In [23]:
```
# -*- coding: utf-8 -*-
%matplotlib inline

import pandas as pd
import numpy as np
import math
import matplotlib as mplstyle
import matplotlib.pyplot as plt
import locale
from locale import atof
from dateutil import parser
from datetime import datetime

plt.style.use('fivethirtyeight')
```

In [24]:
```
# Imported data folder
df_incomeLimits = pd.read_csv('school_choice_data/imported_data/income_limits.
csv')
df_studentByGrade = pd.read_csv('school_choice_data/imported_data/student_by_g
rade.csv')
df_studentParticipation = pd.read_csv('school_choice_data/imported_data/studen
t_participation_num.csv')
df_schoolParticipation = pd.read_csv('school_choice_data/imported_data/school_
participation.csv')
df_enrollment = pd.read_csv('school_choice_data/imported_data/enrollment.csv')
df_previouslyPublicSchool = pd.read_csv('school_choice_data/imported_data/prev
ious_public_school.csv')
df_studentPathway = pd.read_csv('school_choice_data/imported_data/student_by_p
athway.csv')
df_studentEthnicity = pd.read_csv('school_choice_data/imported_data/student_by
_ethnicity.csv')
df_studentGender = pd.read_csv('school_choice_data/imported_data/student_by_ge
nder.csv')
df_studentGeography = pd.read_csv('school_choice_data/imported_data/student_by
_geography.csv')
df_schoolAwardCount = pd.read_csv('school_choice_data/imported_data/awards_by_
school_16_clean.csv')
df_schoolAwardAmount = pd.read_csv('school_choice_data/imported_data/amount_by
_school_16_clean.csv')
df_vouchersByOgSchoolDistrict = pd.read_csv('school_choice_data/imported_data/
voucher-students-by-original-school-district.csv')

# Gov data folder
df_schoolEnrollment = pd.read_csv('school_choice_data/gov_data/EnrollmentGrade
Schls.csv')
df_schoolSpecEdEnrollment = pd.read_csv('school_choice_data/gov_data/Enrollmen
tEnglishLearnerSpecEdSchls.csv')
df_publicSpecEd = pd.read_csv('school_choice_data/gov_data/PublicEnrollmentEng
lishLearnerSpecEd.csv')
```

In [25]:
```python
# Functions

# normalize numbers
def normalizeNums(num):
    if (math.isnan(num)):
        return None
    else:
        num = int(math.floor(num))
        return num

# multiply by 100 to convert from percent
def convertPercent(num):
    return num * 100

# normalize percent from x%
def normalizePerc(num):
    return float(num.strip('%'))


# get average award
def averageAward(awardCount, awardAmount):
    if math.isnan(awardAmount) or math.isnan(awardCount):
        return None
    return round((awardAmount/awardCount),2)

# Convert NaN to zeros
# the zeros do not always indicate that no students
# were in the program. schools with less than ten
# students do not have to report
def convertInt(num):
    if math.isnan(num):
        return 0
    else:
        return int(num)

# calculate percent
def calcPerc(num, denom):
    if num != 0:
        percent = (float(num/denom))*100
        return round(percent,2)
    else:
        return None

# calculate percent change
def percentChange(oldVal, newVal):
    val1 = float(oldVal)
    val2 = float(newVal)
    change = (val2-val1)/val1
    return float(change)

# fill in missing values
def fillInfo(choiceCell, backupCell):
    if pd.isnull(choiceCell):
        return backupCell
    else:
        return choiceCell
```

