

```
In [0]: from google.colab import drive
drive.mount('/content/drive')
```

Drive already mounted at /content/drive; to attempt to forcibly remount, call `drive.mount("/content/drive", force_remount=True)`.

```
In [0]: %cd drive/My Drive
```

/content/drive/My Drive

```
In [0]: %cd Assignments_DonorsChoose_2018
```

/content/drive/My Drive/Assignments_DonorsChoose_2018

```
In [0]: %matplotlib inline
import warnings
warnings.filterwarnings("ignore")

import sqlite3
import pandas as pd
import numpy as np
import nltk
import string
import matplotlib.pyplot as plt
import seaborn as sns
import sklearn
from sklearn.cluster import KMeans, AgglomerativeClustering, DBSCAN
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.neighbors import NearestNeighbors

import re
# Tutorial about Python regular expressions: https://pymotw.com/2/re/
import string

from plotly import plotly
import plotly.offline as offline
import plotly.graph_objs as go
offline.init_notebook_mode()
from collections import Counter
```

```
In [0]: project_data = pd.read_csv('train_data.csv')
resource_data = pd.read_csv('resources.csv')
```

```
In [0]: # how to replace elements in list python: https://stackoverflow.com/a/2582163/4084
cols = ['Date' if x=='project_submitted_datetime' else x for x in list(project_data.columns)]

#sort dataframe based on time pandas python: https://stackoverflow.com/a/49702492/4084
project_data['Date'] = pd.to_datetime(project_data['project_submitted_datetime'])
project_data.drop('project_submitted_datetime', axis=1, inplace=True)
project_data.sort_values(by=['Date'], inplace=True)

# how to reorder columns pandas python: https://stackoverflow.com/a/13148611/4084
project_data = project_data[cols]
#project_data.head(2)

In [0]: price_data = resource_data.groupby('id').agg({'price':'sum', 'quantity':'sum'}).reset_index()
#price_data.head(2)

In [0]: project_data = pd.merge(project_data, price_data, on='id', how='left')
```

1.2 preprocessing of project_subject_categories

```
In [0]: categories = list(project_data['project_subject_categories'].values)
# remove special characters from list of strings python: https://stackoverflow.com/a/2582163/4084

# https://www.geeksforgeeks.org/removing-stop-words-nltk-python/
# https://stackoverflow.com/questions/23669024/how-to-strip-a-specific-word-from-string
# https://stackoverflow.com/questions/8270092/remove-all-whitespace-in-a-string-in-python

cat_list = []
for i in categories:
    temp = ""
    # consider we have text like this "Math & Science, Warmth, Care & Hunger"
    for j in i.split(','): # it will split it in three parts ["Math & Science", "Warmth", "Care & Hunger"]
        if 'The' in j.split(): # this will split each of the category based on space
            j=j.replace('The', '') # if we have the words "The" we are going to remove it
        j = j.replace(' ', '') # we are replacing all the ' ' (space) with '' (empty)
        temp+=j.strip()+" " # " abc ".strip() will return "abc", remove the trailing spaces
    temp = temp.replace('&', '_') # we are replacing the & value into _
    cat_list.append(temp.strip())

project_data['clean_categories'] = cat_list
project_data.drop(['project_subject_categories'], axis=1, inplace=True)

from collections import Counter
my_counter = Counter()
for word in project_data['clean_categories'].values:
    my_counter.update(word.split())

cat_dict = dict(my_counter)
sorted_cat_dict = dict(sorted(cat_dict.items(), key=lambda kv: kv[1]))
```

1.3 preprocessing of project_subject_subcategories

```

In [0]: sub_categories = list(project_data['project_subject_subcategories'].values)
# remove special characters from list of strings python: https://stackoverflow.com/

# https://www.geeksforgeeks.org/removing-stop-words-nltk-python/
# https://stackoverflow.com/questions/23669024/how-to-strip-a-specific-word-from-a-string
# https://stackoverflow.com/questions/8270092/remove-all-whitespace-in-a-string-in-python

sub_cat_list = []
for i in sub_categories:
    temp = ""
    # consider we have text like this "Math & Science, Warmth, Care & Hunger"
    for j in i.split(','): # it will split it in three parts ["Math & Science", "Warmth", "Care & Hunger"]
        if 'The' in j.split(): # this will split each of the category based on space
            j=j.replace('The', '') # if we have the words "The" we are going to remove them
        j = j.replace(' ', '') # we are replacing all the ' ' (space) with '' (empty)
        temp +=j.strip()+" #" "abc ".strip() will return "abc", remove the trailing spaces
        temp = temp.replace('&','_')
    sub_cat_list.append(temp.strip())

project_data['clean_subcategories'] = sub_cat_list
project_data.drop(['project_subject_subcategories'], axis=1, inplace=True)

# count of all the words in corpus python: https://stackoverflow.com/a/22898595/4090899
my_counter = Counter()
for word in project_data['clean_subcategories'].values:
    my_counter.update(word.split())

sub_cat_dict = dict(my_counter)
sorted_sub_cat_dict = dict(sorted(sub_cat_dict.items(), key=lambda kv: kv[1]))

```

1.3 Text preprocessing

```

In [0]: # merge two column text dataframe:
project_data["essay"] = project_data["project_essay_1"].map(str) + \
    project_data["project_essay_2"].map(str) + \
    project_data["project_essay_3"].map(str) + \
    project_data["project_essay_4"].map(str)

