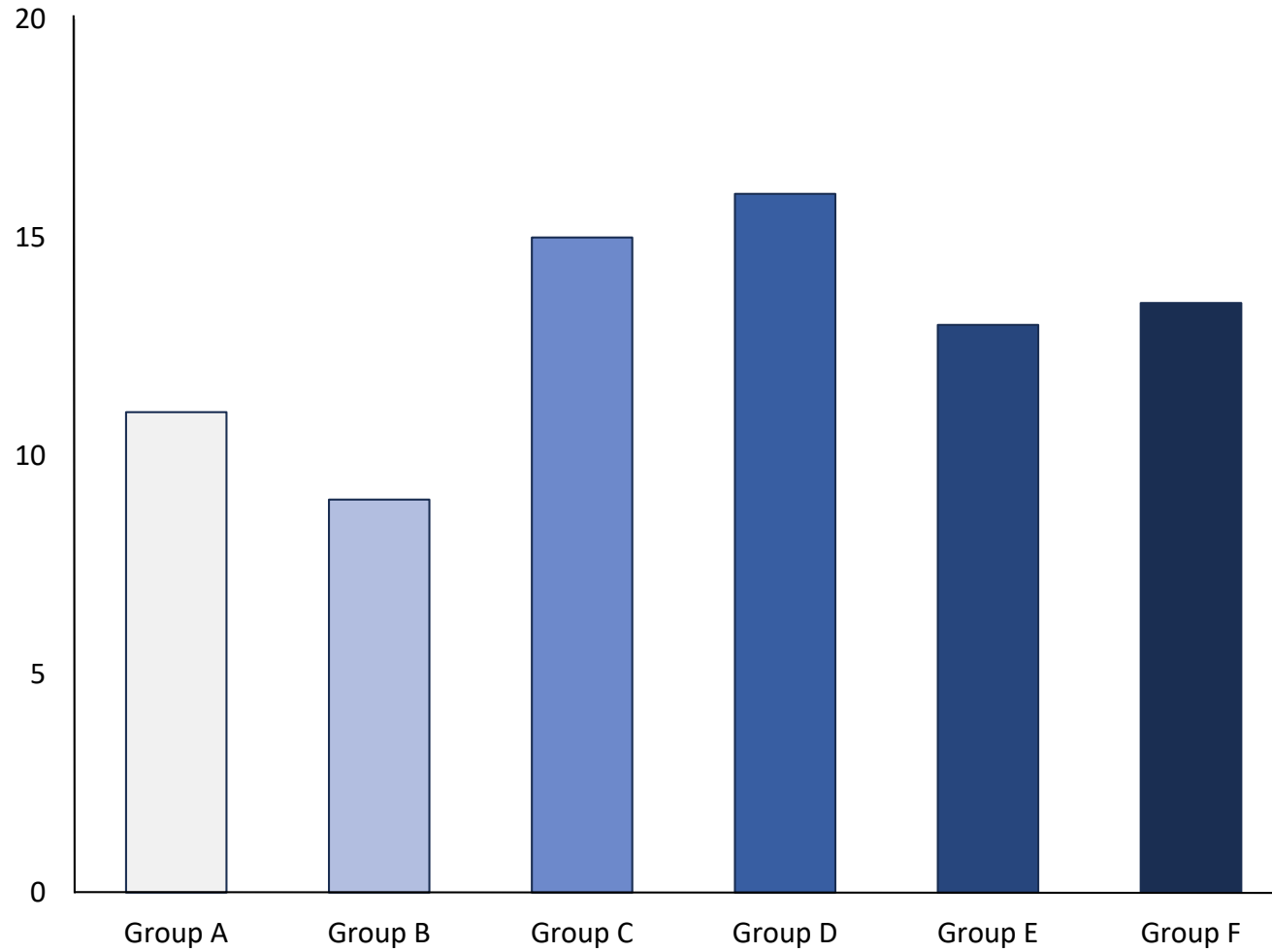


Remove 3D effects

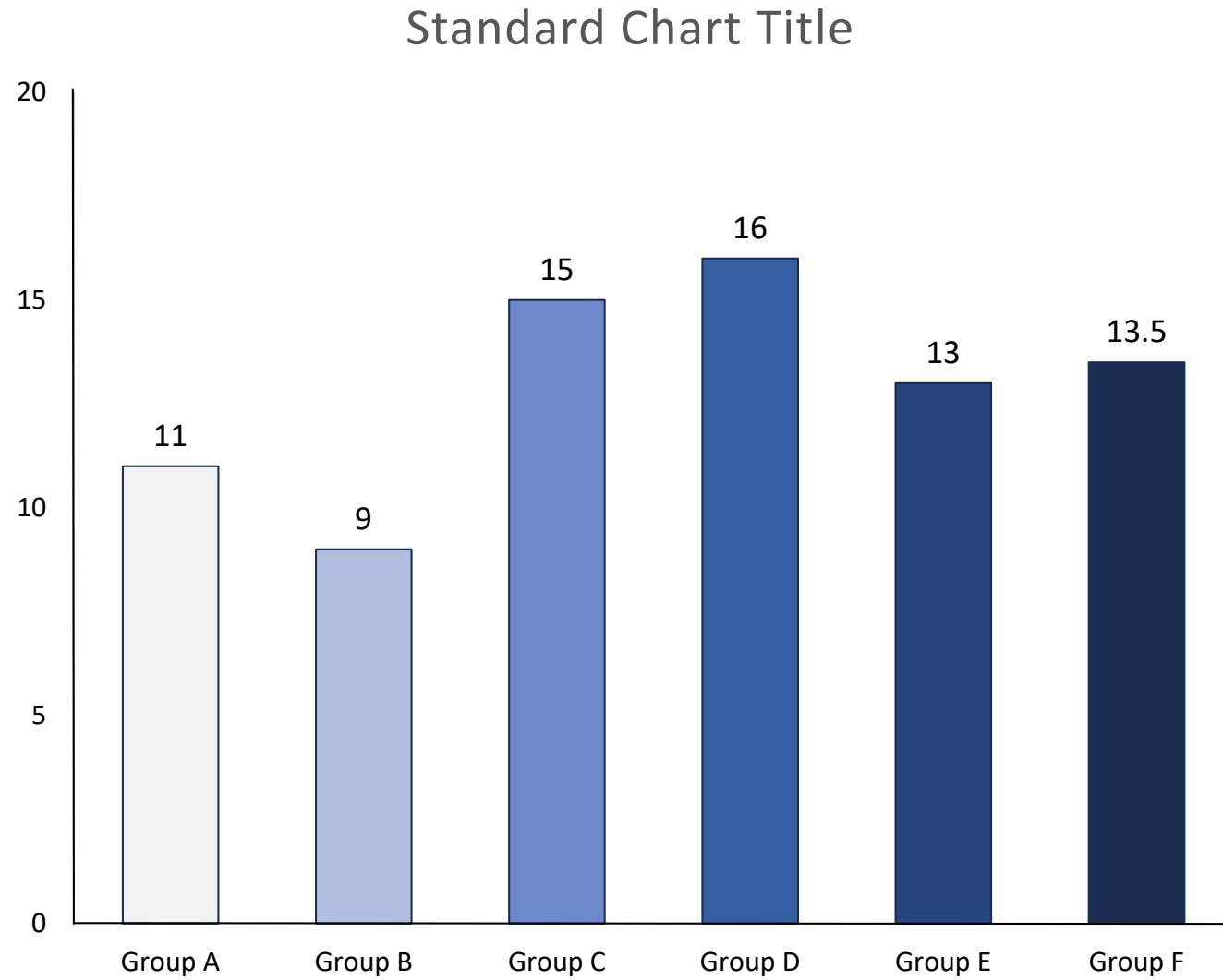


Add X and Y axis line, add borders, remove gridlines

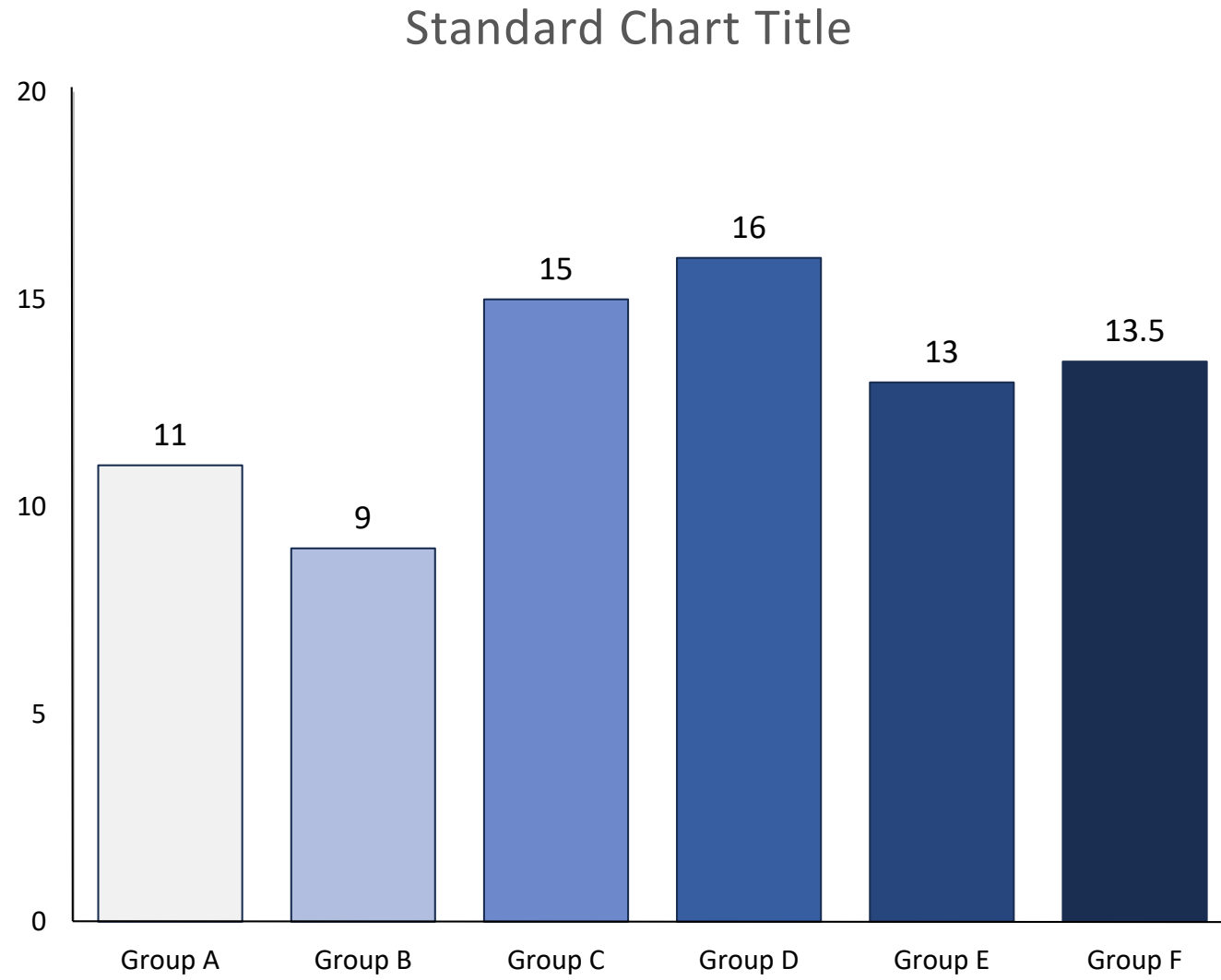
Standard Chart Title



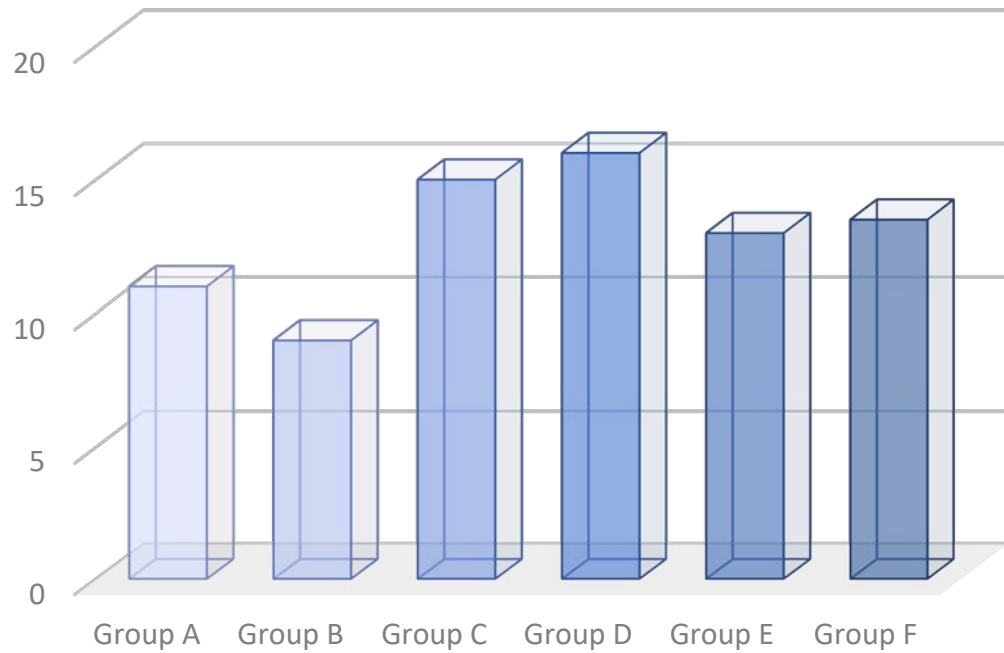