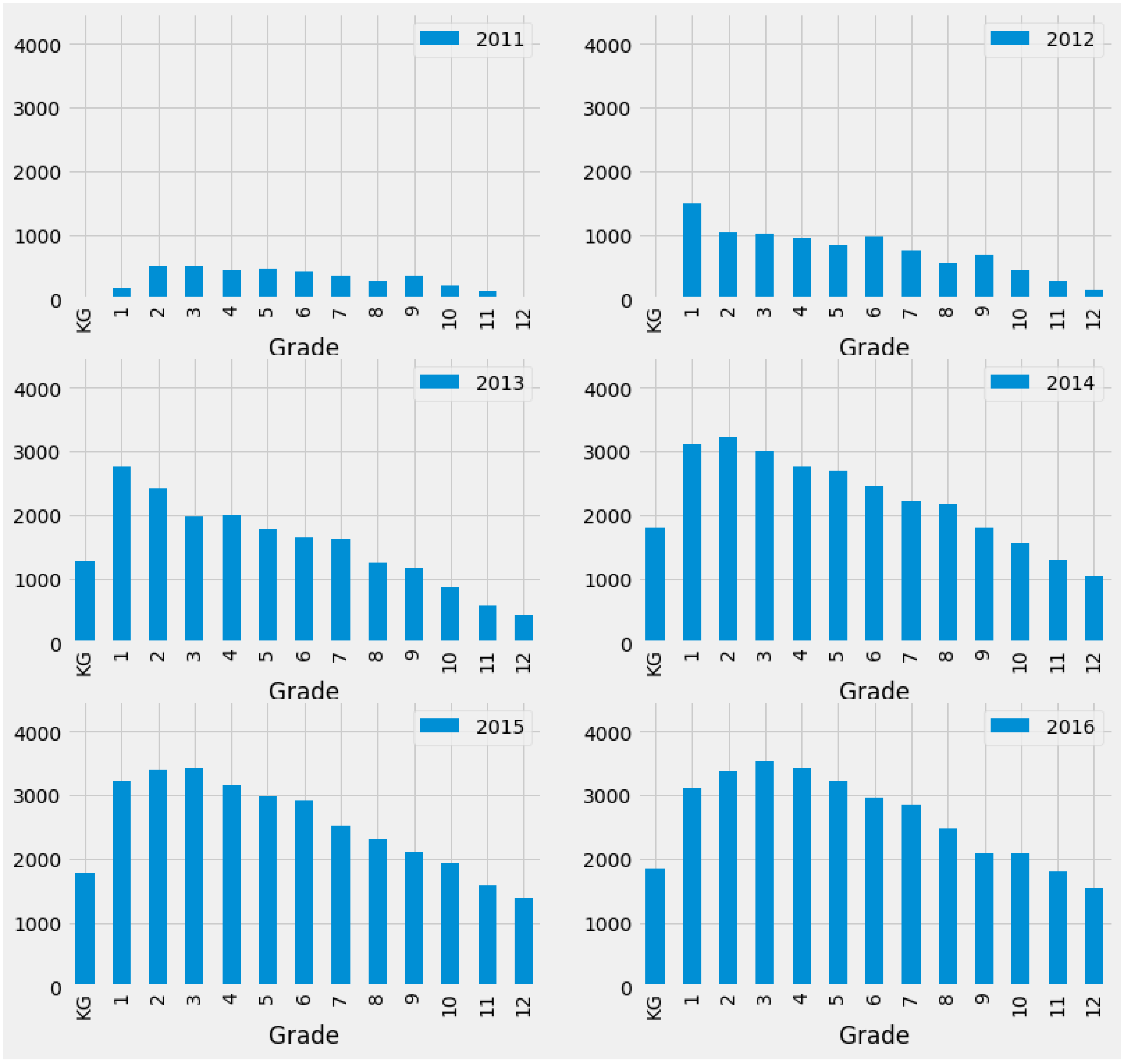
```
# replace with None
def fillNone(num):
    if num == 1:
        return None
    else:
        return num

def convertToStr(item):
    if item == 'nan':
        return None
    else:
        strID = item.split('.', 1)[0]
        return strID
```

In [26]:

```
# Drop total row in dataframe
df_studenByGradeNoTotal = df_studentByGrade.drop(13)
```

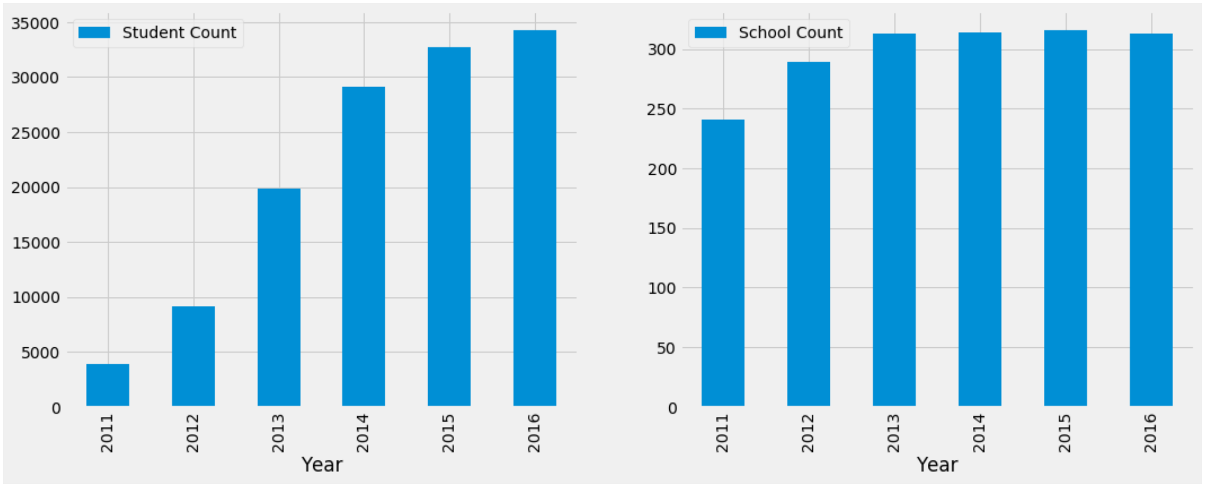
In [27]:
```
# Students by grade, by year
studentsByGrade = fig, ((ax1,ax2),(ax3,ax4),(ax5,ax6)) = plt.subplots(nrows=3,
ncols=2, figsize=(12,12), sharex=False, sharey=False)

df_studenByGradeNoTotal.plot(kind='bar',x='Grade',y='2011',ax=ax1).set_ylim([0
,4500])
df_studenByGradeNoTotal.plot(kind='bar',x='Grade',y='2012',ax=ax2).set_ylim([0
,4500])
df_studenByGradeNoTotal.plot(kind='bar',x='Grade',y='2013',ax=ax3).set_ylim([0
,4500])
df_studenByGradeNoTotal.plot(kind='bar',x='Grade',y='2014',ax=ax4).set_ylim([0
,4500])
df_studenByGradeNoTotal.plot(kind='bar',x='Grade',y='2015',ax=ax5).set_ylim([0
,4500])
df_studenByGradeNoTotal.plot(kind='bar',x='Grade',y='2016',ax=ax6).set_ylim([0
,4500])
```