```

```
In [0]: # https://stackoverflow.com/a/47091490/4084039
import re

def decontracted(phrase):
    # specific
    phrase = re.sub(r"won't", "will not", phrase)
    phrase = re.sub(r"can't", "can not", phrase)

    # general
    phrase = re.sub(r"n't", " not", phrase)
    phrase = re.sub(r"\ 're", " are", phrase)
    phrase = re.sub(r"\ 's", " is", phrase)
    phrase = re.sub(r"\ 'd", " would", phrase)
    phrase = re.sub(r"\ 'll", " will", phrase)
    phrase = re.sub(r"\ 't", " not", phrase)
    phrase = re.sub(r"\ 've", " have", phrase)
    phrase = re.sub(r"\ 'm", " am", phrase)
    return phrase
```

```
In [0]: # https://gist.github.com/sebleier/554280
# we are removing the words from the stop words list: 'no', 'nor', 'not'
stopwords= ['i', 'me', 'my', 'myself', 'we', 'our', 'ours', 'ourselves', 'you', "you'll", "you'd", 'your', 'yours', 'yourself', 'yourselves', 'he', 'she', "she's", 'her', 'hers', 'herself', 'it', "it's", 'its', 'itself', 'theirs', 'themselves', 'what', 'which', 'who', 'whom', 'this', 'that', 'am', 'is', 'are', 'was', 'were', 'be', 'been', 'being', 'have', 'has', 'did', 'doing', 'a', 'an', 'the', 'and', 'but', 'if', 'or', 'because', 'at', 'by', 'for', 'with', 'about', 'against', 'between', 'into', 'through', 'above', 'below', 'to', 'from', 'up', 'down', 'in', 'out', 'on', 'off', 'then', 'once', 'here', 'there', 'when', 'where', 'why', 'how', 'all', 'most', 'other', 'some', 'such', 'only', 'own', 'same', 'so', 'than', 's', 't', 'can', 'will', 'just', 'don', "don't", 'should', "should've", 've', 'y', 'ain', 'aren', "aren't", 'couldn', "couldn't", 'didn', "didn't", 'hadn't', 'hasn', "hasn't", 'haven', "haven't", 'isn', "isn't", 'ma', "mustn't", 'needn', "needn't", 'shan', "shan't", 'shouldn', "shouldn't", 'won', "won't", 'wouldn', "wouldn't"]
```

```
In [0]: def find_num(text):
    if re.findall(r'\d+', text):
        return 1
    return 0

project_data['numerical_digits'] = project_data['project_resource_summary'].apply
```

```
In [0]: project_data['project_grade_category']=project_data['project_grade_category'].str
project_data['project_grade_category']=project_data['project_grade_category'].str
set(project_data['project_grade_category'])
```

```
Out[16]: {'Grades_3to5', 'Grades_6to8', 'Grades_9to12', 'Grades_PreKto2'}
```

```
In [0]: project_data['teacher_prefix']=project_data['teacher_prefix'].fillna('Mrs.')
```

```
In [0]: #project_data = project_data[:1000]
```

```
In [0]: from sklearn.naive_bayes import MultinomialNB
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.metrics import accuracy_score
from collections import Counter
import matplotlib.pyplot as plt
import numpy as np
from scipy.sparse import csr_matrix
import time

project_data_features = project_data.copy()
project_data_features.drop('project_is_approved', axis=1, inplace=True)
y=list(project_data['project_is_approved'])
X_train, X_test, y_train, y_test = train_test_split(project_data_features, y, str
X_train, X_val, y_train, y_val = train_test_split(X_train, y_train, stratify=y_tr
```

```
In [0]: X_train.shape, X_val.shape, X_test.shape
```

```
Out[20]: ((50472, 20), (26001, 20), (32775, 20))
```

```
In [0]: from sklearn.preprocessing import StandardScaler
def standardize_data(df_tr,df_cv,df_te,column_name):
    standardized_vec = StandardScaler(with_mean=False)
    # here it will learn mu and sigma
    standardized_vec.fit(df_tr[column_name].values.reshape(-1,1))

    # with the learned mu and sigma it will do std on train data
    standardized_data_train = standardized_vec.transform(df_tr[column_name].values)
    print(standardized_data_train.shape)

    # with the same learned mu and sigma it will do std on cv data
    standardized_data_traincv = standardized_vec.transform(df_cv[column_name].value
    print(standardized_data_traincv.shape)

    # with the same learned mu and sigma it will do std on test data
    standardized_data_test =standardized_vec.transform(df_te[column_name].values.re
    print(standardized_data_test.shape)

    return standardized_data_train, standardized_data_traincv, standardized_data_te
```

```
In [0]: from sklearn.feature_extraction.text import CountVectorizer
def vectorized_data(df_train,df_cv,df_test,column_name,vocab=False):
    if(vocab):
        vectorizer = CountVectorizer(vocabulary=list(vocab.keys()), lowercase=False,
    else:
        vectorizer = CountVectorizer(lowercase=False, binary=True)

    categories_one_hot_tr = vectorizer.fit_transform(df_train[column_name].values)
    print(vectorizer.get_feature_names())
    print("Shape of matrix after one hot encoding ",categories_one_hot_tr.shape)
    vocab_list = vectorizer.get_feature_names()

    categories_one_hot_cv = vectorizer.transform(df_cv[column_name].values)
    print(vectorizer.get_feature_names())
    print("Shape of matrix after one hot encoding ",categories_one_hot_cv.shape)

    categories_one_hot_te = vectorizer.transform(df_test[column_name].values)
    print(vectorizer.get_feature_names())
    print("Shape of matrix after one hot encoding ",categories_one_hot_te.shape)
    return categories_one_hot_tr,categories_one_hot_cv, categories_one_hot_te,vocab
```

```
In [0]: def create_dict(df,column_name):
    my_counter = Counter()
    for word in df[column_name].values:
        my_counter.update(word.split())

    my_dict = dict(my_counter)
    sorted_dict = dict(sorted(my_dict.items(), key=lambda kv: kv[1]))
    return sorted_dict
```

```
In [0]: def num_hot_encode(df,column_name):
    one_hot_num_dig = pd.get_dummies(df[column_name].values)
    print("Shape of matrix after one hot encoding ",one_hot_num_dig.shape)
    return one_hot_num_dig
```

```
In [0]: from tqdm import tqdm
def textpreprocessed(df,column_name):
    # Combining all the above students
    preprocessed_list = []
    # tqdm is for printing the status bar
    for sentence in tqdm(df[column_name].values):
        sent = decontracted(sentence)
        sent = sent.replace('\r', ' ')
        sent = sent.replace('\n', ' ')
        sent = sent.replace('\n', ' ')
        sent = re.sub('[^A-Za-z0-9]+', ' ', sent)
        # https://gist.github.com/sebleier/554280
        sent = ' '.join(e for e in sent.split() if e.lower() not in stopwords)
        preprocessed_list.append(sent.lower().strip())
    return preprocessed_list
```

```
In [0]: from sklearn.preprocessing import Normalizer
def normalize_data(df, column_data):
    normalizer = Normalizer()
    # normalizer.fit(X_train['price'].values)
    # this will rise an error Expected 2D array, got 1D array instead:
    # array=[105.22 215.96 96.01 ... 368.98 80.53 709.67].
    # Reshape your data either using
    # array.reshape(-1, 1) if your data has a single feature
    # array.reshape(1, -1) if it contains a single sample.
    normalizer.fit(df[column_data].values.reshape(-1,1))

    data_norm = normalizer.transform(df[column_data].values.reshape(-1,1))
    print("After vectorizations")
    print(data_norm.shape)
    return data_norm
```

```
In [0]: price_standardized_tr, price_standardized_val, price_standardized_te = standardiz
print()
project_standardized_tr, project_standardized_val, project_standardized_te = stan
```

```
(50472, 1)
(26001, 1)
(32775, 1)
```

```
(50472, 1)
(26001, 1)
(32775, 1)
```

```
In [0]: cat_one_hot_tr, cat_one_hot_val, cat_one_hot_te, cat_one_hot_list = vectorized_data(
cat_sub_one_hot_tr, cat_sub_one_hot_val, cat_sub_one_hot_te, cat_sub_one_hot_list =
```

```
['Warmth', 'Care_Hunger', 'History_Civics', 'Music_Arts', 'AppliedLearning', 'S
pecialNeeds', 'Health_Sports', 'Math_Science', 'Literacy_Language']
Shape of matrix after one hot encoding (50472, 9)
['Warmth', 'Care_Hunger', 'History_Civics', 'Music_Arts', 'AppliedLearning', 'S
pecialNeeds', 'Health_Sports', 'Math_Science', 'Literacy_Language']
Shape of matrix after one hot encoding (26001, 9)
['Warmth', 'Care_Hunger', 'History_Civics', 'Music_Arts', 'AppliedLearning', 'S
pecialNeeds', 'Health_Sports', 'Math_Science', 'Literacy_Language']
Shape of matrix after one hot encoding (32775, 9)
['Warmth', 'Care_Hunger', 'History_Civics', 'Music_Arts', 'AppliedLearning', 'S
pecialNeeds', 'Health_Sports', 'Math_Science', 'Literacy_Language']
Shape of matrix after one hot encoding (50472, 9)
['Warmth', 'Care_Hunger', 'History_Civics', 'Music_Arts', 'AppliedLearning', 'S
pecialNeeds', 'Health_Sports', 'Math_Science', 'Literacy_Language']
Shape of matrix after one hot encoding (26001, 9)
['Warmth', 'Care_Hunger', 'History_Civics', 'Music_Arts', 'AppliedLearning', 'S
pecialNeeds', 'Health_Sports', 'Math_Science', 'Literacy_Language']
Shape of matrix after one hot encoding (32775, 9)
```

```
In [0]: school_state_dict = create_dict(X_train,'school_state')
teacher_prefix_dict = create_dict(X_train,'teacher_prefix')

state_one_hot_tr,state_one_hot_val,state_one_hot_te,state_one_hot_list = vectoriz
teacher_one_hot_tr,teacher_one_hot_val,teacher_one_hot_te,teacher_one_hot_list =
```

```
['VT', 'WY', 'ND', 'MT', 'NE', 'RI', 'SD', 'DE', 'AK', 'NH', 'HI', 'WV', 'DC',
'ME', 'NM', 'KS', 'ID', 'IA', 'AR', 'CO', 'OR', 'MN', 'NV', 'KY', 'MS', 'MD',
'CT', 'TN', 'UT', 'WI', 'AL', 'VA', 'AZ', 'NJ', 'OK', 'MA', 'WA', 'LA', 'MO',
'OH', 'IN', 'PA', 'MI', 'SC', 'GA', 'IL', 'NC', 'FL', 'TX', 'NY', 'CA']
Shape of matrix after one hot encoding (50472, 51)
['VT', 'WY', 'ND', 'MT', 'NE', 'RI', 'SD', 'DE', 'AK', 'NH', 'HI', 'WV', 'DC',
'ME', 'NM', 'KS', 'ID', 'IA', 'AR', 'CO', 'OR', 'MN', 'NV', 'KY', 'MS', 'MD',
'CT', 'TN', 'UT', 'WI', 'AL', 'VA', 'AZ', 'NJ', 'OK', 'MA', 'WA', 'LA', 'MO',
'OH', 'IN', 'PA', 'MI', 'SC', 'GA', 'IL', 'NC', 'FL', 'TX', 'NY', 'CA']
Shape of matrix after one hot encoding (26001, 51)
['VT', 'WY', 'ND', 'MT', 'NE', 'RI', 'SD', 'DE', 'AK', 'NH', 'HI', 'WV', 'DC',
'ME', 'NM', 'KS', 'ID', 'IA', 'AR', 'CO', 'OR', 'MN', 'NV', 'KY', 'MS', 'MD',
'CT', 'TN', 'UT', 'WI', 'AL', 'VA', 'AZ', 'NJ', 'OK', 'MA', 'WA', 'LA', 'MO',
'OH', 'IN', 'PA', 'MI', 'SC', 'GA', 'IL', 'NC', 'FL', 'TX', 'NY', 'CA']
Shape of matrix after one hot encoding (32775, 51)
['Dr.', 'Teacher', 'Mr.', 'Ms.', 'Mrs.']
Shape of matrix after one hot encoding (50472, 5)
['Dr.', 'Teacher', 'Mr.', 'Ms.', 'Mrs.']
Shape of matrix after one hot encoding (26001, 5)
['Dr.', 'Teacher', 'Mr.', 'Ms.', 'Mrs.']
Shape of matrix after one hot encoding (32775, 5)
```

```
In [0]: grade_dict = create_dict(X_train,'project_grade_category')
grade_one_hot_tr,grade_one_hot_val,grade_one_hot_te,grade_one_hot_list = vectoriz
```

```
['Grades_9to12', 'Grades_6to8', 'Grades_3to5', 'Grades_PreKto2']
Shape of matrix after one hot encoding (50472, 4)
['Grades_9to12', 'Grades_6to8', 'Grades_3to5', 'Grades_PreKto2']
Shape of matrix after one hot encoding (26001, 4)
['Grades_9to12', 'Grades_6to8', 'Grades_3to5', 'Grades_PreKto2']
Shape of matrix after one hot encoding (32775, 4)
```

```
In [0]: one_hot_num_dig_tr = num_hot_encode(X_train,'numerical_digits')
one_hot_num_dig_te = num_hot_encode(X_test,'numerical_digits')
one_hot_num_dig_val = num_hot_encode(X_val,'numerical_digits')
```

```
Shape of matrix after one hot encoding (50472, 2)
Shape of matrix after one hot encoding (32775, 2)
Shape of matrix after one hot encoding (26001, 2)
```



```
In [0]: from scipy.sparse import hstack

f_tr = hstack((one_hot_num_dig_tr,grade_one_hot_tr,state_one_hot_tr,cat_one_hot_tr))
f_cr = hstack((one_hot_num_dig_val,grade_one_hot_val,state_one_hot_val,cat_one_hot_val))
f_te = hstack((one_hot_num_dig_te,grade_one_hot_te,state_one_hot_te,cat_one_hot_te))

def hstack_data(f1_tr, f1_cr, f1_te, f2_tr, f2_cr, f2_te,f3_tr,f3_cr,f3_te):
    X_tr = hstack((f1_tr, f1_cr, f2_tr,f3_tr)).tocsr()
    X_cr = hstack((f1_cr, f1_cr, f2_cr,f3_cr)).tocsr()
    X_te = hstack((f1_te, f1_te, f2_te,f3_te)).tocsr()
    return X_tr,X_cr,X_te
```

```
In [0]: feature_list_x = ['dig_0', 'dig_1']+grade_one_hot_list+state_one_hot_list+cat_one_hot_list
len(feature_list_x)
```

Out[33]: 82

Set 1: categorical, numerical features + project_title(BOW) + preprocessed_essay (BOW)

```
In [0]: def bow_vec(preprocessed_data_tr,preprocessed_data_val,preprocessed_data_te):
    global vectorizer_bow
    vectorizer_bow = CountVectorizer(min_df=10)
    text_bow_tr = vectorizer_bow.fit_transform(preprocessed_data_tr)
    print("Shape of matrix after one hot encoding ",text_bow_tr.shape)
    vectorizer_list = vectorizer_bow.get_feature_names()
    text_bow_val = vectorizer_bow.transform(preprocessed_data_val)
    print("Shape of matrix after one hot encoding ",text_bow_val.shape)

    text_bow_te = vectorizer_bow.transform(preprocessed_data_te)
    print("Shape of matrix after one hot encoding ",text_bow_te.shape)
    return text_bow_tr,text_bow_val, text_bow_te, vectorizer_list
```

```
In [0]: bow_vec_essay_tr, bow_vec_essay_val, bow_vec_essay_te, bow_vec_essay_list = bow_vec(
bow_vec_titles_tr, bow_vec_titles_val, bow_vec_titles_te, bow_vec_titles_list = bow_
bow_vec_resource_tr, bow_vec_resource_val, bow_vec_resource_te, bow_vec_resource_list
```

```
100%|██████████| 50472/50472 [00:30<00:00, 1629.11it/s]
100%|██████████| 26001/26001 [00:15<00:00, 1641.43it/s]
100%|██████████| 32775/32775 [00:20<00:00, 1631.73it/s]
```

Shape of matrix after one hot encoding (50472, 12184)

Shape of matrix after one hot encoding (26001, 12184)

```
7%|██          | 3522/50472 [00:00<00:01, 35211.47it/s]
```

Shape of matrix after one hot encoding (32775, 12184)

```
100%|██████████| 50472/50472 [00:01<00:00, 35091.42it/s]
100%|██████████| 26001/26001 [00:00<00:00, 34931.88it/s]
100%|██████████| 32775/32775 [00:00<00:00, 34972.93it/s]
```

Shape of matrix after one hot encoding (50472, 2032)

Shape of matrix after one hot encoding (26001, 2032)

```
3%|██          | 1591/50472 [00:00<00:03, 15904.25it/s]
```

Shape of matrix after one hot encoding (32775, 2032)

```
100%|██████████| 50472/50472 [00:03<00:00, 15592.18it/s]
100%|██████████| 26001/26001 [00:01<00:00, 15550.94it/s]
100%|██████████| 32775/32775 [00:02<00:00, 15495.32it/s]
```