Add data labels



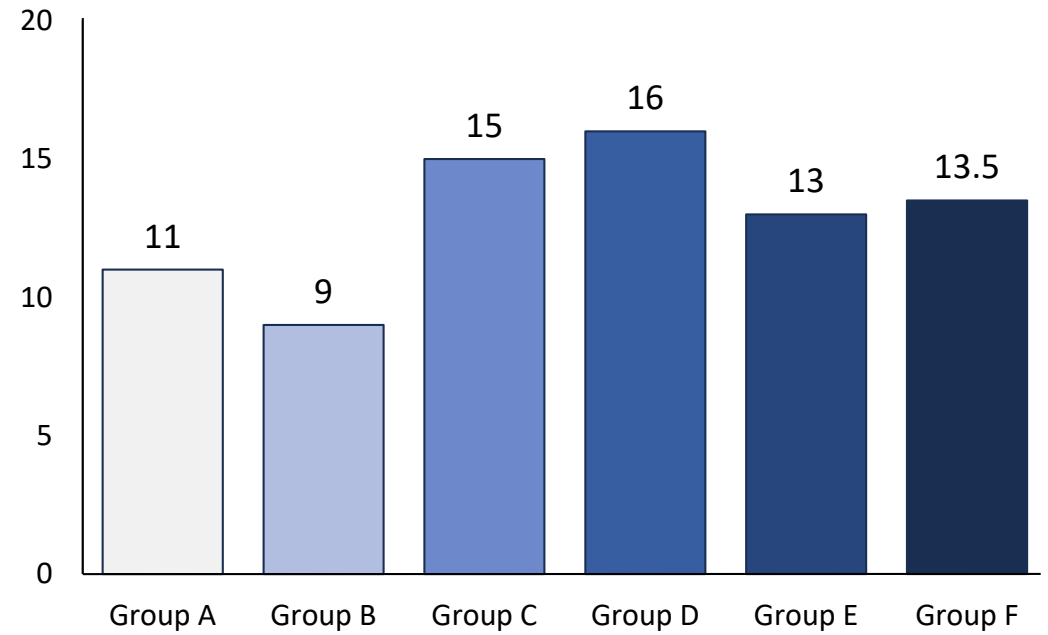
Widen data bars



Standard Chart Title



Standard Chart Title

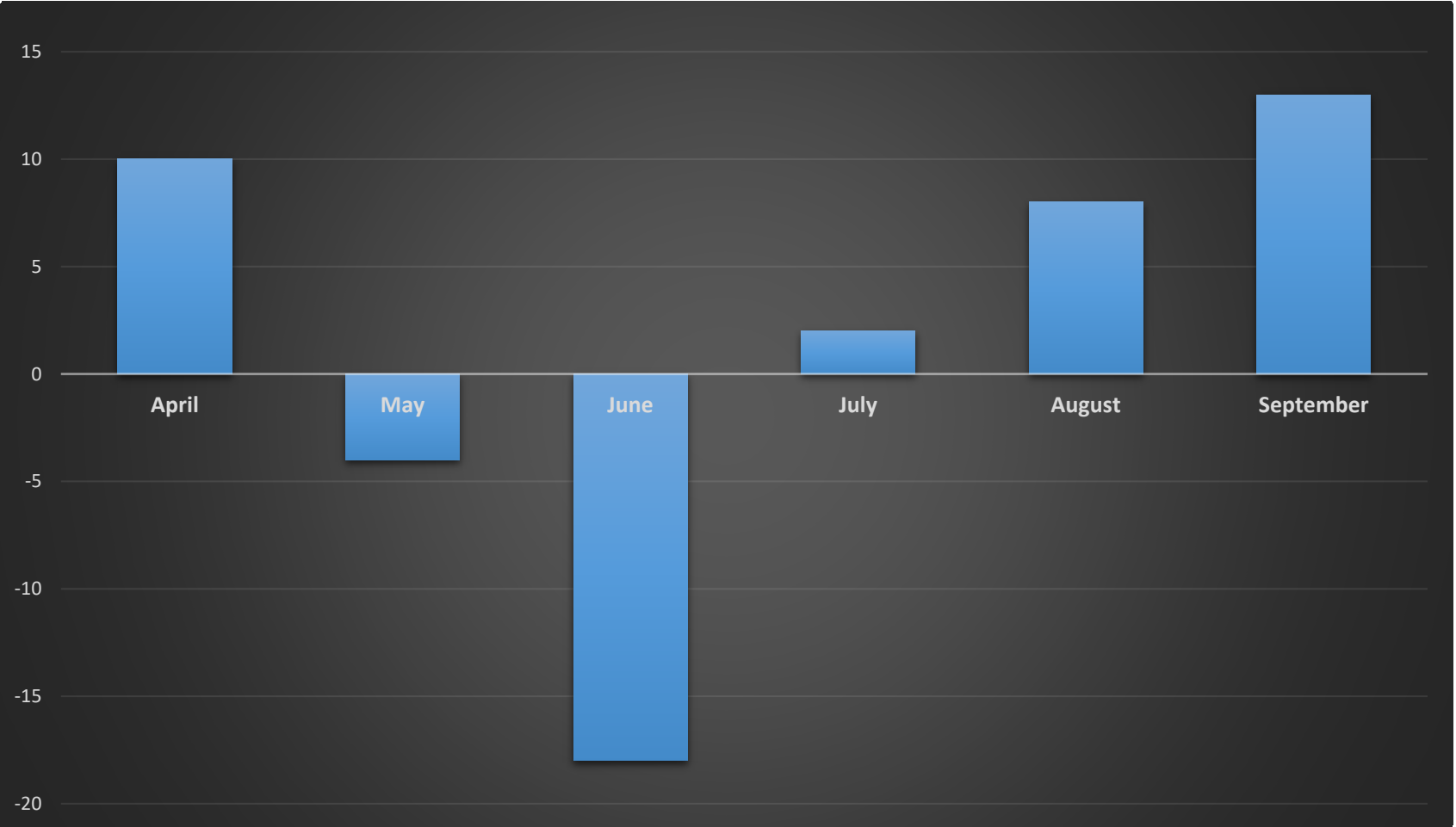


- Remove 3d effects
- Remove gridlines
- Add data labels
- Add X and Y axis lines
- Widen data bars