Out[27]:
```
(0, 4500)
```



In [28]:
```
# Student count and school count by year
fig, ((ax1,ax2)) = plt.subplots(nrows=1, ncols=2, figsize=(16,6), sharex=False
, sharey=False)

df_studentParticipation.plot(kind='bar',x='Year',y='Student Count',ax=ax1)
df_schoolParticipation.plot(kind='bar',x='Year',y='School Count',ax=ax2)
```

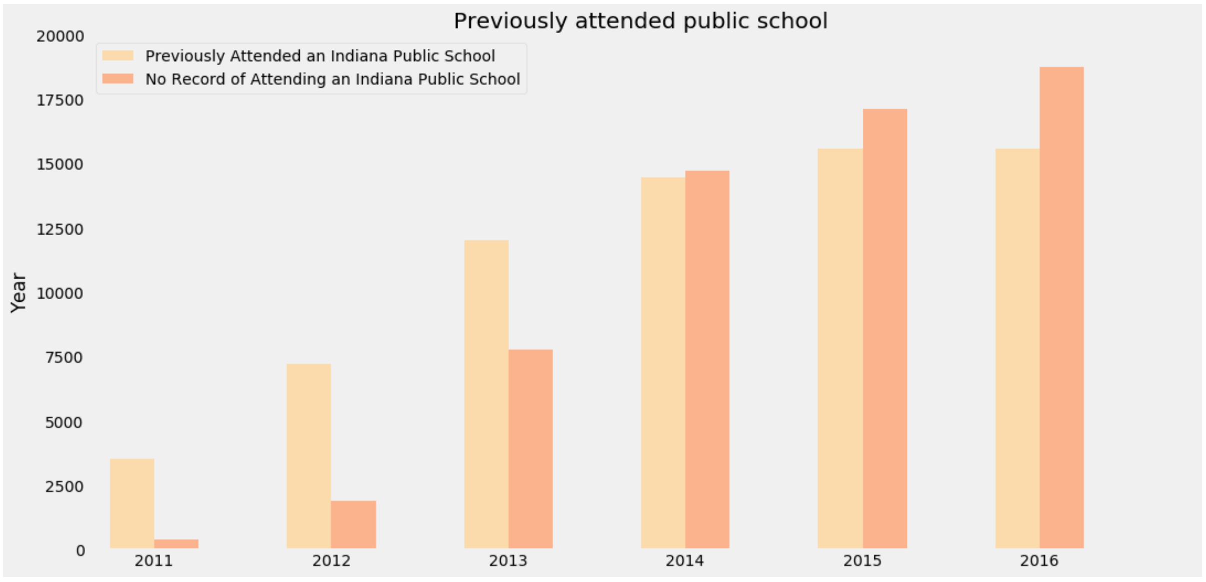
Out[28]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x10a8e3d90>
```



In [29]:
```
# Calculate the change in enrollment from public and private schools
public_school_change = (df_enrollment['Traditional Public Num'][5] - df_enroll
ment['Traditional Public Num'][0])*-1
choice_school_change = (df_enrollment['Choice Num'][5] - df_enrollment['Choice
Num'][0])
non_public_school_change = (df_enrollment['Non-Public (Excluding Choice Studen
ts)* Num'][5] - df_enrollment['Non-Public (Excluding Choice Students)* Num'][0
])*-1

starting_count = df_studentParticipation['Student Count'][0]
current_count = df_studentParticipation['Student Count'][5]
count_change = current_count - starting_count


print("Since the start of the program, public schools lost %s kids.") %  publi
c_school_change
print("Since the start of the program, non-public schools lost %s kids.") %  n
on_public_school_change
print("Since the start of the program, choice schools gained %s kids.") %  cho
ice_school_change
print("The school choice program started with %s kids and grew to %s kids in t
he 2016-17 school year.") % (starting_count, current_count)
```