Shape of matrix after one hot encoding (50472, 3937)

Shape of matrix after one hot encoding (26001, 3937)

Shape of matrix after one hot encoding (32775, 3937)

```
In [0]: feature_list = feature_list_x.copy()
feature_names = [*feature_list, *bow_vec_titles_list, *bow_vec_essay_list, *bow_
print(len(feature_names))
```

```
18235
```

```
In [0]: X_tr, X_cr, X_te = hstack_data(bow_vec_titles_tr, bow_vec_titles_val, bow_vec_tit
bow_vec_essay_tr, bow_vec_essay_val, bow_vec_essay_te, \
bow_vec_resource_tr, bow_vec_resource_val, bow_vec_resource_te
```

```
In [0]: X_tr.shape, X_cr.shape, X_te.shape
```

```
Out[38]: ((50472, 18235), (26001, 18235), (32775, 18235))
```

```
In [0]: from sklearn.feature_selection import SelectKBest, chi2
X, y = X_tr, y_train
print(X.shape)
X_new = SelectKBest(chi2, k=5000).fit_transform(X, y)
print(X_new.shape)
selector = SelectKBest(chi2, k=5000)
selector.fit(X, y)
X_new = selector.transform(X)
X_new.shape
#print(selector.get_support(indices=True))
```

```
(50472, 18235)
(50472, 5000)
```

Out[39]: (50472, 5000)

```
In [0]: indexes_selected = selector.get_support(indices=True) # extracting features indexes
selected_features = [] # it will contain features names
for i in indexes_selected:
    selected_features.append(i)
```

```
In [0]: df = X_te.toarray()
df1 = pd.DataFrame(df)
X_te_new = csr_matrix(df1[list(selected_features)].values)
X_te.shape, X_te_new.shape
```

```
In [0]: df = X_cr.toarray()
df1 = pd.DataFrame(df)
X_cr_new = csr_matrix(df1[list(selected_features)].values)
X_cr.shape, X_cr_new.shape
```

```
In [0]: X_tr_new = X_new[:30000]
```

```
In [0]: from wordcloud import WordCloud, STOPWORDS

def plot_wordcloud(txt):
    text = " ".join(word for word in txt)
    stopwords = set(STOPWORDS)
    wordcloud = WordCloud(width = 1000, height = 600, background_color = 'white',
    plt.figure(figsize = (10, 10))
    plt.imshow(wordcloud, interpolation = 'bilinear')
    plt.axis("off")
    plt.title("World cloud of top words")
    plt.tight_layout(pad = 0)

    plt.show()
```

```
In [0]: def print_clusters(ind,clust):  
        count = 0  
        print("4 datapoints of cluster {}:\\n".format(ind))  
        for i in range(4):  
            print(clust[i])  
            print(len(clust[i]))  
            print()  
        count = count+1
```

K-Means Clustering:

```
In [0]: %%time  
        k_values = [2,3,4,5,6,8,9,10]  
        loss = []  
        for i in k_values:  
            kmeans = KMeans(n_clusters=i, n_jobs=-1).fit(X_new)  
            loss.append(kmeans.inertia_)
```

CPU times: user 2.79 s, sys: 1.39 s, total: 4.19 s

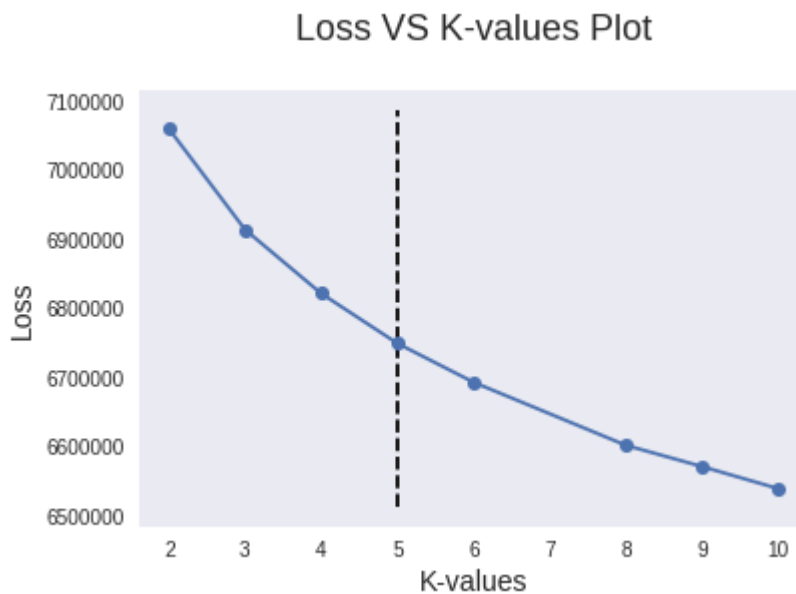
Wall time: 8h 43min 24s

ELBOW METHOD

```
In [0]: !pip install kneed
```

```
In [0]: from kneed import KneLocator
kn = KneLocator(k_values, loss, curve='convex', direction='decreasing')
n_knee = kn.knee
print(kn.knee)
# Draw Loss VS K values plot
plt.plot(k_values, loss, '-o')
plt.xlabel('K-values',size=14)
plt.ylabel('Loss',size=14)
plt.title('Loss VS K-values Plot\n',size=18)
plt.vlines(kn.knee, plt.ylim()[0], plt.ylim()[1], linestyle='dashed')
plt.grid()
plt.show()
```

5



```
In [0]: essay_text = X_train['essay'].values
```

```
In [0]: %%time
optimal_k = n_knee
bow_means_k = optimal_k

# Implementing K-Means++ using optimal value of K
kmeans = KMeans(n_clusters=optimal_k, n_jobs=-1).fit(X_new)
```

```
In [0]: cluster = [[] for i in range(optimal_k)]
for i in range(kmeans.labels_.shape[0]):
    cluster[kmeans.labels_[i]].append(essay_text[i])

print("No of datapoints in Cluster-1 : ",len(cluster[0]))
print("No of datapoints in Cluster-2 : ",len(cluster[1]))
print("No of datapoints in Cluster-3 : ",len(cluster[2]))
print("No of datapoints in Cluster-4 : ",len(cluster[3]))
print("No of datapoints in Cluster-5 : ",len(cluster[4]))
```

cluster 1

```
In [0]: print_clusters(1,cluster[0])
```

4 datapoints of cluster 1:

I teach Math and Math Intervention at Pinecrest Academy St. Rose, a college preparatory public charter school, in Las Vegas, Nevada. My school services students Kindergarten through eighth grade, and I specifically work with middle school students in 6th through eighth grade.\r\nSince Pinecrest Academy is a public charter school with a lottery enrollment system, students come from a variety of different backgrounds. Some students live closely to the school, while others live as far as a half hour from the school. We are a very supportive school system that makes sure all of our students have all they need in order to be successful and to prepare them for college.The game buzzers that I am requesting through this Donors Choose Project will allow me to host Math Olympiad contests with 6th-8th grade students at my school. This will enhance student learning because it will motivate students to work hard to prepare their math skills for the competition.\r\nWith the game buzzers, I will be able to run official Math Olympiad contests with my math intervention students, my regular math students, and my accelerated math students! The use of this technology will ensure that the students will have a fair competition by locking in the first student to hit the buzzer.nannan
1281

I teach at a Title 1 K-8 elementary school set in a semi rural part of our city. At our school 100% of the students receive free or reduced lunch and 63% of our students are second language learners. My students in the past have enjoyed projects that beautify our school campus and teach them about the environment we live in. We live in a rich agricultural area but few of our 950 students are familiar with farms/gardening. A butterfly garden would add beauty to our school site.For the past several years, I have been teaching my students about vermiculture and composting. We have planted several half barrels at our school site with spring bulbs and wild flower seeds. \r\n\r\nThis year, I would like to continue to teach my students about gardening through development of a butterfly garden. We have about 30 half barrels we will be moving to a bare corner of our school site. We will be integrating math, science and language arts curriculum into this project through measuring, studying life cycles, and writing about our project. Students will develop pride in their school and have a peaceful sanctuary to visit and work in.nannan
1142

We are moving & grooving kindergarteners! Sitting still is not an option. Our activities must be hands-on. My students work in small groups to promote movement, differentiation, engagement, and quality practice of our objectives. At the end of the year my students should perform at grade level.\r\n\r\nOur school is a Title 1 school in a high-need area. Our school has a very diverse population. Our students have a history of struggling academically. We work very hard to reach each student and recently improved from a focus school with a high achievement gap to a reward school! We call our school \"the best-kept secret\" of our district.Many of my students come to kindergarten without ever having held a pencil, and suddenly, they are expected to show what they know and practice what we teach with grace and fluidity using a pencil. Those little muscles aren't always prepared to perform that way. These tools will help to build up the muscles in my students' hands in fun, creative ways. The students will squeeze hole punches, lace beads onto sturdy pipe cleaners, place rubber bands onto geo boards, pinch mini light bulbs to create designs on Lite Brite boards and flick spinners to play fun learning games. Building up my students' fine motor muscles will help them to complete pencil and paper tasks throughout their educational career.

reers. We already funded the first half of this project! These supplies are to enhance the tools we already received.nannan
1468

Our school is a separate public day school which provides special education services for students who range in age from 11-21 years, with a wide range of cognitive disabilities. The school provides collaborative, comprehensive educational services utilizing a trans-disciplinary approach.\r\n\r\nRTS promotes the advancement of each student's highest potential to access and interact with the surrounding community, access post-secondary academic options and obtain and retain employment.\r\n\r\nOur educational program provides students with a modified set of courses from the MCPS program of studies based on the Common Core Standards. Students graduate at 21 years of age with a Maryland Certificate of Program Completion. RTS is comprised of 3 levels: middle school (ages 11-14), high school (ages 15-17) and upper school (ages 18-21). All students have an Individual Education Program (IEP) which aligns classroom instruction to each student's specific academic, functional, and social/behavioral goals. Classroom teachers differentiate instruction to address the individual skills of each student in all classes. The primary objectives of RTS are continuous student achievement and maximum independence after graduation. Our students have active bodies and would benefit greatly from wobble chairs. Students will be able to move their bodies while sitting down so they can focus on their learning. These chairs are lightweight and easy to transport. Our students with disabilities also benefit from brain breaks and enjoy relaxing in bean bag chairs.\r\n\r\nMovement is critical to student development as physical movement both increases well-being and encourages the physical and intellectual maturing process. These chairs will help us meet the needs of our students with diverse needs.\r\n\r\nWe want to transform stationary sitting into an activity, ideal for brainstorming sessions and other active sitting environments. Our students will be moving, even when they seem to be sitting still.nannan
2007

observation: By looking at 4 datapoints we can infer it is about service they provide and how donation is going to help them.

cluster 2

```
In [0]: print_clusters(2,cluster[1])
```

4 datapoints of cluster 2:

Many of them face adversity on a daily basis. Many of my students are dyslexics or they have a special needs. I also have a handful of gifted students. They have confidence issues, anxiety and do not feel comfortable in a typical classroom setting. Despite the struggles my students have, they are very hardworking. \r\n\r\nMy students work well together and respect every individual's needs. They understand that even though they are at different levels, each one of them will meet their own personal goals. They support each other and hold each other accountable. They leave no one behind as they race toward success. Over the past two years, I have had Fit Chairs donated. These chairs have sparked productivity and creativity in my students. My students enjoy the chairs and feel privileged to have them in our room. My students love the idea of coming to school and sitting in these awesome chairs. My students that have ADHD bounce away throughout the day but remained focused. My tactile learners will also bounce on the chairs as they complete their work. We use the chairs for brain breaks and stretches throughout the school day. What child doesn't love a rolling chair? My students feel like a CEO. I am attempting to get a class set so that not one student is left out. \r\n\r\nMy students have various levels of anxiety. So we love to work with the lights off. I typically hang Christmas lights around the room and that gets the students excited. The Night Light Projector is a billion times better than Christmas lights! The projector would help my students relax and focus on the tasks at hand. One on each side of the room will make my students feel as though they are learning while on vacation. Who wouldn't want that? This would bring any anxiety level down, especially in my students. \r\n\r\nMy students would benefit from having wireless LED lamps on their group tables. My students that have vision problems will be able to focus on note taking and completing assignments in a soothing environment. The lamps will be placed at the center of the groups so that each child is able to look at their work in a low light setting. The wireless feature will keep my students safe. \r\n\r\n\r\n\r\nnanna
n
2214

My students love to learn and love to be challenged. I teach at a public high school where the teachers are very caring and the students take pride in their school. Our students are hard working and come from very diverse backgrounds. We have a mix of socioeconomic backgrounds and cultures, but that is what makes our school strong. Our differences help unite us. \r\n\r\nStudents learn that through hard work and perseverance, they can accomplish anything. A very important word our students learn is "yet." "I don't know how to do this yet" or "I don't understand this yet." Our school culture fosters growth and improvement and helps everyone understand that they help determine their own futures. Our students are eager to learn more, even if it means extending their learning opportunities outside of class time. As a math department, we have been looking for ways to help our students be creative. All too often, students want to "consume" what is around them and aren't given opportunities to "create" something. When it comes to learning math, there are many ways students can show that they have learned a concept. In Geometry, students can build things based on geometric properties. In Algebra, students can design projectile launchers to model quadratic motion. \r\n\r\nFull STEAM Ahead - Math Makerspace is a project that gives students the resources they need to creatively express their learning. Students will look forward to math class if they know they will be given the opportunity to create products to demonstrate their understanding. \r\n\r\nStudents will reuse materials from recycling bins to build rockets, race cars, and Ferris wheels, but they also need duct tape, glue, tape, and other tools to help make t

these projects become a reality. While the main focus will be the math concepts students are learning, our teachers are getting creative in how they let students express their understanding and learn the content. These Makerspace materials will provide students and teachers with the tools to build devices so we can study their mathematical properties.

nannan
2101

My students are a vital part of a diverse multicultural community located in Duarte, California. Our school is located along the foothills of the San Gabriel Mountains, approximately 20 miles outside of Los Angeles. Although we reside in a suburban community, we mirror the characteristics of many urban schools in Los Angeles County, including a school-wide Title 1 program. As diverse as my students are culturally, economically, and socially, so are they diverse academically. \r\n RO Elementary is a dedicated STEAM (Science, Technology, Engineering, Art, and Math) school. We strive to integrate Common Core Standards into this curricular focus. There is a palpable level of dedication and excitement to teaching and learning that makes school meaningful for everyone involved. Together we are lifelong learners, with willingness to explore all options and try new things so that all students in our diverse community have opportunities for success. Our school has partnered with other schools, universities, renowned medical research facilities, and a local arts foundation, all to incorporate their expertise into our curriculum. In my 2nd and 3rd grade classroom, my students represent some of the youngest learners, willing to learn and do amazing things, and rise above all expectations. \r\nMy students need a flexible learning environment to develop their 21st century skills, often referred to as the 4 Cs (Communication, Collaboration, Critical Thinking, and Creativity) in a physical environment that accommodates their needs. A flexible, non-traditional learning space is an important part of meeting my students' physical, emotional, and educational needs. We've all seen the model of students required to sit still in a chair, at a single desk, facing forward, and expected to remain focused for significant stretches of time. While our expectations of what students should learn, what they should be able to do, and the skill set they should possess has changed, our physical environments have not! Furthermore, Common Core Standards now specify collaboration and communication skills as an integral part of a student's skills. \r\n\r\nThe flexible learning environment I am creating will encourage small group, active participation in communication and collaboration, increasing both verbal and non-verbal skills. Students will be explicitly taught and then able to choose a classroom location that best supports their learning. These flexible learning spaces will include a variety of tables (for standing, sitting, and kneeling) and different types of seating from which students may self-select. The options I am requesting encourage physical movement in a contained and focused manner. Seven and eight year olds are in constant motion, providing them an avenue of release increases their focus to the task before them. \r\n\r\n\r\nTables, rugs, pillows, and crate seating have already been acquired (begged, borrowed, and bought). This project requests balance balls (both with and without base support), different types of wobble seats, fidget bands to fit on traditional chairs, lap desks, and yoga mats. This non-traditional classroom environment will allow students to have mobility and access to flexible learning spaces throughout the classroom.

nannan
3277

My class is a lively bunch of students from a variety of backgrounds. I teach 2nd grade at a Title 1 school in South Carolina. About 80% of the students receive free/reduced lunch and come from single parent households. \r\n\r\n\r\nMy students are eager to learn and it is my job to provide an environment where they can. The items that I have requested will help my students find the best place for them to learn and make sure they have full tummies to do so. By having several

l seating options for students will allow them to find their optimal place for learning while allowing an outlet to get their wiggles out! \r\n\r\nI want students to think they are in the best 2nd grade classroom because they are allowed to make decisions that will impact their learning in a positive way. Many of my student suffer from ADHD and other disabilities that prevent them from being able to sit in the regular desks and chairs we are all accustomed to. While talking as a class, we decided that we could be better learners if we had a full stomach and a way to get our energy out without bothering others. We have a few hokki stools and one ball chair in the classroom. Students' suggested we get more ball chairs and have snacks on hand for those who miss breakfast. Students also believe that by having snacks on hand, we will be able to make healthier choices about what they are eating because many students are bringing cookies and candy for their classroom snack. \r\n\r\nThis project will allow students who have been labeled as disruptions show just how successful they can be when given the opportunity. All students agreed that they would work harder and be able to pay attention better with healthy snacks in their bodies and chairs that let them move. Please help my classroom keep moving and show just how great they can be.annan
1836

Observation This tells about how the resources can help to carry out classroom activities to enhance their skills and learning.

cluster 3

```
In [0]: print_clusters(3,cluster[2])
```

4 datapoints of cluster 3:

My goal is to create a classroom environment that promotes cooperation and engaged academic learning opportunities which are student centered. I hope to do this by designing an effective classroom environment that has a flexible work space. \r\n\r\nThink about where you like to work. Is it Starbucks, Panera, on your couch, in your bed, at the kitchen table, standing, sitting or kneeling? Children learn and process the same way we do. They need more than just the \"sitting\" desk. I am trying to provide a classroom that meets the needs of all students.\r\n\r\n70 percent of American employees are now working in an open-office environment with low or no partitions. We are in a prime advantage to start teaching students how to productively and effectively work in these environments. A general google search will show you that some major companies that currently use the open office space layout include: Google, Facebook, Groupon, Ferrero Rocher Inc., Yahoo, eBay, Goldman Sachs, Pixar, and Jet.com The intent of this project is for students to learn important life skills that can be used in the classroom and beyond in the \"The Learning Lounge: Creating A Flexible Classroom.\" I am in need of furniture. Flexible classroom furniture will provide an increase in attention, engagement and allow students to work on relationship management. \r\n\r\nThe physical environment is one of the most important elements of the classroom. \r\n\r\nThis project will provide a creative learning space for all students to choose where they learn best. With the use of this flexible furniture students will have the opportunity to work on self-selection and monitoring of their work in a realistic atmosphere while learning. The purchase of flexible classroom furniture will allow for this to happen on a daily basis in my classroom.nannan

1829

My students come from diverse backgrounds and must overcome adversity every day. Although they are young, many of my students have faced difficult challenges in their lives. I see it as my responsibility to create a place where students can relax and enjoy learning. \r\n\r\nI try my best to make school a fun and loving place for them. \r\n\r\nMy students are special. They deserve to have a quality education regardless of their background. Each year, I enjoy seeing my students thrive as they let go of insecurities and open up to a world of learning! They learn that hard work leads to fun, exciting results and that it's okay to make mistakes. They learn to overcome challenges. Most importantly, they learn to succeed. My students are learning to be successful in the 21st Century! Technology plays a key role in many 21st century classrooms. But for our littlest learners, hands-on and engaging activities are the best combination. Square Panda and Osmo products combine interactive fun learning games on an IPAD with the hands-on manipulatives that help our students thrive. \r\n\r\nMy students deserve fun and engaging activities to enhance their learning. These tools are fun and educational. My students will be able to use manipulatives to interact with the IPAD activities as they learn to become lifelong readers! Square panda combines magnetic letters with learning activities to help identify letters and form words. OSMO adds manipulatives to math, spatial reasoning and coding to encourage critical thinking. As an ATPE member, they will match any donations, up to half of my project, to help my classroom succeed.nannan

1631

My students are very active sixth graders looking for different ways to keep their interest alive in mathematics! They live in a low-income, mobile neighborhood, making it difficult for me to keep supplies and resources readily available for the students. The students often come to my class in the middle of the year

ar and missing many skills. \r\n\r\nMy students come to school ready to learn about mathematics but they are in need of fun and interactive ways to do it!My sixth grade students enjoy completing hands-on math tasks in my class so I continually look for strategies and activities to motivate them to deepen their understanding of various math topics.\r\nMath games such as Hot Dots Fraction Cards, Minute Math Electronic Flash Cards, and Integer Operations Bingo will be used in stations and centers to reinforce sixth grade math standards. The students will complete tasks based on the rules of the games so they will practice and enhance their math skills while having fun in collaborative groups.\r\nThe implementation of math games will remind the students that learning can be fun!nanna
n
1108

My students come from a variety of backgrounds and cultures. They don't have much but they give a lot when they walk into my classroom each day. I want to make sure they have every opportunity to become the best person they can be.\r\n\r\n\r\nThe students at our school work incredibly hard from the minute they get here until the minute they leave. If they are willing to put in the work, then I know I have to work extra hard as well to support them. These iPads will be used by students in our classroom during our small group instruction block. It is incredibly important that students are able to work with their teacher in order to receive the extra they need to succeed. In order for this to occur, the other students in the classroom must have engaging activities to ensure they are also receiving high quality instruction, even though it's independent and without a teacher.\r\n\r\n\r\nOur school has purchased a revolutionary program called ST Math for our students. This nonverbal math program allows students to discover math on their own and in many different ways. If we have iPads in our classroom, the students that are not working with their teacher can use this program to support and extend their mathematical reasoning abilities.\r\nnnannan
1249

Observation: This tells about resources that they don't have and how it will help to improve the learning.

cluster 4

```
In [0]: print_clusters(4,cluster[3])
```

4 datapoints of cluster 4:

I have discovered that with nearly half of my \"non-writers\" the problem is not the writing but the handwriting. When I introduced computers to these writers they bloomed. Finally, they had a way to display their thoughts in a clear, fast manner that could be shared with others. \r\n\r\nWe are a public magnet school for high achieving and gifted children located directly downtown. This location affords us many opportunities for walking field trips to museums and concert halls in our neighborhood. Our students keep us on our toes and we are always looking for new and interesting ways to bring them current topics of discovery, this includes compacting instruction and adding differentiated levels of instruction and rigor to adjust to our diverse learners needs. Everyday during Writer's and Reader's Workshops, as well as during science, and social studies, my 4th graders and I discuss topics of great interest to inspire them, as writers, to research challenges of today's world using periodicals, books, and the Internet. I have individual student accounts set up on Google Classroom that encourage independence, sharing, and idea collaboration.\r\n\r\nMy material challenge is the lack of computers for group and independent student work. When we do have a classroom of computers, students using Google Docs can instantly share writing and contribute to the same document in real-time. I also develop mini-learning labs that are accessed via Google Classroom where students can work at their own pace learning, investigating, and completing answers to questions relevant to the lab topic. These labs include video, text with audio, and links to photos, articles, and other material that my students use to write to an opinion, expository, or narrative piece.nannan
1776

My students are enthusiastic! They love to learn, they love to play music, and they love to move. My students are overwhelmingly Hispanic and learn in English and Spanish during the school day.\r\n\r\nIn my school, every fifth grade student learns to play the trumpet. This is important because, even more than LISTENING to music, my students love to MAKE music. They love to learn how to read music notes, play the instruments, and bring their music to the community. When my students enter my room they have a routine. They need to get trumpets out of the closet, open them up, sanitize their mouthpieces (or go look for a mouthpiece if it is not in the case), and start their warm-up. This takes a lot of time and leaves the room with a bunch of cases lying around. Because of your donation to this project, we would be able to hang the trumpets up on the wall and put the mouthpieces in a basket. This would reduce our 10 minute opening routine to 5 minutes. That's a savings of 30 minutes a day, or, 2.5 hours a week! Please help my students learn the trumpet more efficiently and keep my room tidy!nannan
1105

Our students are wonderfully gifted, talented, and hard-working. Our students have a sense of school pride and want to try their hardest on every single activity in which they are involved. The activities they participate in, are a wide variety. They are so special to me and our community.\r\n\r\nWe have a such a sense of school, and community pride. It's great to see our students thrive in this environment, and we want to continue to give back to them, more and more. We want to show them how much they mean to us. Your generous donation will help in the obtaining of very important equipment for our very young people. We are asking for removable hoops that can hang on the wall. There is a bracket that will be mounted to the wall at around the 6 1/2 or 7 foot level for the little kids. When we are not using them they can be removed by sliding the hoop out of the bracket.\r\n\r\nWe never want any kid to stop trying, so we need to offer alternatives

to set them up for success. These hoops and brackets will offer our little guys and girls the chance to be just like the big kids and actually do the skills and games that they do!nannan

1136

My students are extremely eager to learn more about gender constructs and how to combat them. They are from all areas of New York City, a variety of racial and ethnic backgrounds, work diligently and inquisitively, and have been studying gender constructs for the past 3 weeks. \r\n\r\nThey are so engaged in this deep dive into psychological and systemic understanding of gender! We have watched Killing Us Softly by Jean Kilbourne and The Mask You Live In by the Representation Project and also listened to an episode of What Would A Feminist Do? by Jessica Valenti. They have already explored so much and now we need to help them see how to combat these problems. \r\n\r\nThese materials will help students be able to connect their knowledge about gender constructs to actual experiences that they have and others have in society. They will learn the causes of sexual harassment and how to combat it, whether they are male or female. \r\n\r\nThey will read for homework and come to class prepared with discussion questions and comments like a college seminar. This model will help them process what they have read while also modeling the way higher education works. At the end, a culminating project will be focused on activism and how they can affect change in their own lives and those around them.\r\n\r\nnnannan

1317

Observation: This tells about what are the resources they are lacking and in need for.

cluster 5

```
In [0]: print_clusters(5,cluster[4])
```

4 datapoints of cluster 5:

My kindergarteners attend a Title 1 elementary-middle school in Maryland. In addition to facing the challenges that come with growing up in a low-income community, many of my students also face the challenge of not being native speakers of English. They are so excited to be in school and learning each and every day! There is a strong sense of community in our classroom and students are encouraged to treat each other with kindness and respect. \r\n\r\nWe are trying to create a comfortable and welcoming environment in which students are able to showcase their talents, share their ideas, and expand their knowledge to become successful learners. A large part of learning in the early years happens through play. Although students participate in read alouds and guided reading and math activities every day, the place that they are most able to apply and solidify their learning is in their independent play. This opportunity to engage in free play is made more important by the fact that these specific students need the opportunity to practice their newly acquired English language skills in a comfortable and non-threatening environment with their peers. We were so fortunate to receive an order of big books that will help my students learn to read. They are large so that students can easily learn to point to each word, use the pictures to help them read, identify punctuation, and practice various other literacy activities. But, as you can imagine, these very large books are very difficult to store! We need a large, but practical, storage place that is friendly to little hands. In order to fully benefit from our generous donation, the kindergarteners must be able to independently retrieve, use, and store the fabulous big books!nannan
1749

I currently have 25 six- and seven-year-old students in my classroom. I am teaching first graders in a Title I school, located in a high poverty and high crime area of Pennsylvania.\r\n\r\nAll of my students receive free breakfast and lunch. Many of my students come from homes where English is not spoken. I have three special education students and two ESL (English as a Second Language) students in my classroom. Several of the students in my classroom have an in-class social worker. My students have been reading the Knuffle Bunny books by Mo Willems.\r\n\r\nMy first graders will be doing an Author's study with books by Mo Willems.\r\n\r\nIt has been suggested to us by a dear friend and supporter that we should read the Elephant and Piggy books. Since we only have one Elephant and Piggy book, we decided that we should get some additional books.\r\n\r\nWe are also hoping to get videos with stories by Mo Willems such as Knuffle Bunny and the Pigeon series.\r\n\r\nPlease help support our Mo Willems author study by getting us wonderful books and videos by him. Thanks so much for your help with this exciting project.nannan
1118

For many of my students, this is their first year in a structured school program. Most students have had no previous preschool experience. They are just entering into the world of education where I strive to create a positive learning environment that will help build a strong foundation of learning for them to build upon over the next 12+ years.\r\n\r\nMy students enter the classroom each day with an excitement for learning that cannot be described. They are eager to be challenged with new ideas and learn so much from their interactions with each other through hands on activities and conversations about what they see happening. Parents are a child's first educator! These materials will help to keep parents involved in their young students' learning. My students' parents have very little knowledge of what their students do all day at school. Once the student

s begin to read, they don't know how to help them or where to find books to support their new found skills. My students are eager to show their parents their ability to read but lack the materials to do this.\r\nThese materials will help my students bring their learning home to share with their families. The books will be used as take home reading materials. Students will take home two to three books a week to read to an adult family member. These books will then be returned and reused with other students. This will not only boost their reading ability, but will also boost their confidence in their learning! Which in turn, will impact their learning not only this year, but for years to come.nannan
1581

My students love to read. The majority of my students are on free or reduced lunch. Our school has been categorized as one of the lowest three hundred schools in the state. They are in a school that doesn't have much technology or literacy support. My classroom has four desktop computers. That does not allow sufficient time for literacy remediation. The students need to be exposed to resources that can enhance their learning experiences in all subjects daily. Most of our students come from homes that do not have basic technology and cannot afford additional resources. My students need reading center activities to help improve comprehension, fluency, syntax, and phonics skills in reading. These activities will be used in the class during center time. My students will use the material to build their word work, decoding, comprehension, and fluency. They will also learning how to comprehend difficult vocabulary words with the bingo activity. While the beginning of the school year students are mostly learning about new words and how to put them together, the second part of school year is all about the comprehension and moving up in levels. I want my students to be ready for their next grade where they start reading chapter books and are able to pick genres that they like. I would like them to be well versed in all types of reading and various texts. I want them to excel using these material independently in centers.nannan
1438

Observations: This tells what students are upto and how donation helps them.