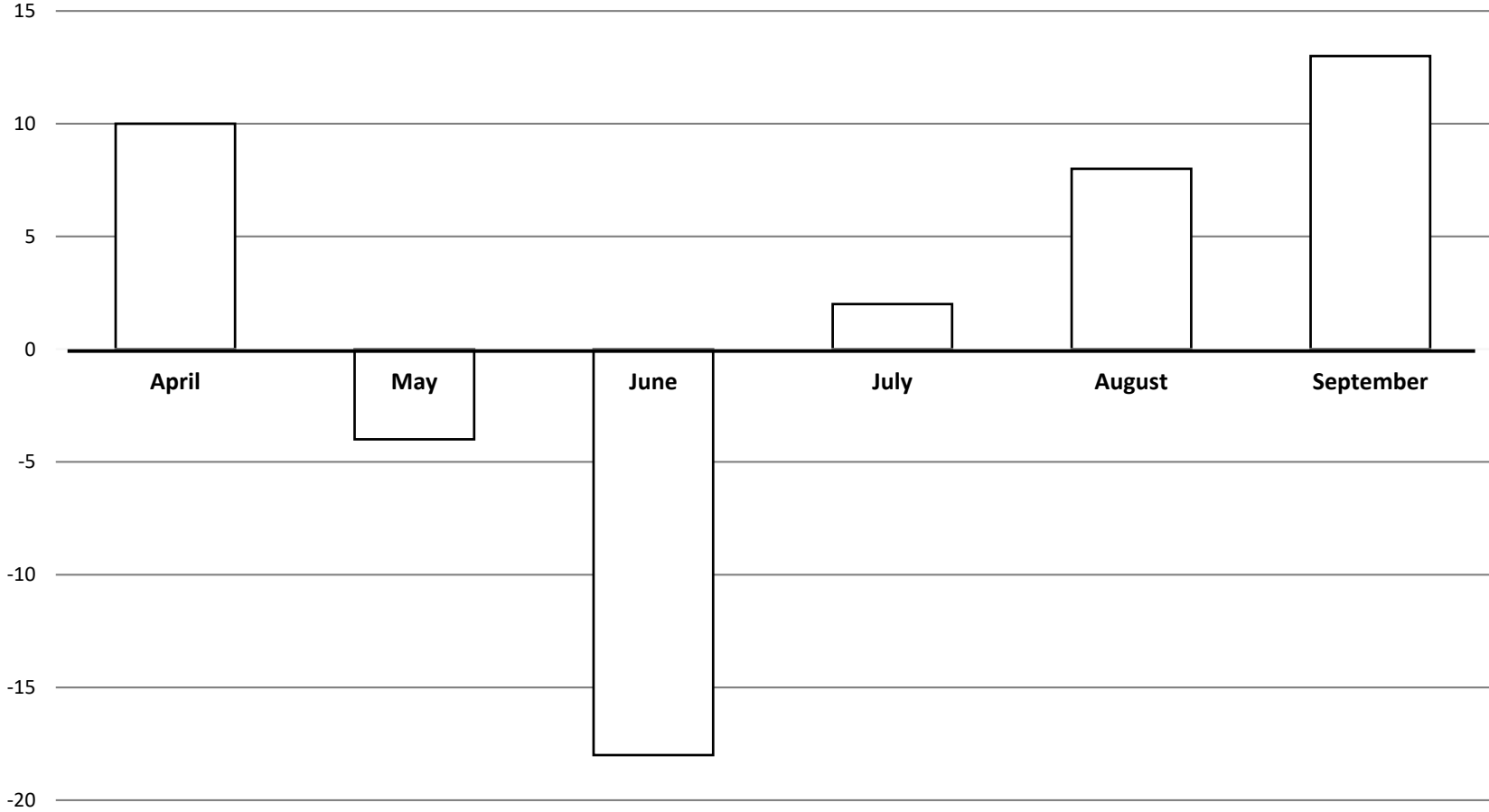
Which sentence is easiest to read?

Which sentence is easiest to read?

Which sentence is easiest to read?