```
Since the start of the program, public schools lost 8630 kids.
Since the start of the program, non-public schools lost 18718 kids.
Since the start of the program, choice schools gained 30388 kids.
The school choice program started with 3911 kids and grew to 34299 kids in th
e 2016-17 school year.
```

In [30]:
```
# Graph the number who have or have not previously attended public school
# Setting the positions and width for the bars
pos = list(range(len(df_previouslyPublicSchool['Previously Attended an Indiana
Public School'])))
width = 0.25

# Plotting the bars
fig, ax = plt.subplots(figsize=(16,8))

# Create a bar with previous data
plt.bar(pos,
        df_previouslyPublicSchool['Previously Attended an Indiana Public Schoo
l'],
        width,
        alpha=0.8,
        color='#ffd59b',
        label=df_previouslyPublicSchool['Year'][0])

# Create a bar with no record data
plt.bar([p + width for p in pos],
        df_previouslyPublicSchool['No Record of Attending an Indiana Public Sc
hool'],
        width,
        alpha=0.8,
        color='#ffa474',
        label=df_previouslyPublicSchool['Year'][1])

# Set the y axis label
ax.set_ylabel('Year')

# Set the chart's title
ax.set_title('Previously attended public school')

# Set the position of the x ticks
ax.set_xticks([p + .5 * width for p in pos])

# Set the labels for the x ticks
ax.set_xticklabels(df_previouslyPublicSchool['Year'])

# Setting the x-axis and y-axis limits
plt.xlim(min(pos)-width, max(pos)+width*4)
plt.ylim([0, 20000])

# Adding the legend and showing the plot
plt.legend(['Previously Attended an Indiana Public School', 'No Record of Atte
nding an Indiana Public School'], loc='upper left')
plt.grid()
plt.show()
```

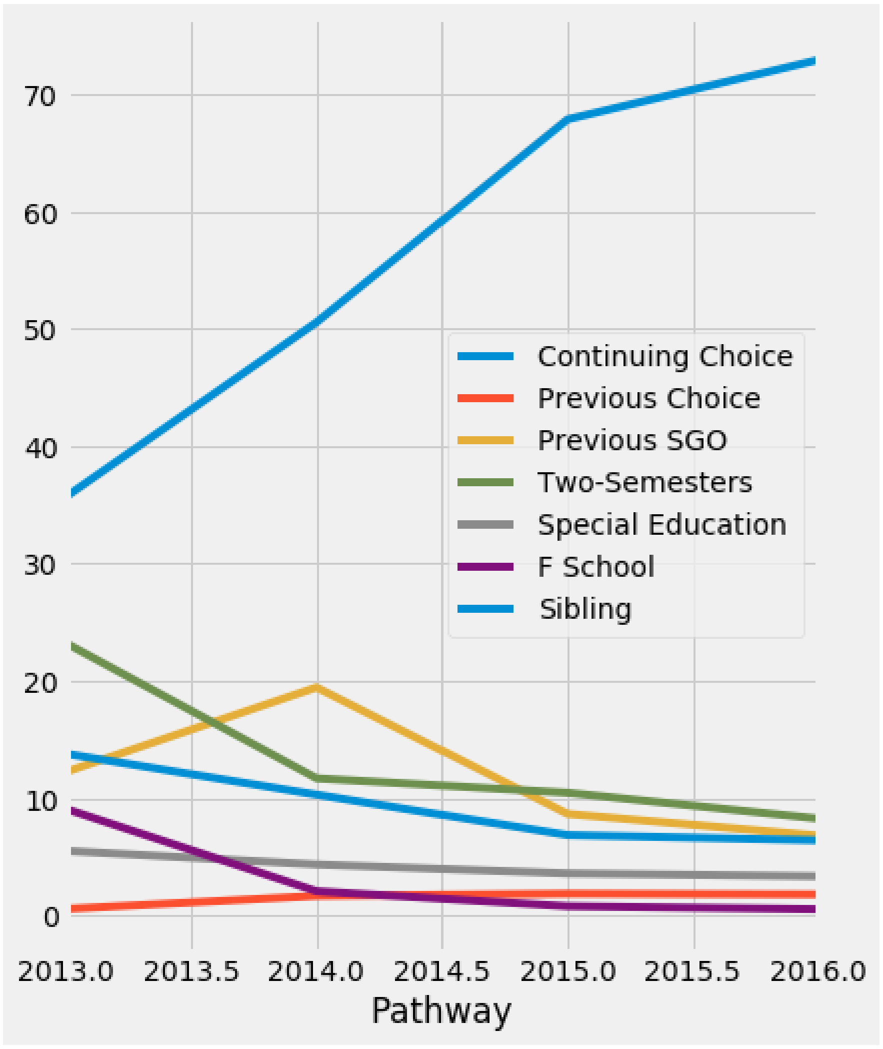