Word cloud

cluster 1

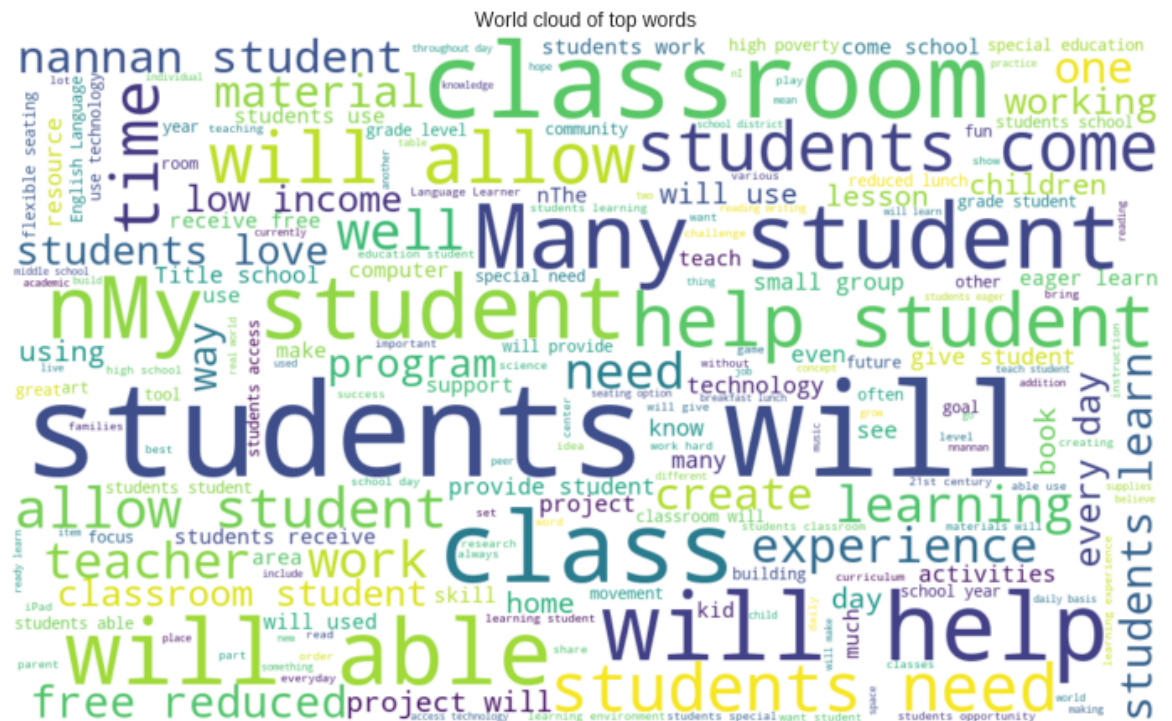

```
plot_wordcloud(cluster[0])
```



These are the words that are used in cluster 1

cluster 2

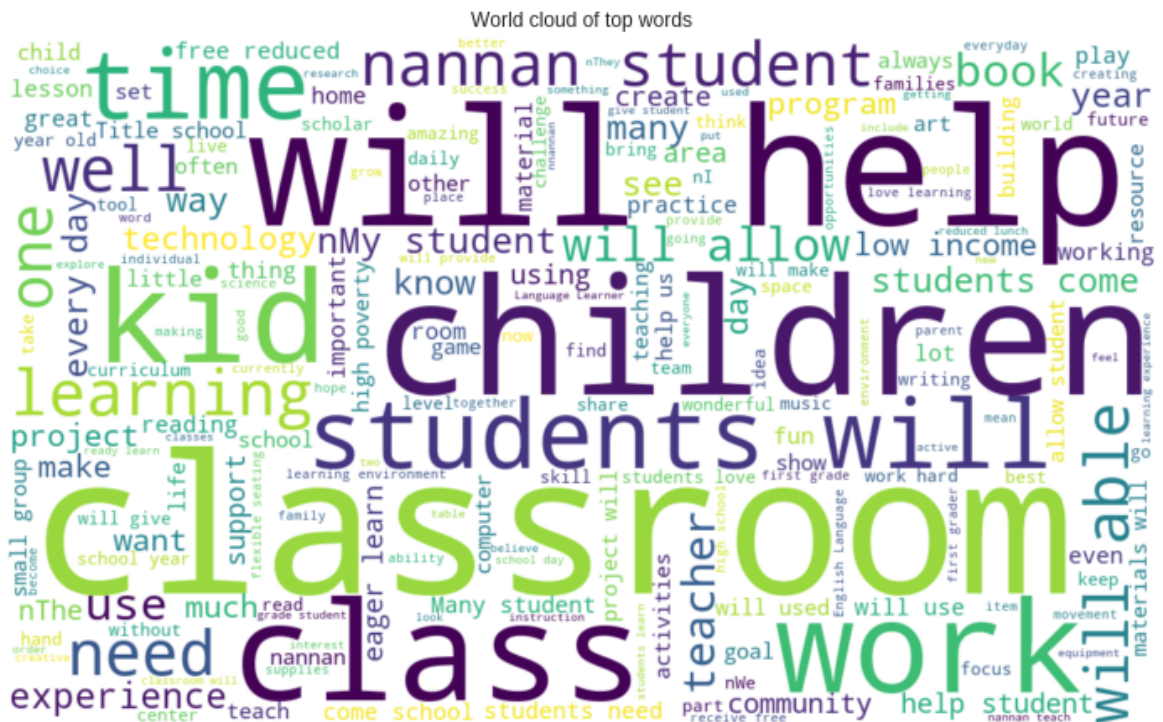
```
plot_wordcloud(cluster[1])
```



cluster 3

cluster 4

```
In [0]: plot_wordcloud(cluster[3])
```



These are the words that are used in cluster 4

Agglomerative Clustering

With no. of clusters as 2

```
In [0]: %time
small_sample = X_tr_new[:20000]
essay_text = X_train['essay'][[:20000]].values

n_cluster = 2
cluster = [[] for i in range(n_cluster)]
model = AgglomerativeClustering(n_clusters=n_cluster).fit(small_sample.toarray())
for i in range(model.labels_.shape[0]):
    cluster[model.labels_[i]].append(essay_text[i])
```

CPU times: user 22min 55s, sys: 539 ms, total: 22min 56s

Wall time: 22min 56s

cluster 1

```
In [0]: print_clusters(1, cluster[0])
```

4 datapoints of cluster 1:

I have an amazing and unique class of thirty 5th graders. My students come from many different socioeconomic backgrounds. My school is considered high poverty. In my classroom 80% of my students qualify for free or reduced lunches, 10% are Native American, 65% African American, and 5% Hispanic. They are diverse learners who have a passion for learning and are always willing and eager to learn. My students tend to learn better when they have hands on resources versus just doing a worksheet. With 30 students reaching each individual learner can be a challenge. Having interactive and engaging reading stations can help meet the needs of my students and help engage them in hands on higher order thinking activities.

A student attains 'higher order thinking' when he/she no longer believes in right or wrong". "A large part of what we call good teaching is a teacher's ability to obtain affective objectives by challenging the student's fixed beliefs....a large part of what we call teaching is that the teacher should be able to use education to reorganize a child's thoughts, attitudes, and feelings.

- Benjamin Bloom

This can be achieved through the use of reading stations!

1200

I teach in a low-income/high poverty neighborhood; many of my students must overcome obstacles children should never have to deal with. 88% of the students in my school live at the poverty level or below. \r\nMany of my students live in crowded, low income housing with very little material objects to call their own. Due to their living situations and life experiences it is hard for them to imagine a world beyond their community. The classroom is their safe haven, connection to the world and the key to a successful future!TIME Magazine for Kids and Scholastic News will provide a full-color, physical magazine for each of my students weekly, as well as digital access. I teach students that come from low-income homes with limited access to the news and personal reading material. These magazine subscriptions will open up the world for my third graders!\r\n\r\nGlobal awareness is a trait which must be developed in children through engaging platforms. Nonfiction reading skills must also be attained by children to ensure their success as readers. Using the subscriptions to TIME Magazine for Kids and Scholastic News I will be able to expose my students to current events happening around the world, as well as provide colorful, current, engaging nonfiction text for them to read and keep. \r\n\r\nnnannan

I have the pleasure of working at my dream school. I get to teach a group of students that is excited and motivated to come to school. \r\n\r\nMy school is a small rural school in a farming community. The community is very supportive of its students. We have an amazing family feel and every staff member knows every child's name. The students at are school are some of the most empathetic, spirited, intelligent, fun kids to be around. It is a joy to spend my days with the m.I have found several apps that have proved to be very effective. However I currently bring my own personal iPad to school everyday for the kids to use. One iPad for 18 students doesn't give each child an opportunity to be successful. \r\n\r\nMy ultimate goal for my classroom is to have 6-8 iPads for student use. I feel my students could make measurable growth with these apps if used a few times a week. We have a school mobil ipad cart but it has to be shared between all grade levels. \r\n\r\nI also want to set my students up for success. Not all students have access to technology at home. I want to give all my students an equal playing field by providing them exposure to multiple types of technology. Purchasing iPads is only the beginning!nannan

1224

We are a Title I school in which families are from a low social economic status. My gifted students are always eager to learn and be challenged. They are always curious about things around them and enjoy learning and researching a variety of things despite the lack of resources.

My students are always challenged to "Think Outside the Box"-and to put their thinking caps on as our brains are fed with a growth mindset. Each of my students is unique and special in their own special way and I always instill that no matter what's around us-They can always make a difference!

The tablets will enhance my students research skills and therefore improve their school lives by having the technology at hand to provide them with up to date information that can be utilized to acquire new knowledge.

My students will get an opportunity to research, explore, and inquire different engaging topics that will enrich their lives and inquisitive minds with knowledge forever. They will then transfer this new learned knowledge and improve their writing skills, as well as their ability to produce PowerPoint presentations in which they get to orally present and pass on to their friends and families.

Our classrooms are not yet at the level technologically to meet their needs as learners. This grant will help to close that gap just a little bit more.

1370

Observation: This tells about what are problems that the student faces and how resources will help them.

cluster 2


```
In [0]: print_clusters(2,cluster[1])
```

4 datapoints of cluster 2:

All of my students have been identified as special needs students based on academics, physical, or emotional challenges. The students that will benefit from this project being funded are reading below grade level.\r\n We are in a Title I school and many of our students do not have the advantages of personal technology that would provide a better opportunity for them to achieve academic success. \r\nThese students are encouraged to read nightly at home and they participate in guided reading groups at school on a daily basis. They are very excited about the possibility of hearing themselves read. The majority of them have never listened to a recording of their own voices. The excitement of recording their voices and hearing how they read is certain to motivate them to improve their reading fluency and ultimately increase comprehension of both fiction and nonfiction text.\r\nThe students are very hard workers who appreciate the time and effort given to help them succeed.On numerous occasions, I have questioned students that I teach about their goals in life. The most frequent answer is they don't have any goals or aspirations. Many of them are attending school because they are required to and are not thinking about goals beyond completing fifth grade and going to middle school. \r\nAs they read to record and evaluate fluency, they will be exposed to unfamiliar cultures, life opportunities, and careers. Dreams and visions will be developed as they visit places they have never been and are exposed to occupations they may not know exist. The desire to record and listen to their voices will require them to read more, both fiction and nonfiction text.nannan
1686

Our scholars are some of the most hardworking 6- and 7-year-old children. Many come from homes with little support, and coming to school is not only important for them, but it is the place that they have the opportunity to grow and shine.\r\n\r\nThese scholars work hard every day learning to read, write, add, subtract and more. Our first grade teachers love to find opportunities for our scholars to play and to be children! Our scholars rarely complain about the limitations they are given; instead, they find ways around them.These books will help my students continue to find a love for reading through a variety of topics with books that are at just the right level for them. Many of my students have just started reading independently but have discovered a love for reading and are flying through books at an amazing rate.\r\n\r\n\r\n"Reading gives us a place to go when we have to stay where we are". My students love to read, explore and learn through books and they continue to dream about the places they will go and the things that they will see and learn. Through the donation of additional books for our classroom library, my students will be able to explore and learn further without leaving the safety and security of our classroom.nannan
1252

The students at R. K. Middle School are diverse, hardworking, kind, and striving to be great community members who are empowered through education. The majority of students receive a reduced lunch. \r\n\r\n\r\nOur students received an outstanding API score and we are a pillar for surrounding schools to follow. By demonstrating respect, responsibility, honesty, and a wide range of other character traits and engaging in rigorous reading and math programs coupled with many non-core subjects, students are being well prepared for their future.Our school has developed a strong literacy program through a program called Reading Counts. The students are eager to read the books and take the assessments. This will empower students to develop literacy skills such as comprehension, vocabulary knowledge, and imagination. We want our students to be life long learners and

d critical thinkers and literacy must be at the foundation. This project will make content more easily accessible and will give our students a wide variety of books to choose from. We will be forever grateful and our students will go on to serve our communities, nation, and the world!nannan
1163