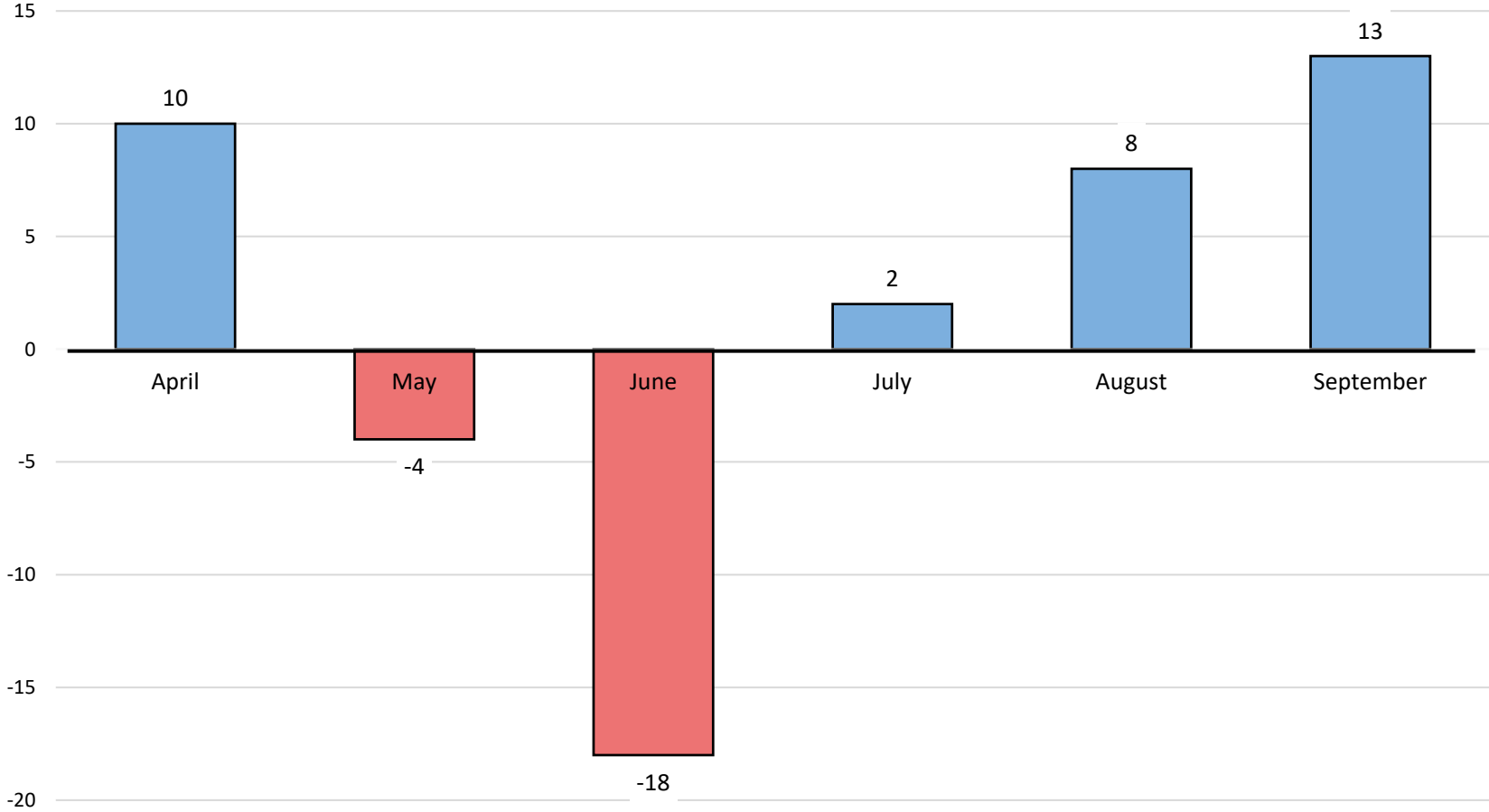
Start with a blank slate



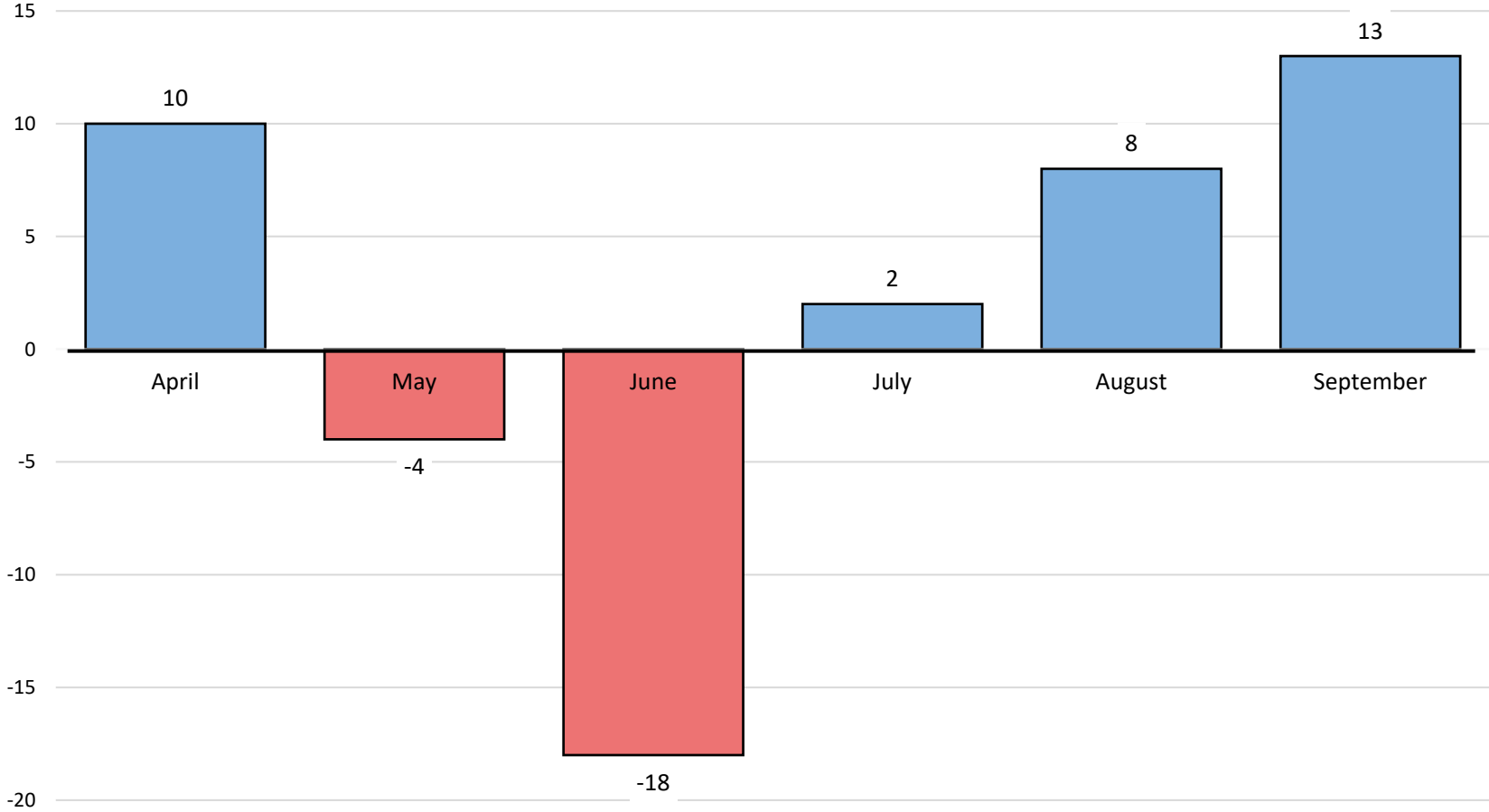
Add back in color, lighten gridlines



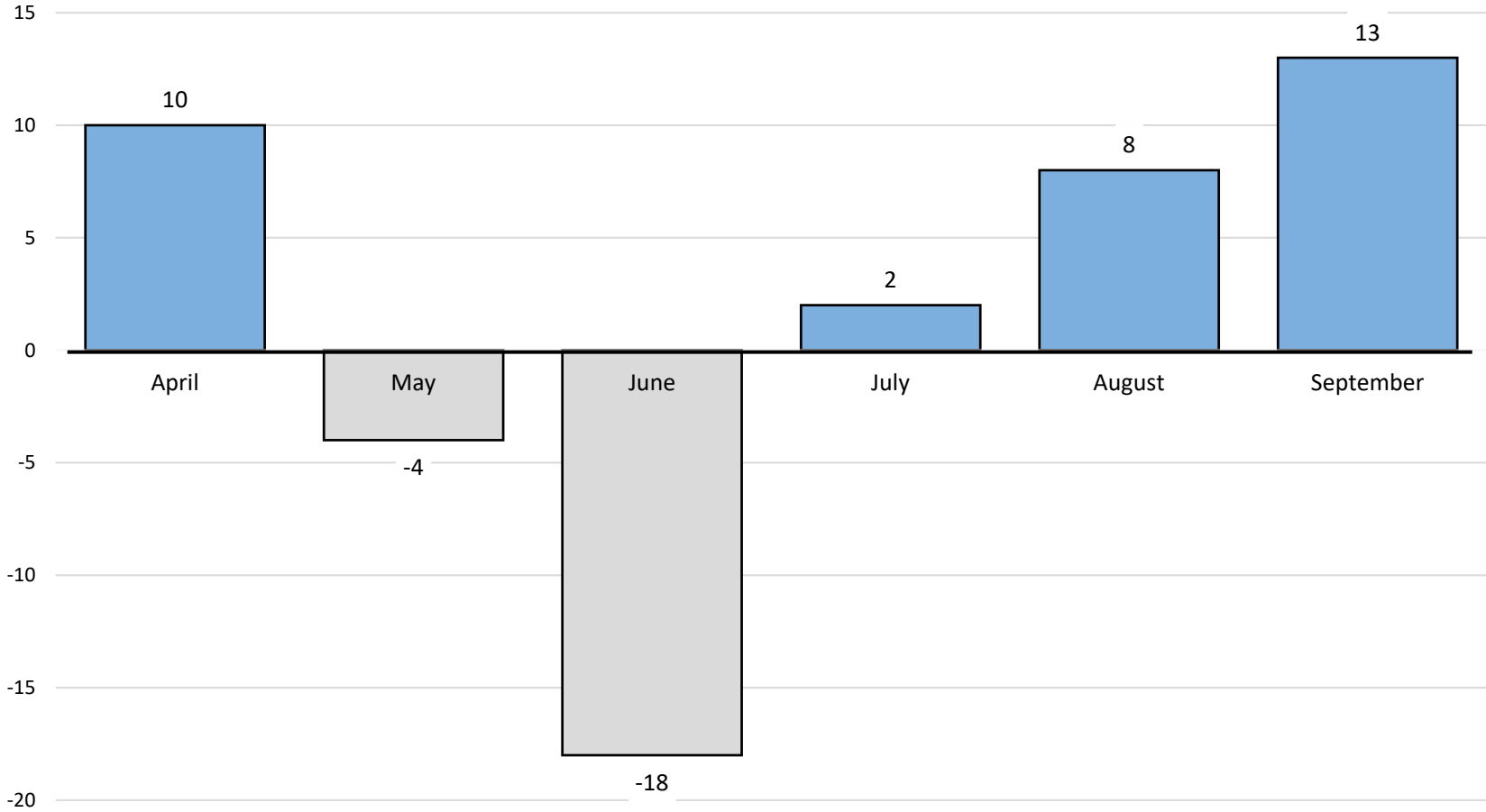
Add data labels



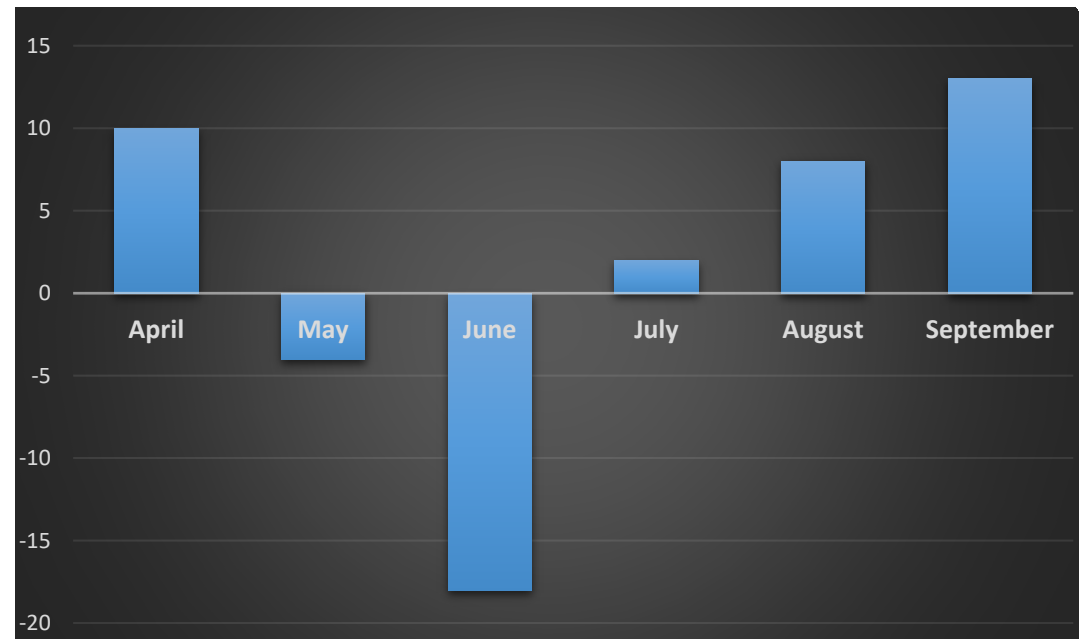
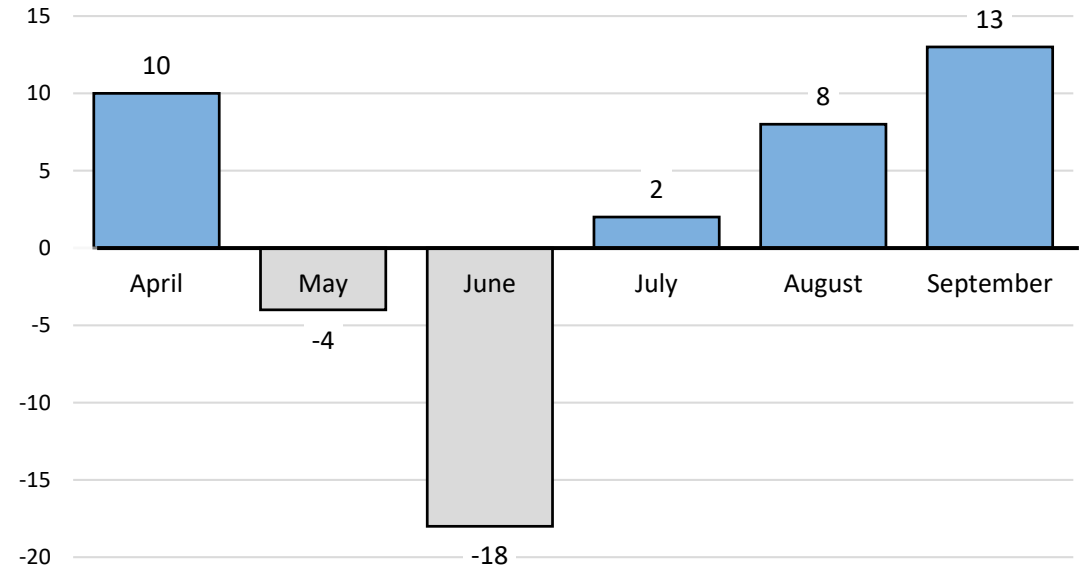
Widen data bars



Is the negative red too harsh?



- Remove background
- Remove shading
 - Use color to make an impact
- Add data labels, widen data bars
- Move x axis title to the bottom of the graphic



First Year (FY) Cohort Graduation by Semester, FA07 - FA17

Cohort Year	Entering Class	Exclusions	Adj. Class Size	Dec 10 (and prior)	May 11	Aug 11	Dec 11	May 12	Aug 12	Dec 12	May 13	Aug 13	Dec 13	May 14	Aug 14	Dec 14	May 15	Aug 15	Dec 15	May 16	Aug 16	Dec 16	Total Grads (FY)	Grad Rate (FY)	
2006 (and prior)	-	-	-	-	7	6	3	3	1	2			1		1		1		1		1		-	-	
2007	371	0	371	19	207	16	8	8	2					2										262	71%
2008	349	0	349	1	9	3	25	166	23	19	7	1	1			1					1			257	74%
2009	375	0	375					6	1	23	212	15	12	6	3	3								282	75%
2010	383	0	383							1	5	2	18	207	19	13	3	3	2		1	1		275	72%
2011	344	0	344											6	2	25	181	15	13	8	2	1		254	74%
2012	357	1	356														5	2	18	188	26	17		262	74%
2013	491	0	491																1	3	2	37		310	63%
2014	382	1	381																			1		10	3%
2015	359	0	359																					0	0%
2016	381	0	381																					0	0%
2017	362	0	362																					0	0%
Grads by semester				-	223	25	36	183	27	45	224	18	32	221	25	42	190	20	35	200	32	57			