In [31]:
```
# Drop totals in student pathway dataframe
df_studentPathwayWoTotal = df_studentPathway.drop([4,8,9])
```

In [32]:

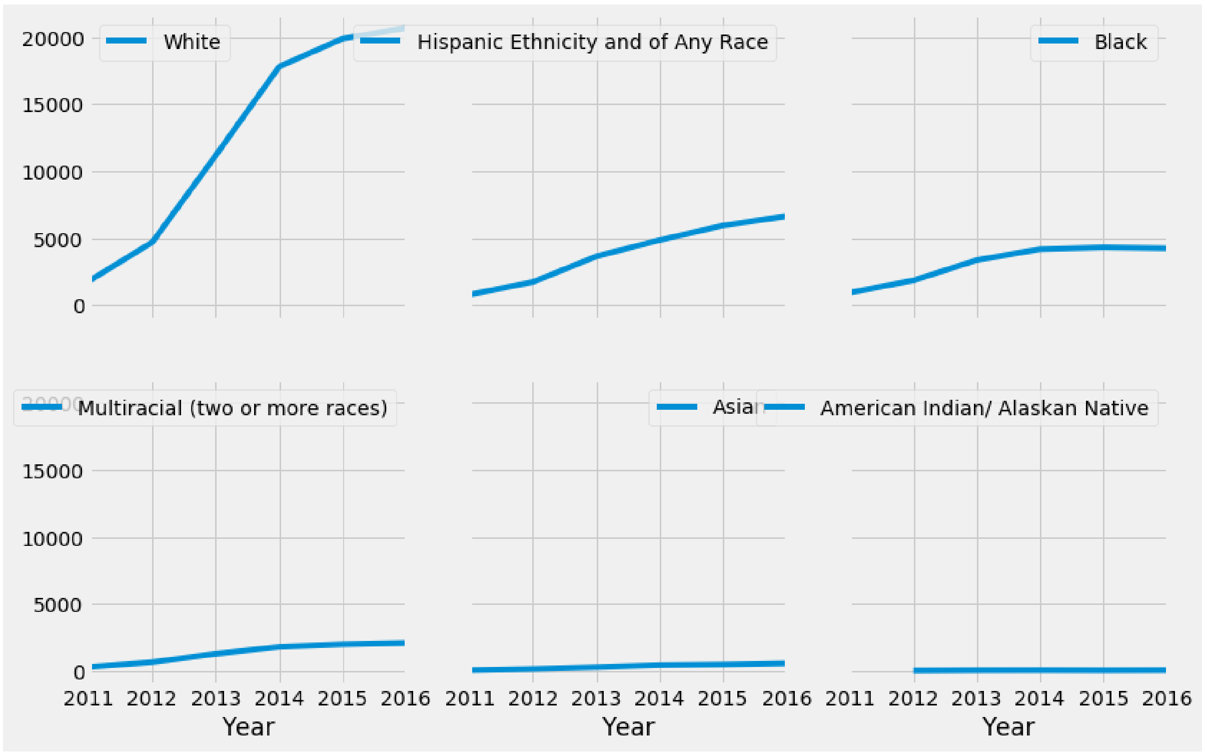
```
# Drop raw pathway numbers
df_studentPathwayPerc = df_studentPathwayWoTotal.drop(['2013','2014','2015','2
016'], axis=1)

# Convert percentage
df_studentPathwayPerc['2013 %'] = df_studentPathwayPerc['2013 %'].apply(conver
tPercent)
df_studentPathwayPerc['2014 %'] = df_studentPathwayPerc['2014 %'].apply(conver
tPercent)
df_studentPathwayPerc['2015 %'] = df_studentPathwayPerc['2015 %'].apply(conver
tPercent)
df_studentPathwayPerc['2016 %'] = df_studentPathwayPerc['2016 %'].apply(conver
tPercent)

# Transpose pathway dataframe, export and reupload
df_studentPathwayPercExport = df_studentPathwayPerc.transpose()
df_studentPathwayPercExport.to_csv('school_choice_data/exported_data/df_studen
tPathwayPerc.csv')
df_studentPathwayPercTransposed = pd.read_csv('school_choice_data/imported_dat
a/df_studentPathwayPerc-transposed.csv')

# Graph student pathway
fig, ((ax1)) = plt.subplots(nrows=1, ncols=1, figsize=(6,8), sharex=False, sha
rey=False)

df_studentPathwayPercTransposed.plot(kind='line',x='Pathway',y='Continuing Cho
ice',ax=ax1)
df_studentPathwayPercTransposed.plot(kind='line',x='Pathway',y='Previous Choic
e',ax=ax1)
df_studentPathwayPercTransposed.plot(kind='line',x='Pathway',y='Previous SGO',
ax=ax1)
df_studentPathwayPercTransposed.plot(kind='line',x='Pathway',y='Two-Semesters'
,ax=ax1)
df_studentPathwayPercTransposed.plot(kind='line',x='Pathway',y='Special Educat
ion',ax=ax1)
df_studentPathwayPercTransposed.plot(kind='line',x='Pathway',y='F School',ax=a
x1)
df_studentPathwayPercTransposed.plot(kind='line',x='Pathway',y='Sibling',ax=ax
1)
```