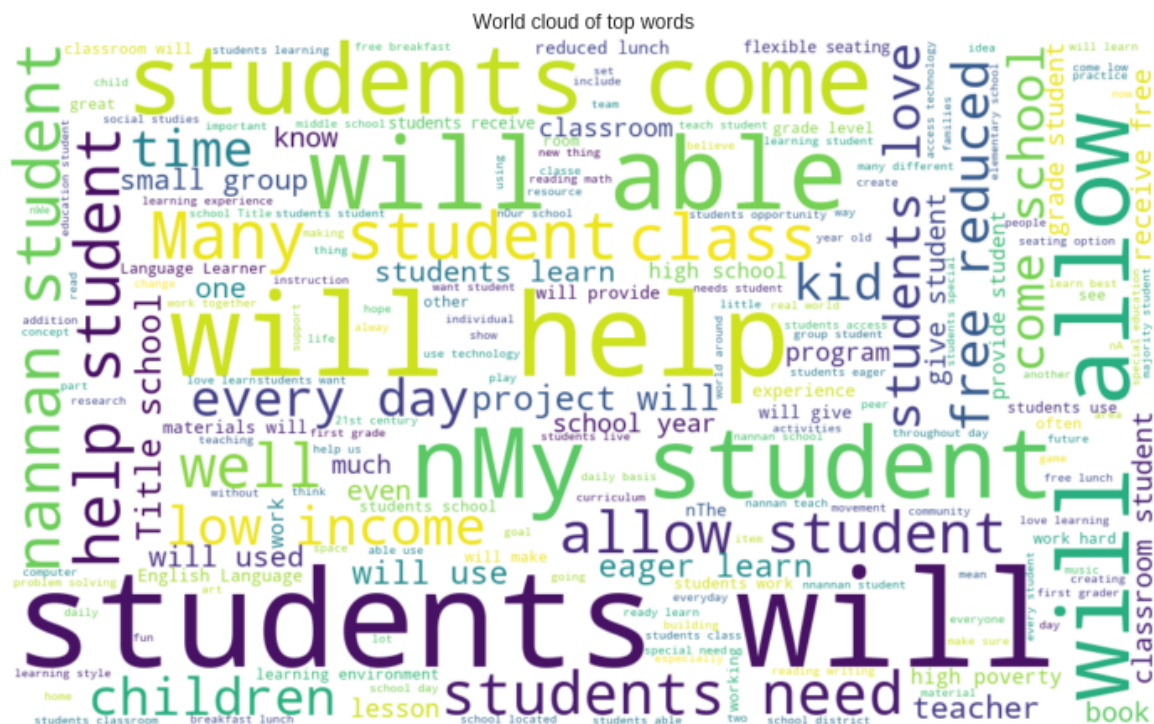
My kids are wonderfully creative and remarkably resilient. Many come from loving homes in this small, caring community, but too many come from homes where poverty is a way of life.\r\nFor the most needy of our kids, school is a refuge; they get 2 meals a day, teachers care if their needs are met, and there is always someone to listen and respond to them.\r\nI want to create an environment where books are abundant and easy to access. A place to call home!The fifth grade has just made a move from the elementary school to the middle school. In the process, we had to leave behind our giant closet and our big shelves and now we have boxes and boxes of books all over the room!\r\nTeaching literacy doesn't just mean teaching children how to read, it also means teaching them how to find the books that they will love to read. These 2 shelving units fit neatly beneath the bulletin board and would easily hold 300 books for kids to browse and borrow! If you want kids to read you have to make books accessible! By stretching our library out over eight feet, several children can browse at the same time.nannan
1113

Observations: It tells about how having the resources related to reading, literature will help to increase the knowledge of student.

Word cloud

cluster 1

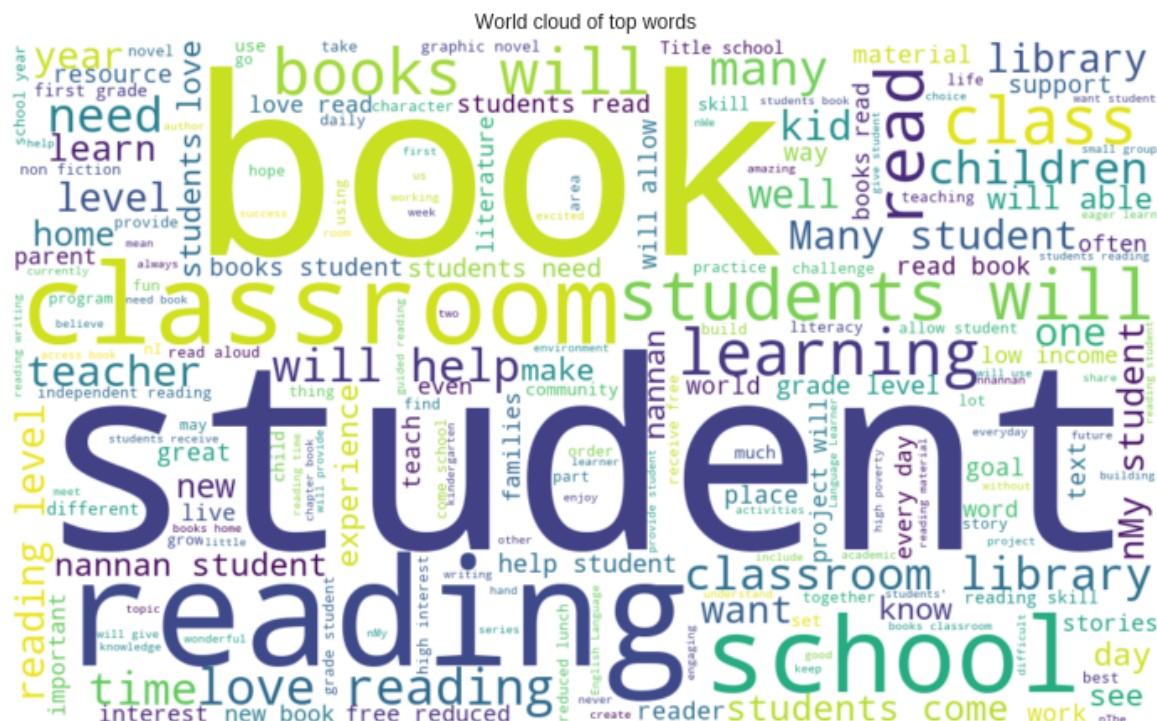
```
In [0]: plot_wordcloud(cluster[0])
```



These word cloud represent cluster 1, students,will, help are the most frequently used words which tells this cluster is mostly about their needs.

cluster 2


```
plot_wordcloud(cluster[1])
```



These are the words that corresponds to the cluster 2. The one with the higher frequency are student,book,reading so this cluster is related to student

With no. of cluster as 5

```
n_cluster = 5
cluster = [[] for i in range(n_cluster)]
model = AgglomerativeClustering(n_clusters=n_cluster).fit(small_sample.toarray())
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1370

Observation: This tells about what are problems that the student faces and how resources will help them.

cluster 2

```
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```

4 datapoints of cluster 2:

Our school is a charming little K to 8 school in the Philadelphia School District. We have a wonderful staff and community who despite budget cuts work very hard to provide our students with the best educational experience. The students come to school to work hard and learn new things everyday. \r\n\r\nEspecially the Kindergartners, who start each and everyday bursting with excitement and eagerness to learn.\r\n\r\nIn Kindergarten, I work hard to enable our students to develop a love of learning and reading. I love seeing the joy on their faces when they are learning and working together. My students come from all different sections of the city and have to learn how to adjust to a new school as well as work together. We often have students whose first school experience is Kindergarten. By the end of Kindergarten, they work together like a well oiled machine. It's amazing to watch the transformation!\r\n\r\nLast year we had one wobble seat in our classroom and all the students were eager to sit in this special seat. Many of my students suggested we get more wobble seats to use during small group work and reading groups. \r\n\r\nThese wobble seats provide an outlet for energy and restlessness. \r\n\r\nKindergartners can be a very energetic bunch. While we do take time for movement breaks throughout the day. It is my hope that these wobble seats allow some of my more energetic students the opportunity to let some energy out so they can focus on the task at hand. One task we hope to focus on is the My Plate Game, so the students can learn about healthy eating options while they wobble in the wobble chairs.nannan
1650

My classroom serves a diverse group of learners ranging from kindergarten through middle school- each and everyday is different, just like my students! Through determination, grit, and a whole lot of resiliency, we are navigating the world and all it has to offer together. \r\n A place of wonder, curiosity, struggle, strength, and joy- I strive to cultivate an environment that provides a place of consistency and understanding as students balance their sensory needs with academic rigor. \r\n My students work hard to overcome life's hurdles and deserve the resources to help them learn and thrive. My special education students persevere through challenges and limitations in my classroom each and every day as they learn and practice foundational academic skills. With the acquisition of math, literacy, and daily living skills comes the need to teach and promote independence. I am requesting Math and Literacy games and Listening Headphones, as well as some organizational tools and supplies to allow my students to access and interact with the classroom materials independently.\r\n Having these materials will help my students to gain a level of independence needed to boost their self-confidence and succeed both in and out of the classroom environment. \r\n In Special Education, my students face a lot of challenges and often hear the word \"can't.\" I want to help my students to develop a sense of self-worth, pride in their abilities and accomplishments, and the motivation to say \"yes we can!\" \r\nnannan
1537

My fourth grade students are creative, persevering, and eager learners. They encourage each other to be successful and to maximize all tools available to assist them in their accomplishments.\r\n\r\n This year they will enter a brand new classroom with limited resources for flexible learning.\r\n\r\nMy fourth graders are so excited to be the first fourth grade class at our new school. With us moving into a brand new school, we only have the basic necessities. My students deserve more than the bare minimum to maximize their learning experiences. Using the workshop model in reading, students come to the half moon table to work

k with me for small group instruction. Students need to bring their own chair, which takes time and causes extra distractions including movement and sound.\r\n\r\n The Gaiam Balance Ball Chairs would be an addition to our center and provide students with an alternative seat.\r\n\r\nThese seats would promote perfect posture for students to strengthen abdominal and back muscles, as well as strengthen core muscles and improve posture while sitting. Studies have proven the ability to move around more while sitting made students more attentive. Gaiam Balance Ball Chairs would help meet the needs of all students deeming them particularly helpful for children with special learning needs and those who have trouble focusing in school.nannan
1377

My students come from mostly a lower to middle class neighborhood. They are energetic, creative, sharp and full of personality. Everything I bring to my classroom is to enhance learning, and create more excitement about the lessons.\r\n\r\nI want to bring real life examples to my classroom to enhance the depth of my students' learning. They love Science and Social Studies! They love thinking outside the box! I am teaching them to be individuals and think and act creatively. \r\n\r\nPlease help my classroom be the best space for my students!!A sturdy classroom mailbox center will help our class be more organized! We will use this mailbox to keep office notes, and all corrected work. Students tend to be more accountable for their paperwork, if they have their own storage place. It also gives us a chance to assign a class job to monitor and organize all paperwork. Less papers will be lost or forgotten. Parents can also visit the classroom and know where their child's work will be. It's a win win project for parents, students, and especially me, the teacher. Thanks for your support in funding this project.nannan
1132

Observations: It tells about what resources are needed to make better class environment for the students.

cluster 3

```
In [0]: print_clusters(3,cluster[2])
```

4 datapoints of cluster 3:

My 56 third grade students, split into three classes, are residents of an urban community in Washington, D.C. We are a high poverty school where 100% of my students receive free lunch and have limited access to technology at home. Despite these challenges my students are eager to learn and read every day! My school has very limited technology resources that we must share within the building. \r\nMy intermediate students need as much practice as they can get using technology during their day to day learning activities and to perform well on end of the year assessments. Blended learning or learning using technology programs, has proven to accelerate a child's level of proficiency in reading. The access to using iPads during literacy centers will provide an engaging learning experience and a positive learning culture which fosters motivation to become a better reader. The use of five iPads and five cases will increase collaboration between students and creativity while working through different applications. During literacy centers for reading, my third graders will interact with different programs to help increase their reading proficiency levels and practice for end of the year standardized test. This is so critical during the pivotal year of third grade. \r\nThe last school year began with 54% of students on or above grade level in reading and increased to 63% by the end, imagine how much the student's reading levels will soar with technology. I look forward to celebrating with my students when they achieve their reading goals and master the end of the year standardized test.\r\nnnanan
1617