Readjust column width

First Year (FY) Cohort Graduation by Semester, FA07 - FA17																								
Cohort Year	Entering Class	Exclusions	Adj. Class Size	Dec 10 (and prior)	May 11	Aug 11	Dec 11	May 12	Aug 12	Dec 12	May 13	Aug 13	Dec 13	May 14	Aug 14	Dec 14	May 15	Aug 15	Dec 15	May 16	Aug 16	Dec 16	Total Grads (FY)	Grad Rate (FY)
2006 (and prior)	-	-	-	-	7	6	3	3	1	2			1		1		1		1		1		-	-
2007	371	0	371	19	207	16	8	8	2					2									262	71%
2008	349	0	349	1	9	3	25	166	23	19	7	1	1			1					1		257	74%
2009	375	0	375					6	1	23	212	15	12	6	3	3							282	75%
2010	383	0	383							1	5	2	18	207	19	13	3	3	2		1	1	275	72%
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2017	362	0	362																				0	0%
Grads by semester				-	223	25	36	183	27	45	224	18	32	221	25	42	190	20	35	200	32	57		

Remove borders and colors

First Year (FY) Cohort Graduation by Semester, FA07 - FA17

Cohort Year	Entering Class	Exclusions	Adj. Class Size	Dec 10 (and prior)	May 11	Aug 11	Dec 11	May 12	Aug 12	Dec 12	May 13	Aug 13	Dec 13	May 14	Aug 14	Dec 14	May 15	Aug 15	Dec 15	May 16	Aug 16	Dec 16	Total Grads (FY)	Grad Rate (FY)
2006 (and prior)	-	-	-	-	7	6	3	3	1	2			1		1		1		1		1		-	-
2007	371	0	371	19	207	16	8	8	2					2									262	71%
2008	349	0	349	1	9	3	25	166	23	19	7	1	1			1					1		257	74%
2009	375	0	375					6	1	23	212	15	12	6	3	3							282	75%
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2015	359	0	359																				0	0%
2016	381	0	381																				0	0%
2017	362	0	362																				0	0%
Grads by semester				-	223	25	36	183	27	45	224	18	32	221	25	42	190	20	35	200	32	57		

Add thick top and bottom line, add thin lines every 3 rows

First Year (FY) Cohort Graduation by Semester, FA07 - FA17

Cohort Year	Entering Class	Exclusions	Adj. Class Size	Dec 10 (and prior)	May 11	Aug 11	Dec 11	May 12	Aug 12	Dec 12	May 13	Aug 13	Dec 13	May 14	Aug 14	Dec 14	May 15	Aug 15	Dec 15	May 16	Aug 16	Dec 16	Total Grads (FY)	Grad Rate (FY)
2006 (and prior)	-	-	-	-	7	6	3	3	1	2			1		1		1		1		1		-	-
2007	371	0	371	19	207	16	8	8	2					2									262	71%
2008	349	0	349	1	9	3	25	166	23	19	7	1	1			1					1		257	74%
2009	375	0	375					6	1	23	212	15	12	6	3	3							282	75%
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2015	359	0	359																				0	0%
2016	381	0	381																				0	0%
2017	362	0	362																				0	0%
Grads by semester				-	223	25	36	183	27	45	224	18	32	221	25	42	190	20	35	200	32	57		

Add vertical lines to break up information

Cohort Year	Entering Class	Exclusions	Adj. Class Size	First Year (FY) Cohort Graduation by Semester, FA07 - FA17																			Total Grads (FY)	Grad Rate (FY)	
				Dec 10 (and prior)	May 11	Aug 11	Dec 11	May 12	Aug 12	Dec 12	May 13	Aug 13	Dec 13	May 14	Aug 14	Dec 14	May 15	Aug 15	Dec 15	May 16	Aug 16	Dec 16			
2006 (and prior)	-	-	-	-	7	6	3	3	1	2				1		1		1			1		-	-	
2007	371	0	371	19	207	16	8	8	2					2									262	71%	
2008	349	0	349	1	9	3	25	166	23	19	7	1	1			1					1		257	74%	
2009	375	0	375					6	1	23	212	15	12	6	3	3							282	75%	
2010	383	0	383							1	5	2	18	207	19	13	3	3	2			1	1	275	72%
2011	344	0	344											6	2	25	181	15	13	8	2	1	254	74%	
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2015	359	0	359																				0	0%	
2016	381	0	381																				0	0%	
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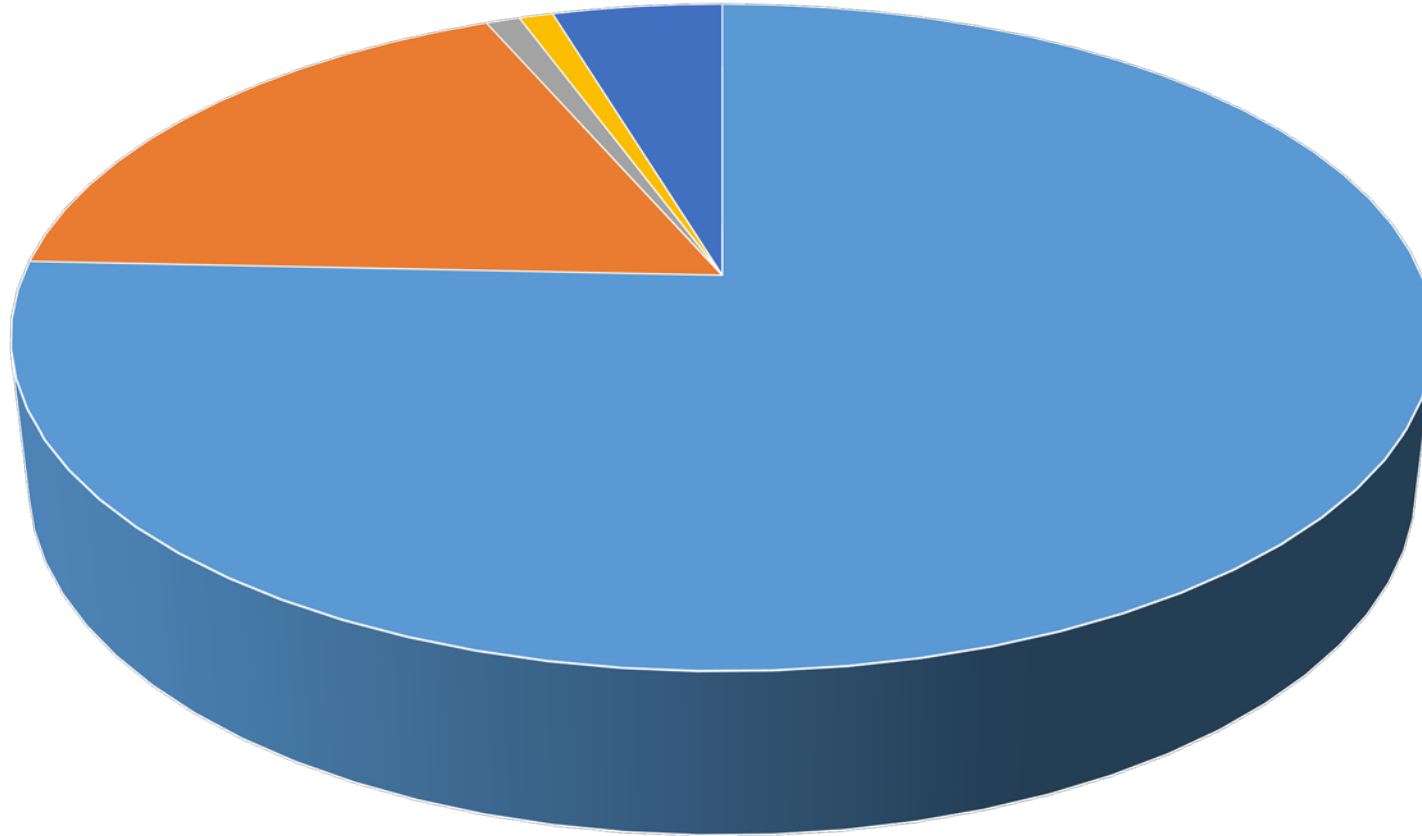
Add color

Cohort Year	Entering Class	Exclusions	Adj. Class Size	First Year (FY) Cohort Graduation by Semester, FA07 - FA17																			Total Grads (FY)	Grad Rate (FY)
				Dec 10 (and prior)	May 11	Aug 11	Dec 11	May 12	Aug 12	Dec 12	May 13	Aug 13	Dec 13	May 14	Aug 14	Dec 14	May 15	Aug 15	Dec 15	May 16	Aug 16	Dec 16		
2006 (and prior)	-	-	-	-	7	6	3	3	1	2			1		1		1		1		1	-	-	
2007	371	0	371	19	207	16	8	8	2				2									262	71%	
2008	349	0	349	1	9	3	25	166	23	19	7	1	1			1					1	257	74%	
2009	375	0	375					6	1	23	212	15	12	6	3	3						282	75%	
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2007	371	0	371	19	207	16	8	8	2					2									262	71%
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2009	375	0	375					6	1	23	212	15	12	6	3	3							282	75%
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2006 (and prior)	-	-	-	-	7	6	3	3	1	2			1		1		1		1		1		-	-
2007	371	0	371	19	207	16	8	8	2					2									262	71%
2008	349	0	349	1	9	3	25	166	23	19	7	1	1			1					1		257	74%
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Degrees Awarded by Degree Type 2017-18