```
Out[32]: <matplotlib.axes._subplots.AxesSubplot at 0x10aac6a50>
```


70
60
50
40
30
20
10
0
2013.0
2013.5
2014.0
2014.5
2015.0
2015.5
2016.0
Pathway
Continuing Choice
Previous Choice
Previous SGO
Two-Semesters
Special Education
F School
Sibling

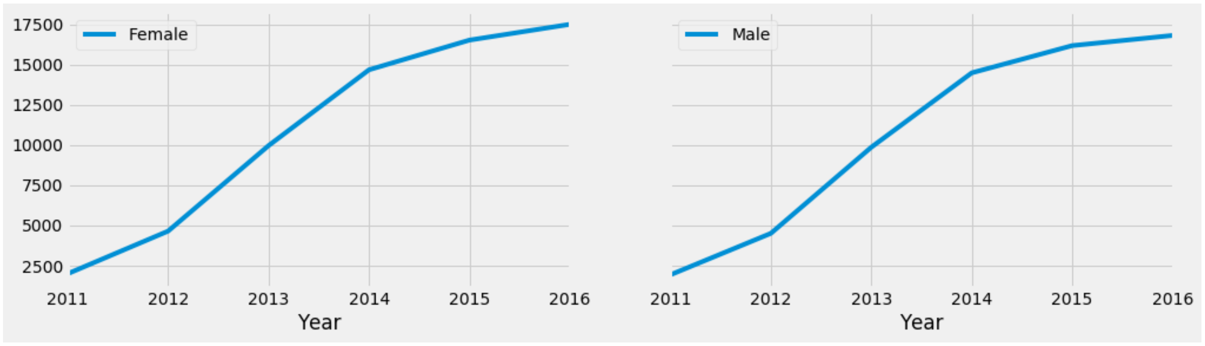
In [33]:
```
# Graph student ethnicity numbers by year
fig, ((ax1,ax2,ax3),(ax4,ax5,ax6)) = plt.subplots(nrows=2, ncols=3, figsize=(1
2,8), sharex=True, sharey=True)

df_studentEthnicity.plot(kind='line',x='Year',y='White',ax=ax1)
df_studentEthnicity.plot(kind='line',x='Year',y='Hispanic Ethnicity and of Any
Race',ax=ax2)
df_studentEthnicity.plot(kind='line',x='Year',y='Black',ax=ax3)
df_studentEthnicity.plot(kind='line',x='Year',y='Multiracial (two or more race
s)',ax=ax4)
df_studentEthnicity.plot(kind='line',x='Year',y='Asian',ax=ax5)
df_studentEthnicity.plot(kind='line',x='Year',y='American Indian/ Alaskan Nati
ve',ax=ax6)
# df_studentEthnicity.plot(kind='line',x='Year',y='Native Hawaiian or Other Pa
cific Islander',ax=ax1)
```

Out[33]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x108684f90>
```



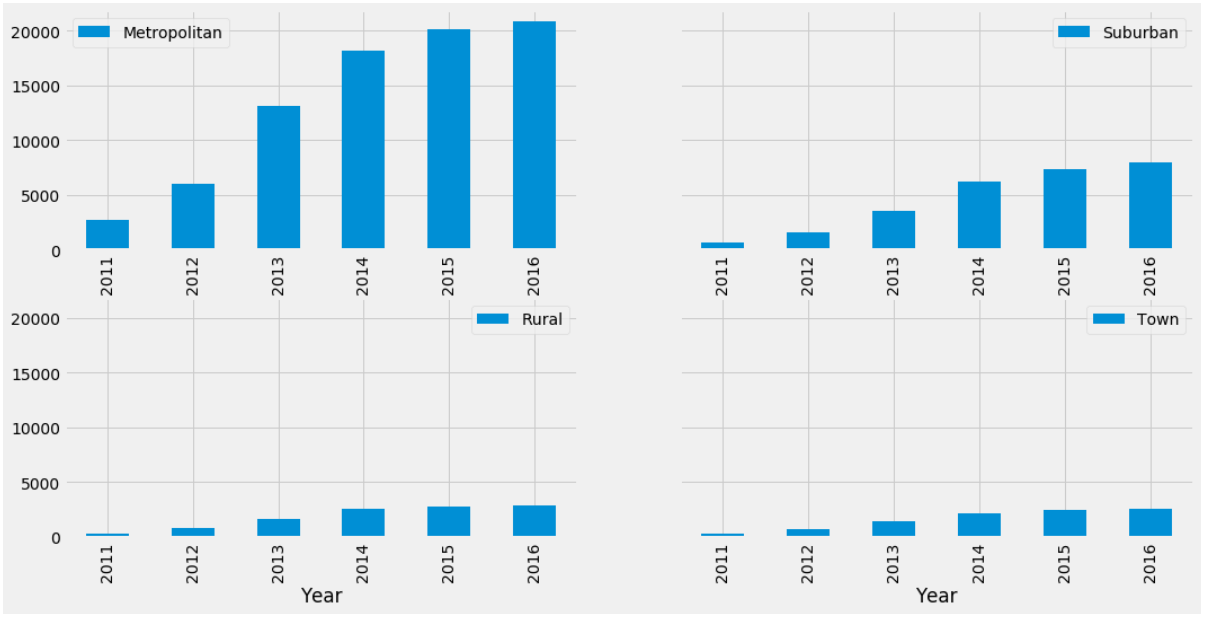
In [34]:
```
# Graph student gender numbers by year
fig, ((ax1,ax2)) = plt.subplots(nrows=1, ncols=2, figsize=(15,4), sharex=True,
sharey=True)

df_studentGender.plot(kind='line',x='Year',y='Female',ax=ax1)
df_studentGender.plot(kind='line',x='Year',y='Male',ax=ax2)
```

Out[34]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x108bd1810>
```



In [35]:
```
# Graph student geography numbers by year
fig, ((ax1,ax2),(ax3,ax4)) = plt.subplots(nrows=2, ncols=2, figsize=(16,8), sh
arex=False, sharey=True)

df_studentGeography.plot(kind="bar",x="Year",y="Metropolitan", ax=ax1)
df_studentGeography.plot(kind="bar",x="Year",y="Suburban", ax=ax2)
df_studentGeography.plot(kind="bar",x="Year",y="Rural", ax=ax3)
df_studentGeography.plot(kind="bar",x="Year",y="Town", ax=ax4)
```

Out[35]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x108842750>
```



In [36]:
```
# Duplicate df_schoolAwardAmount dataframe, find average award amount
df_AvgAwardAmt = df_schoolAwardAmount

df_AvgAwardAmt['2011'] = np.vectorize(averageAward)(df_schoolAwardCount['2011'
],df_schoolAwardAmount['2011'])
df_AvgAwardAmt['2012'] = np.vectorize(averageAward)(df_schoolAwardCount['2012'
],df_schoolAwardAmount['2012'])
df_AvgAwardAmt['2013'] = np.vectorize(averageAward)(df_schoolAwardCount['2013'
],df_schoolAwardAmount['2013'])
df_AvgAwardAmt['2014'] = np.vectorize(averageAward)(df_schoolAwardCount['2014'
],df_schoolAwardAmount['2014'])
df_AvgAwardAmt['2015'] = np.vectorize(averageAward)(df_schoolAwardCount['2015'
],df_schoolAwardAmount['2015'])
df_AvgAwardAmt['2016'] = np.vectorize(averageAward)(df_schoolAwardCount['2016'
],df_schoolAwardAmount['2016'])

# Export avg award amount
df_AvgAwardAmt.to_csv('school_choice_data/exported_data/df_AvgAwardAmt.csv')
```

In [37]:
```
# Sort avg award amount by school number
df_AvgAwardAmt_sorted = df_AvgAwardAmt.sort_values('School No.')

# Count values by county
df_CountySchoolsCount = pd.value_counts(df_AvgAwardAmt_sorted['County'].values
)
```

In [38]:
```
# Merge award count and award amount
df_schoolsCountAmount = df_schoolAwardCount.merge(df_schoolAwardAmount,on='Sch
ool No.',how='outer').drop(['School Name_y', 'County_y'], axis=1)
df_schoolsCountAmount = df_schoolsCountAmount.rename(columns = {'School Name_
x':'School Name','County_x':'County','2011_x':'2011 Count','2012_x':'2012 Coun
t','2013_x':'2013 Count','2014_x':'2014 Count','2015_x':'2015 Count','2016_x':
'2016 Count','2011_y':'2011 Avg Amount','2012_y':'2012 Avg Amount','2013_y':'2
013 Avg Amount','2014_y':'2014 Avg Amount','2015_y':'2015 Avg Amount','2016_y'
:'2016 Avg Amount'})
df_schoolsCountAmountCols = df_schoolsCountAmount.columns.tolist()
df_schoolsCountAmountCols = ['School No.',
                             'School Name',
                             'County',
                             '2011 Count',
                             '2011 Avg Amount',
                             '2012 Count',
                             '2012 Avg Amount',
                             '2013 Count',
                             '2013 Avg Amount',
                             '2014 Count',
                             '2014 Avg Amount',
                             '2015 Count',
                             '2015 Avg Amount',
                             '2016 Count',
                             '2016 Avg Amount']
df_schoolsCountAmount = df_schoolsCountAmount[df_schoolsCountAmountCols]
```