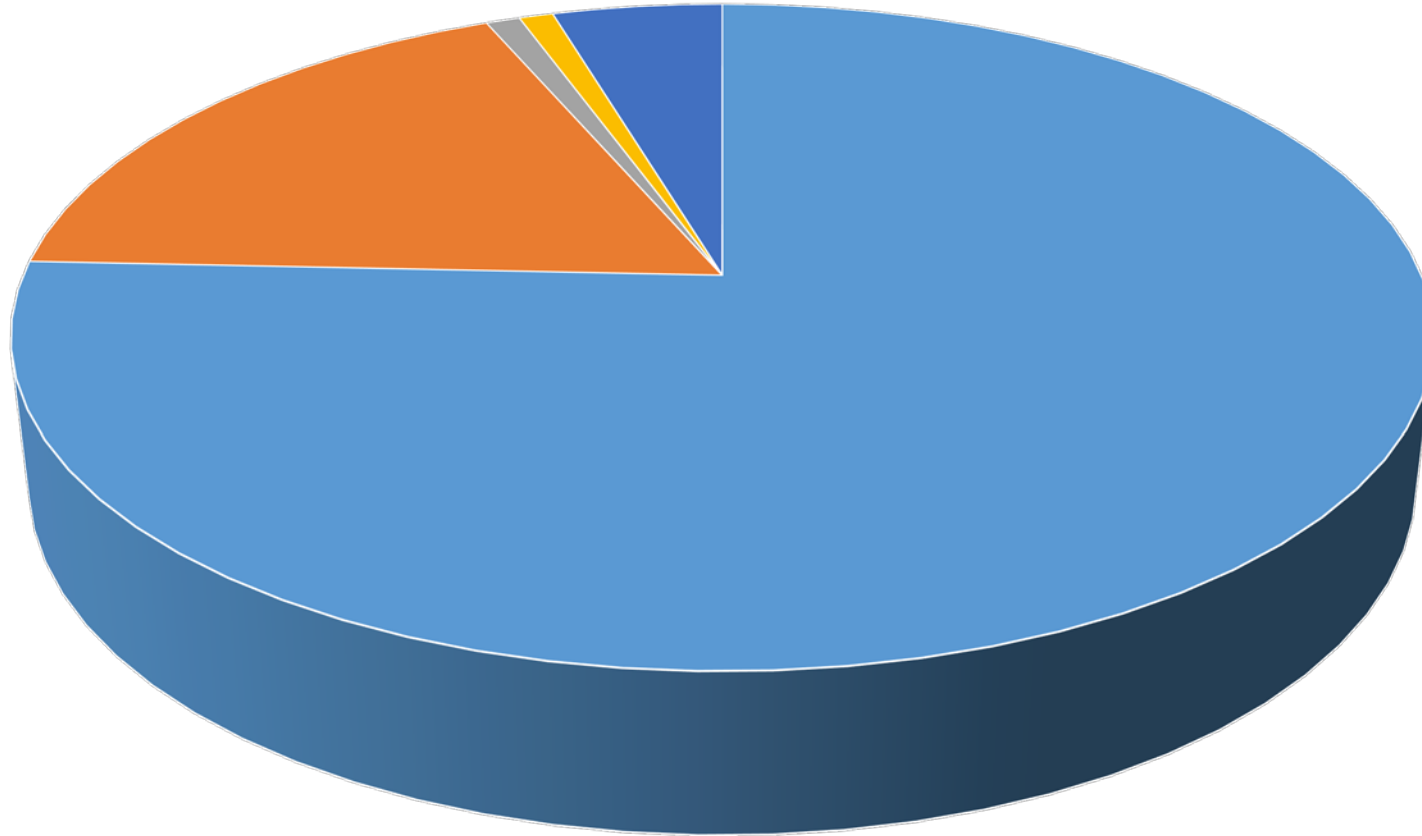


- Bachelor of Arts (BA)
- Bachelor of Science (BS)
- Bachelor of Fine Arts (BFA)
- Bachelor of Music (BM)
- Bachelor of Science in Education (BSE)

Question:

Roughly what percent of
graduates received a BA?

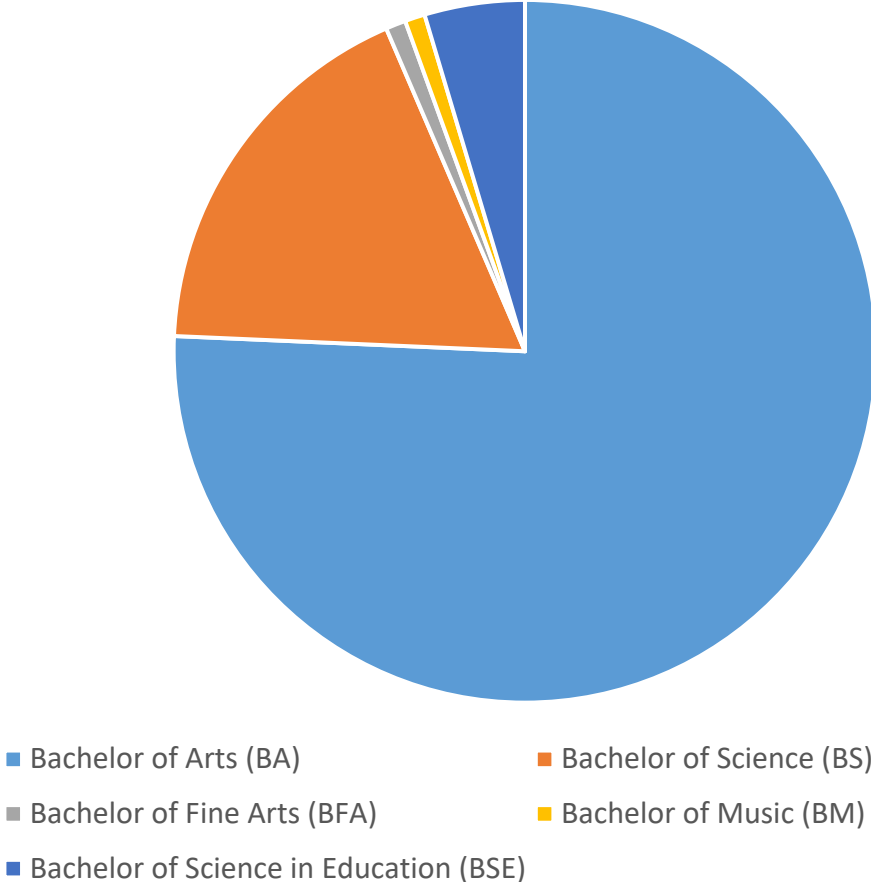
Degrees Awarded by Degree Type 2017-18



- Bachelor of Arts (BA)
- Bachelor of Science (BS)
- Bachelor of Fine Arts (BFA)
- Bachelor of Music (BM)
- Bachelor of Science in Education (BSE)