In [39]:
```
# Duplicate awards count df then convert to int
df_schoolsCountAmountClean = df_schoolsCountAmount

df_schoolsCountAmountClean['2011 Count'] = df_schoolsCountAmount['2011 Count']
.apply(convertInt)
df_schoolsCountAmountClean['2012 Count'] = df_schoolsCountAmount['2012 Count']
.apply(convertInt)
df_schoolsCountAmountClean['2013 Count'] = df_schoolsCountAmount['2013 Count']
.apply(convertInt)
df_schoolsCountAmountClean['2014 Count'] = df_schoolsCountAmount['2014 Count']
.apply(convertInt)
df_schoolsCountAmountClean['2015 Count'] = df_schoolsCountAmount['2015 Count']
.apply(convertInt)
df_schoolsCountAmountClean['2016 Count'] = df_schoolsCountAmount['2016 Count']
.apply(convertInt)

print('the zeros do not always indicate that no students were in the program.'
)
print('schools with less than ten students do not have to report')
```

```
the zeros do not always indicate that no students were in the program.
schools with less than ten students do not have to report
```

In [40]:
```
# import school ratings df
df_schoolRatings = pd.read_csv('school_choice_data/imported_data/final-2016-af
-school-grades.csv')

df_schoolRatingsCond = df_schoolRatings.drop(['IDOE_CORPORATION_ID','CORPORATI
ON_NAME'], axis=1)
df_schoolRatingsCond = df_schoolRatingsCond.rename(columns = {'IDOE_SCHOOL_ID'
:'School No.','SCHOOL_NAME':'School Name','2016 Grade':'2016_grade'})
```

In [41]:
```
# Import reworked awards data - data without symbols
df_schoolAwardsReworked = pd.read_csv('school_choice_data/imported_data/awards
_by_school_16_reworked.csv')
df_schoolAwardsReworked

# dupe dataframe and apply fillNone function to all cells
df_schoolAwardsWithNull = df_schoolAwardsReworked
df_schoolAwardsWithNull['2011'] = df_schoolAwardsWithNull['2011'].apply(fillNo
ne)
df_schoolAwardsWithNull['2012'] = df_schoolAwardsWithNull['2012'].apply(fillNo
ne)
df_schoolAwardsWithNull['2013'] = df_schoolAwardsWithNull['2013'].apply(fillNo
ne)
df_schoolAwardsWithNull['2014'] = df_schoolAwardsWithNull['2014'].apply(fillNo
ne)
df_schoolAwardsWithNull['2015'] = df_schoolAwardsWithNull['2015'].apply(fillNo
ne)
df_schoolAwardsWithNull['2016'] = df_schoolAwardsWithNull['2016'].apply(fillNo
ne)
```

In [42]:
```
# dupe dataframe and find the percent change in student count from the first year of SC in 2011 to current numbers
df_schoolsPercChange = df_schoolAwardsReworked
df_schoolsPercChange['percent_change'] = np.vectorize(percentChange)(df_schoolAwardsReworked['2011'],df_schoolAwardsReworked['2016'])

# dupe dataframe and find the percent change in awards from the first year of SC in 2011 to current numbers
df_schoolAwardsPercChange = df_schoolAwardsWithNull
df_schoolAwardsPercChange['percent_change'] = np.vectorize(percentChange)(df_schoolAwardsPercChange['2011'],df_schoolAwardsPercChange['2016'])
```

In [43]:
```
# Merge school ratings and awards percent change; clean dataframe
df_schoolsChangeGrade = df_schoolRatingsCond.merge(df_schoolAwardsPercChange,on='School No.', how='outer').drop(['2012','2013','2014','2015'], axis=1)
df_schoolsChangeGrade['School Name'] = np.vectorize(fillInfo)(df_schoolsChangeGrade['School Name_y'],df_schoolsChangeGrade['School Name_x'])
```

In [44]:
```
# organize dataframe with percent change: drop and reorder columns, then export to csv
df_schoolsChangeGrade = df_schoolsChangeGrade.drop(['School Name_x','School Name_y'], axis=1)
cols = list(df_schoolsChangeGrade)
df_schoolsChangeGrade = df_schoolsChangeGrade.rename(columns = {'percent_change':'Count % Change','2016_grade':'Grade', '2011':'SC 2011', '2016':'SC 2016'})
cols = ['School No.','School Name','County','Grade','SC 2011','SC 2016','Count % Change']
df_schoolsChangeGrade = df_schoolsChangeGrade[cols]
df_schoolsChangeGrade.sort_values('School Name').to_csv('school_choice_data/exported_data/df_schoolsChangeGrade.csv')
```