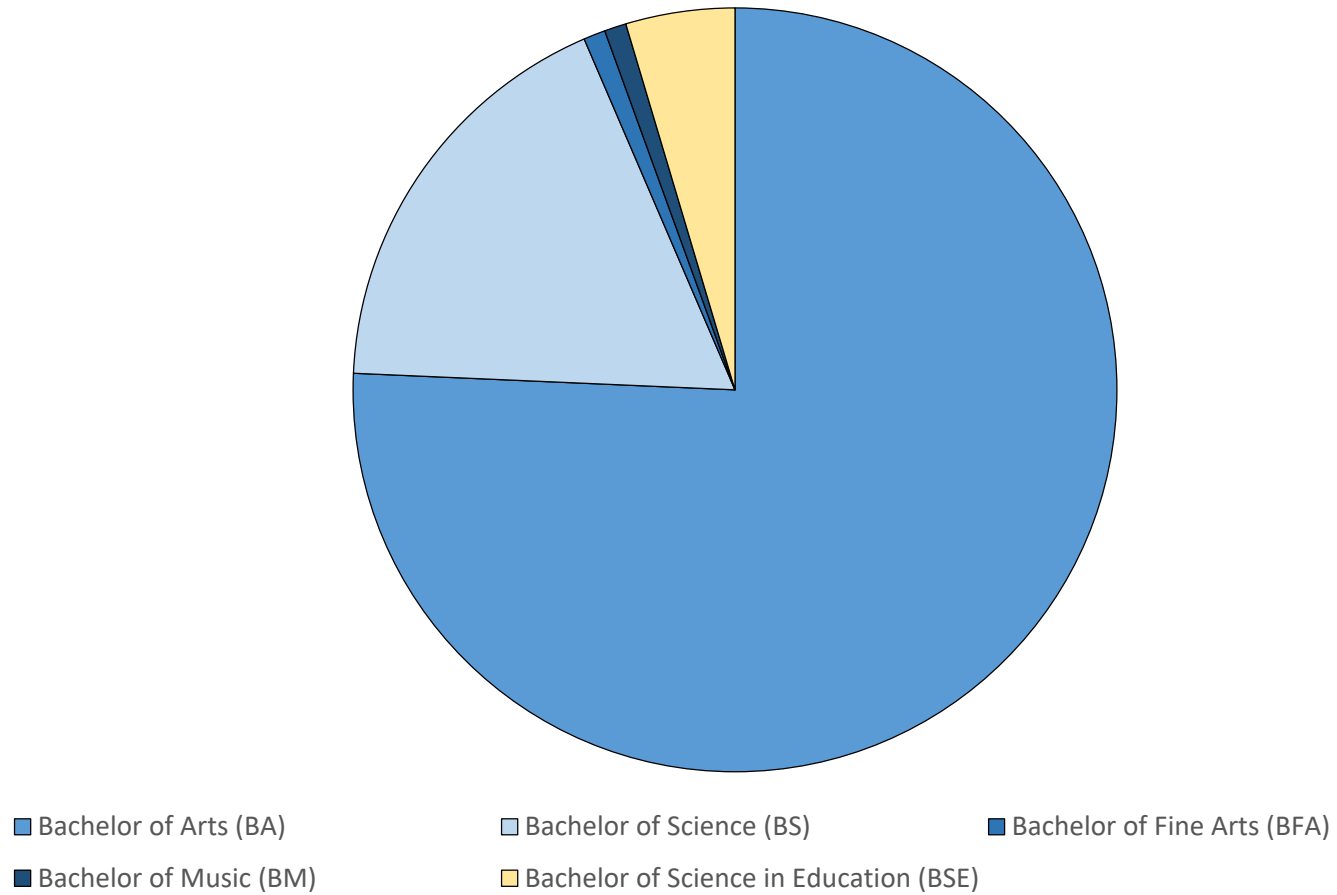
Remove 3D effects

Degrees Awarded by Degree Type 2017-18

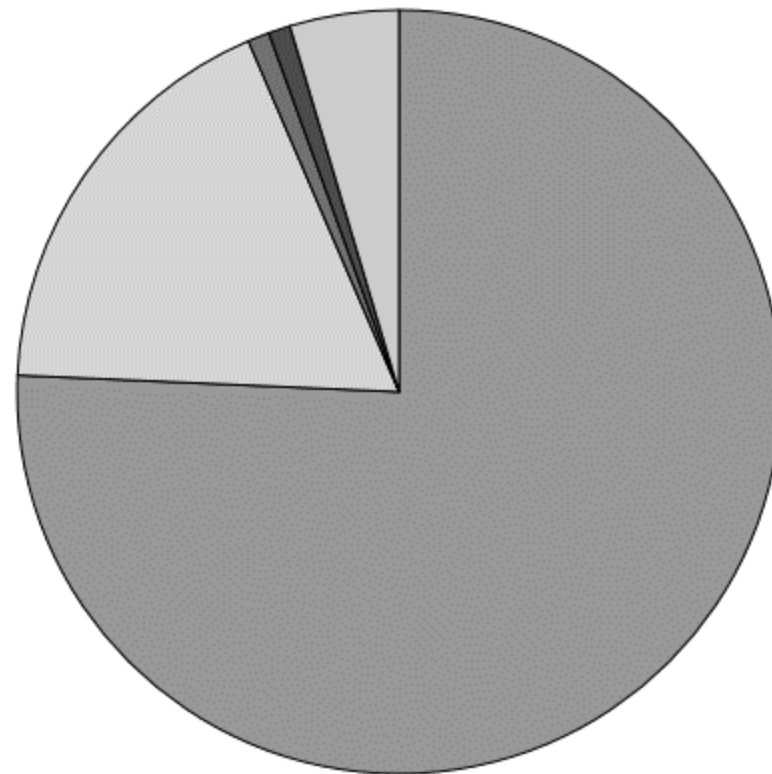
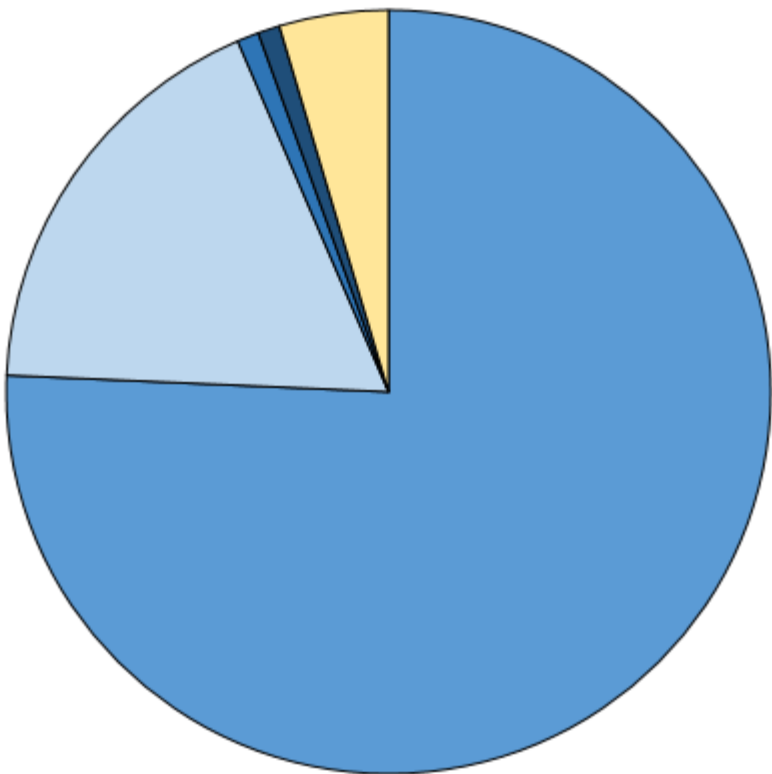


Add borders, change colors

Degrees Awarded by Degree Type 2017-18

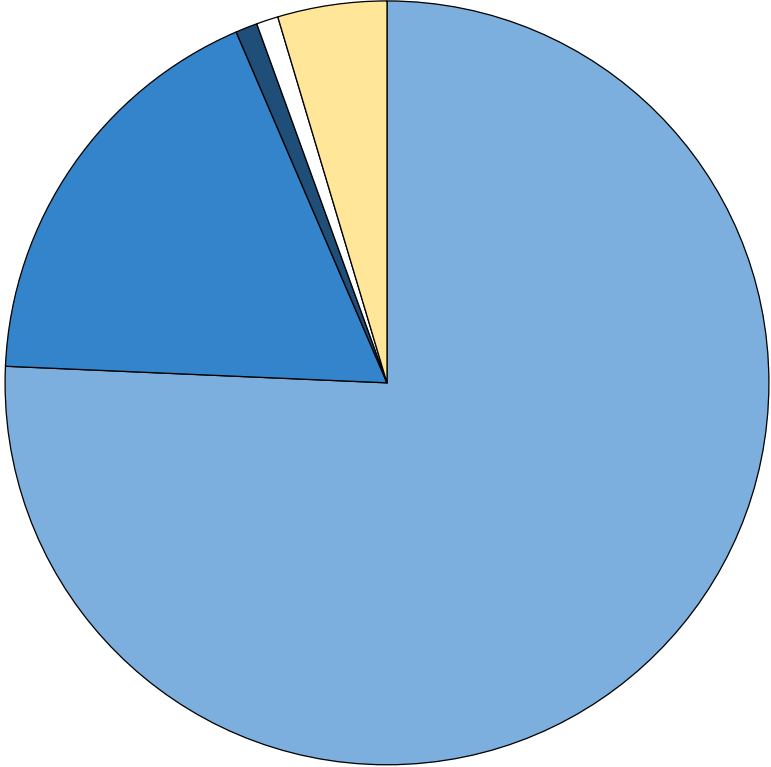


Check contrast



Edit colors again...

Degrees Awarded by Degree Type 2017-18



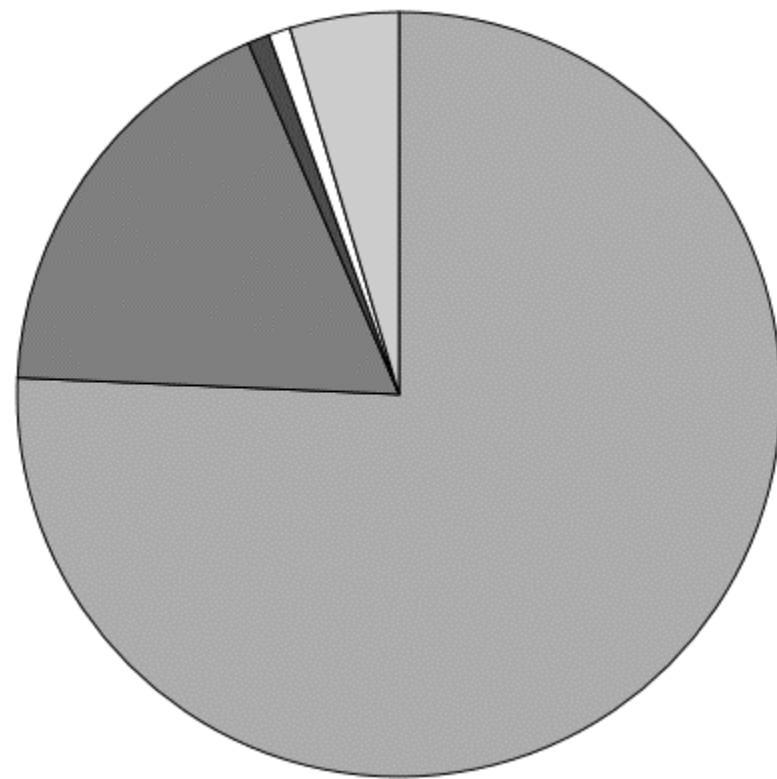
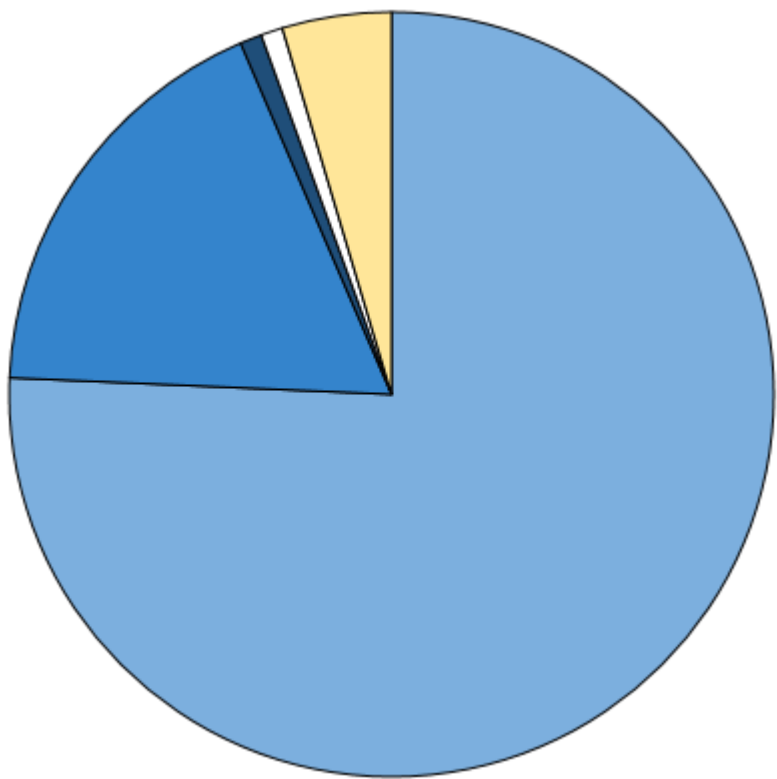
■ Bachelor of Arts (BA)

■ Bachelor of Science (BS)

■ Bachelor of Fine Arts (BFA)

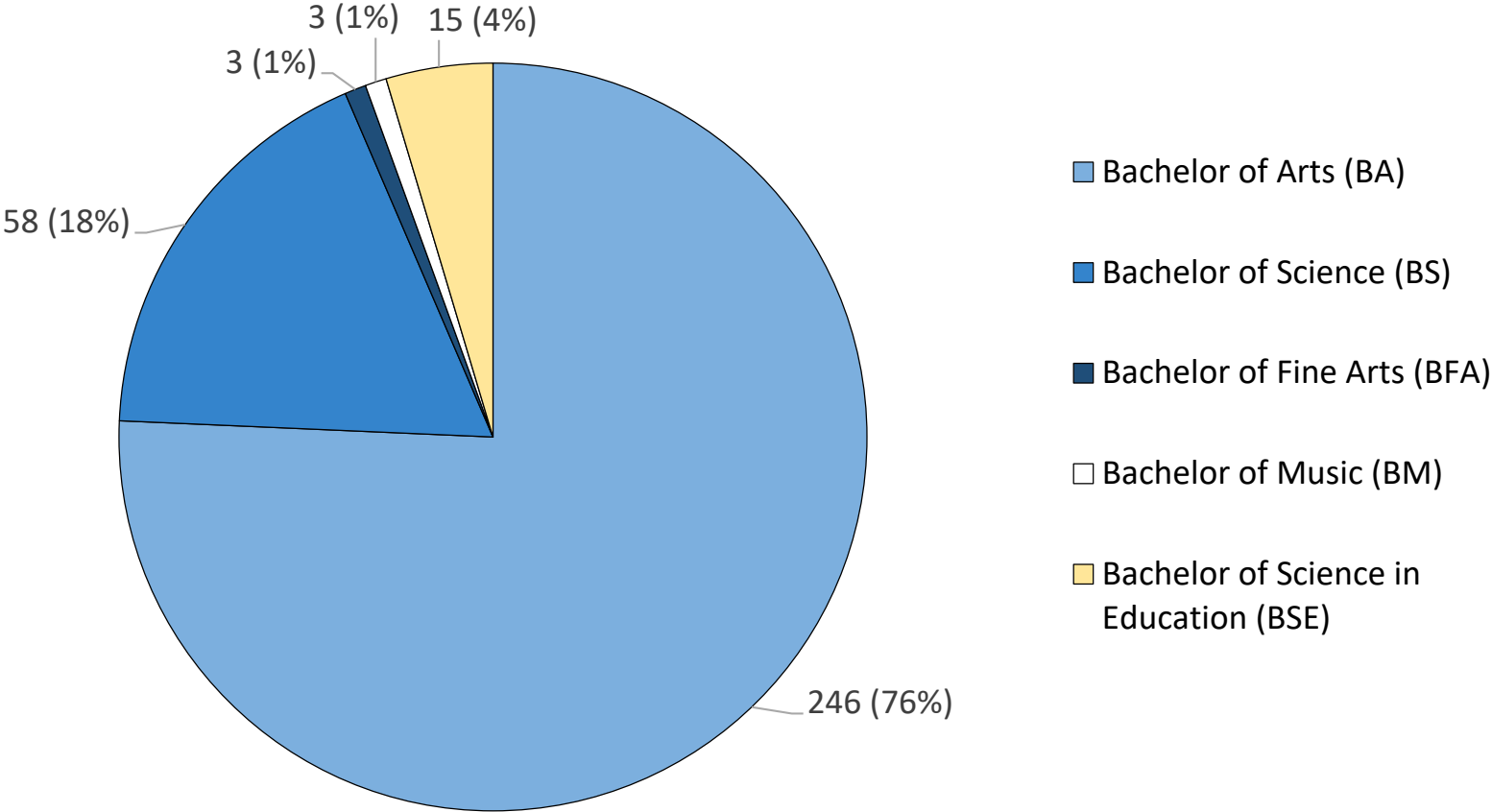
□ Bachelor of Music (BM)

■ Bachelor of Science in Education (BSE)



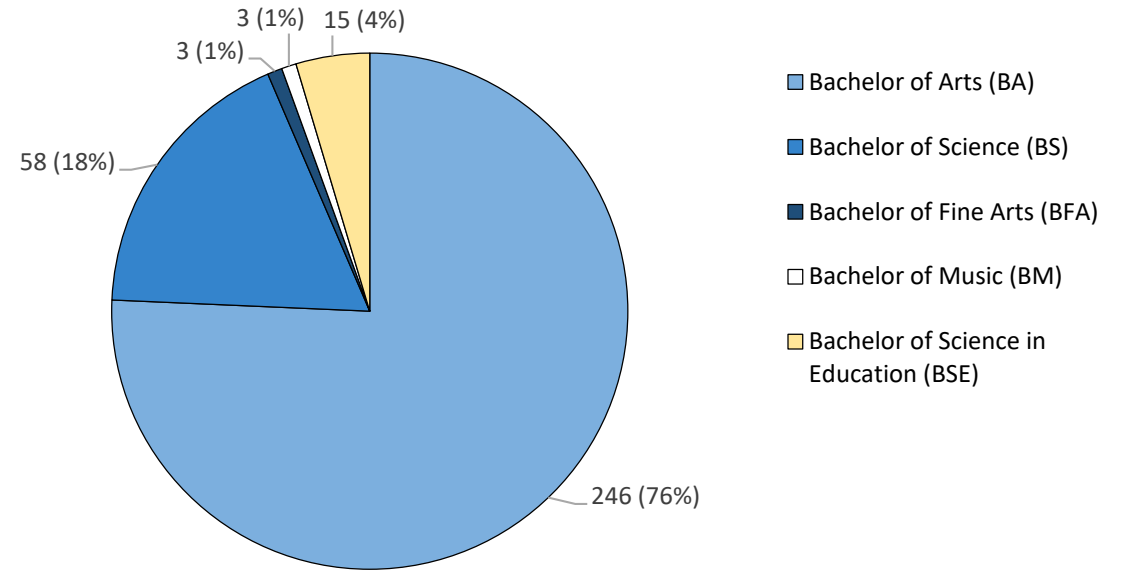
Add data labels

Degrees Awarded by Degree Type 2017-18

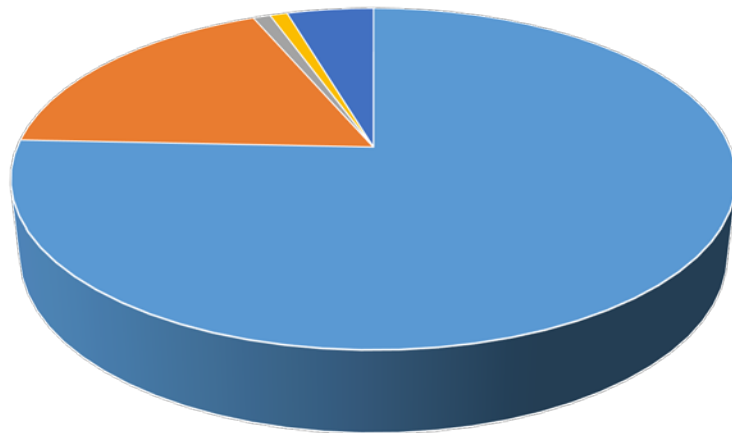


- Remove 3D effects
- The biggest “slice” should always go first
- Put colors in a gradient / similar complimentary colors
 - Use bright color to emphasize piece of data
 - Check contrast
- Add data labels with percentages

Degrees Awarded by Degree Type 2017-18



Degrees Awarded by Degree Type 2017-18



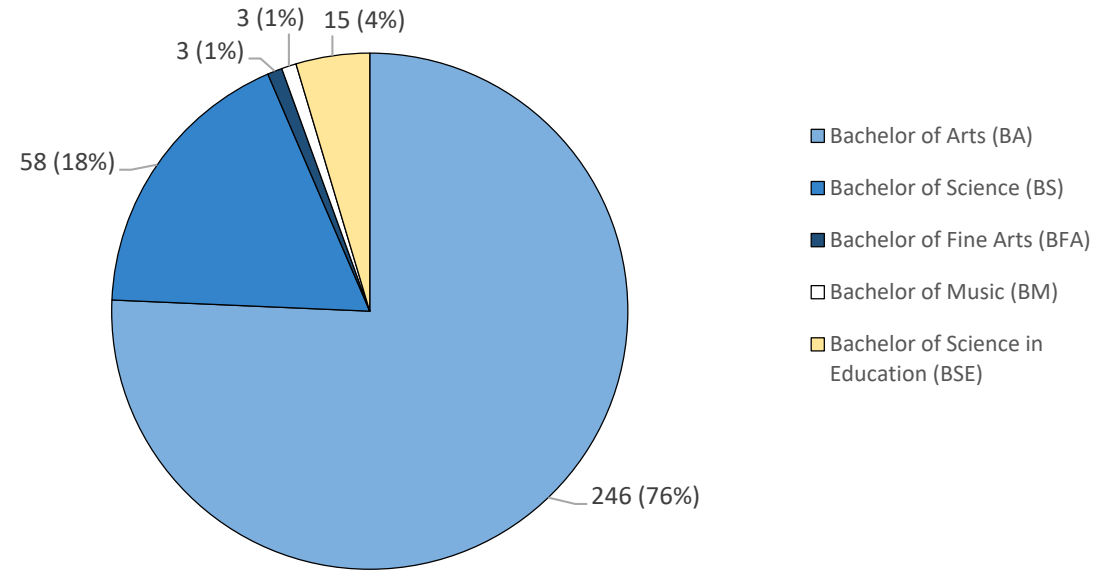
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Question:

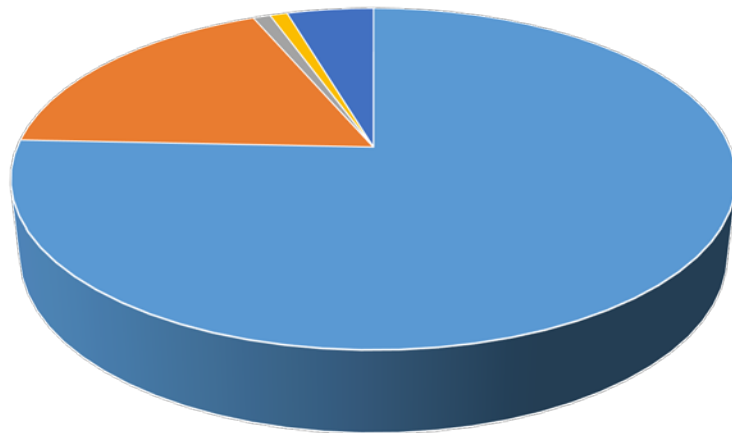
Roughly what percent of graduates received a BA?

- Remove 3D effects
- The biggest “slice” should always go first
- Put colors in a gradient / similar complimentary colors
 - Use bright color to emphasize piece of data
 - Check contrast
- Add data labels with percentages

Degrees Awarded by Degree Type 2017-18



Degrees Awarded by Degree Type 2017-18



- Bachelor of Arts (BA)
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- Bachelor of Fine Arts (BFA)
- Bachelor of Music (BM)
- Bachelor of Science in Education (BSE)

Rules for Graphics

- Keep it simple – every bit of ink must serve a purpose
- Don't use 3D
- Use colors effectively
- Thin out and lighten gridlines
- Add data labels and axis titles when needed
- Fancy formatting and tricks are unnecessary – let the data speak for itself

References and additional reading:

Wong, Dona. (2010). The Wall Street Journal Guide to Information Graphics (1st ed.). New York, NY: W. W. Norton & Company, Inc.

Tufte, Edward. (2001). The Visual Display of Quantitative Information (2nd ed.). Cheshire, CT: Graphic Press.

Tufte, Edward. (1997). Visual Explanations: Images and Quantities, Evidence and Narrative (8th ed.). Cheshire, CT: Graphic Press.

Nicole, A; Pexman, P. (2010). Displaying Your Findings: A Practical Guide for Creating Figures, Posters, and Presentations (6th ed.). Washington, DC: American Psychological Association.

Kosslyn, Stephen. (1994). Elements of Graph Design (1st ed.). New York, NY: W. H. Freeman and Company.

Questions?

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Grace.Mineta@gmail.com