Our school is a small, community-based school in a rural area. We are so blessed to have an amazing student population with students who are passionate about learning and playing. We are also blessed to have an amazing team of teachers who believe play and movement are important parts of a balanced educational experience for our students. \r\n\r\nOur school supports and encourages daily physical activity for all students. This project will allow students to explore physical activities and stay active with a variety of materials that promote exercise and teamwork. Students in our school love recess time! It is the time of our day when free play, social skills and most importantly, movement are encouraged. Our playground is busy with activity every day and teachers understand the value of this time. While we are fortunate to have a great playground, there are only a few playground balls that are shared among students. When asked what kind of project they wanted, a project to give them more choices at recess quickly created excitement among our amazing students! They are excited to have this project funded. These materials will have a great impact on students in our school as it will provide them with further opportunities to play and learn together as well as chances to explore sports that they may be interested in trying. As many of our students participate in team sports and still others are not able to do so, this project will be a great opportunity for students to teach one another and learn from peers. Students who play soccer on a team will become teachers to lead those students who haven't played before. \r\n\r\n\r\nThis kid-inspired project was created with student input and includes a variety of materials to allow students to play cooperative games as well as equipment that will promote creativity, teamwork and free exploration. Students may choose to work together to play flag football, soccer, basketball or kickball. They may choose to use the Let's Get Moving Activity Mats to set up obstacles courses and challenges for themselves and their classmates. They may use the parachute to foster creative movement and teamwork. Whatever they choose to do, they will be working towards our school's goal for every child to be active for at least 60 minutes every single day!nannan

I work with English Language Learners (ELLs) in grades K-5, which is approximately 25% of our school population. Our students come from diverse cultural, linguistic, and socioeconomic backgrounds. \r\n\r\nMy ELL students are joyful, strong, and resilient. Some have just arrived to the United States and are not only learning English but are also adjusting to a new culture. My school is in the process of becoming an International Baccalaureate (IB) school, and our entire staff works together to help students be \"caring, principled, thinkers\" on a daily basis. My ELL students work extremely hard. Some are literate in their first language and are emergent readers in English. All students are working on developing academic language, vocabulary, and reading comprehension. My first grade students have been asking for these tablets because they see the older kids using them for reading books. We need more at our school so younger students are able to use the tablets as educational resources too. \r\n\r\nThese Amazon Fire tablets will allow students to use educational apps and software to learn English in an engaging and interactive way. We use an online reading program that reads aloud books to students and matches them with appropriate texts to further their reading skills. I can also put learning games on the tablets for students to play. Many of my students do not have access to technology, such as tablets, at home. Getting to use tablets at school would be both exciting and motivating for them to grow their literacy skills. \r\n\nnnannan

Observations: It tells about how having the resources will make the learning and classroom better.

39/52


```
In [0]: print_clusters(4,cluster[3])
```

4 datapoints of cluster 4:

All of my students have been identified as special needs students based on academics, physical, or emotional challenges. The students that will benefit from this project being funded are reading below grade level.\r\n We are in a Title I school and many of our students do not have the advantages of personal technology that would provide a better opportunity for them to achieve academic success. \r\nThese students are encouraged to read nightly at home and they participate in guided reading groups at school on a daily basis. They are very excited about the possibility of hearing themselves read. The majority of them have never listened to a recording of their own voices. The excitement of recording their voices and hearing how they read is certain to motivate them to improve their reading fluency and ultimately increase comprehension of both fiction and nonfiction text.\r\nThe students are very hard workers who appreciate the time and effort given to help them succeed.On numerous occasions, I have questioned students that I teach about their goals in life. The most frequent answer is they don't have any goals or aspirations. Many of them are attending school because they are required to and are not thinking about goals beyond completing fifth grade and going to middle school. \r\nAs they read to record and evaluate fluency, they will be exposed to unfamiliar cultures, life opportunities, and careers. Dreams and visions will be developed as they visit places they have never been and are exposed to occupations they may not know exist. The desire to record and listen to their voices will require them to read more, both fiction and nonfiction text.nannan
1686

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1163

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1113

Observation: It tells about how having the resources related to reading, literature will help to increase the knowledge of student.

cluster 5

```
In [0]: print_clusters(5,cluster[4])
```

4 datapoints of cluster 5:

Our students in San Francisco are intelligent, free-spirited and curious. They have fully embraced the growth mindset and the power of \"yet\" by understanding that learning requires failure, information of why they failed and continued hard work to get better, while valuing their successes as a product of knowledge and hard work and a stepping stone to something even greater.\r\n\r\nAt our school the students consider Physical Education as a academic subject area, and NOT as purely activity time. They respond with excitement to monitoring their heart rate during activity rather than existing under the general idea that movement is good for the heart. They use all their classroom skills within their PE classes. Determining their hear rate per min, journal entries about progress and goal setting, charting and vocabulary building. These come into play when the students are given the data and tools needed to own their Physical Education and lifetime fitness rather than be a passive bystander. Fitness is a lifetime activity, one that we all know we should value, but maybe don't always, at least to the level we would like. Some might go to a gym, run, swim or walk for exercise. Students know it too. They know that they will need to exercise to stay healthy, but like students in any subject area, they still need to learn WHY exercise is important and WHAT it is.\r\n\r\nFitness tracking will motivate students to learn both WHY exercise is important and WHAT it is. When there's a number attached there's a progression of inquiry. \"How many steps did I take? What's my Heart Rate when exercising?\" These question spur on the next logical set of questions. \"How many steps SHOULD I take? What SHOULD my Heart Rate be when I'm exercising?\" And it's individual to each student, just like exercise should always be.\r\n\r\nFinding a way to encourage students to ask these kinds of questions motivates them to achieve the goals that are embedded in the answer. \"I want to take 10% more steps a day. I want my Heart Rate to be around 170 beats per min when exercising my heart and lungs for 15-20 min.\" \r\n\r\nStudent s that know WHAT fitness is, WHY it's important and HOW to track it are much more likely to value it... for LIFE!nannan
2252

My school is Title I with 87% of our students qualifying for free and reduced lunch. We are also a magnet school. Students come from all over the district for our Science, Technology, Engineering and Math (STEM) theme. Each grade level also has a theme: 6th graders investigate global planting, 7th graders focus on global sustainability, and 8th graders explore Global Engineering. \r\n\r\nI teach math and architecture with a focus on problem solving and cooperative learning. Students are encouraged to work together to find creative solutions. I coach a middle school girl's volleyball team and it can be challenging to get the supplies we need. For many students, this is the first time they have ever played and the equipment to practice and play is expensive. We would use these ball carts and bags during practice to ensure drills run smoothly. My girls will use the kneepads on game days so we look like a team wearing the same gear. The gym gets very hot while we play and the girls are always running to the water fountain. They will use the water bottles and carrier to stay hydrated during the game.nannan
1119

I teach at a Pre-kindergarten and kindergarten school with families from a variety of ethnic and economic backgrounds. Our school is a Title I school where all children receive free lunch. My class is an inclusive kindergarten that serves children with developmental and hearing disabilities as well as children who are not identified as special needs.\r\n\r\nMy children come each day excited t

o learn! We spend lots of time together on the carpet doing calendar and other group activities as we learn how to be a part of a school family. My class needs a large rug and an easel for our group time gatherings. A large rug will give us plenty of room to sit and the easel will put all we need for group time in one place!\r\n\r\nGroup time, especially in the morning, is a great time for my children to do group learning and work on being a school family. A large rug will give each child their own space to sit without crowding while we learn. We do calendar, brain breaks and shared reading. An easel will provide storage for all the items needed for our lessons.nannan
1072

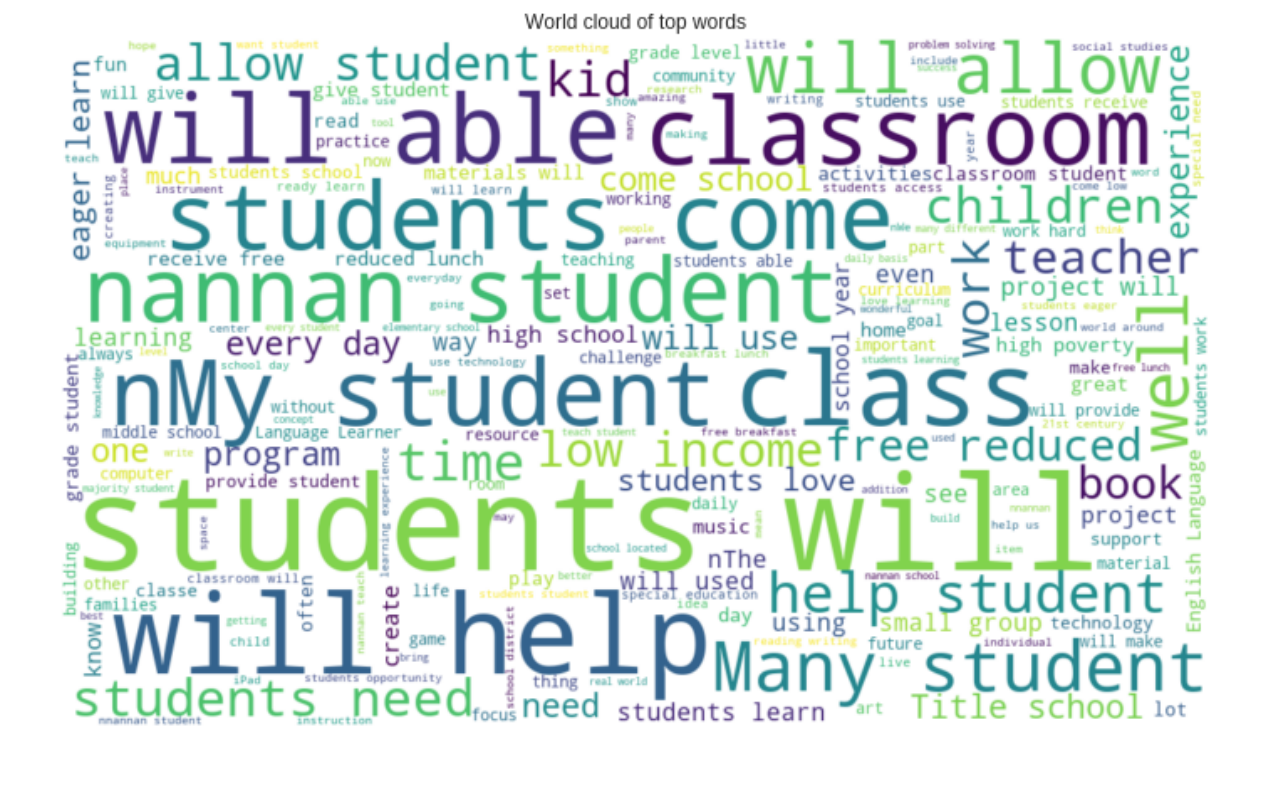
Children are hands-on learners. It is essential that teachers can provide their students materials that allow them to learn in ways that meet their various unique needs. Children need a chance to experiment as they learn. \r\n\r\nMy classroom is in Michigan, bordering Detroit just to the south.\r\n\r\nMy students come from a wide range of backgrounds, experiences, and family structures. For some of my students, our school is their first structured educational environment, while other students come from many preschool experiences. \r\n\r\nNo one likes to sit all day-especially young children! More and more children are expected to sit to write and work during the school day. Providing alternative seating options such as these ball chairs will help children who need to move, shake, and wobble during the school day as they complete their reading or writing. Both their academic requirements and their body's needs will be met. \r\n\r\n\r\nChildren are looking for sensory input and these ball chairs can provide appropriate sensory input for students which allows for children to focus on their work while moving their bodies. Having chairs with legs will help the children keep the bouncy ball under control versus having it go all around the room or used inappropriately. It is vital that teachers provide the tools children need to meet their maximum potential!nannan
1371

Observation: It tells about what are the resources they need to make the classroom better and what help in curriculum activities.

Word cloud

cluster 1

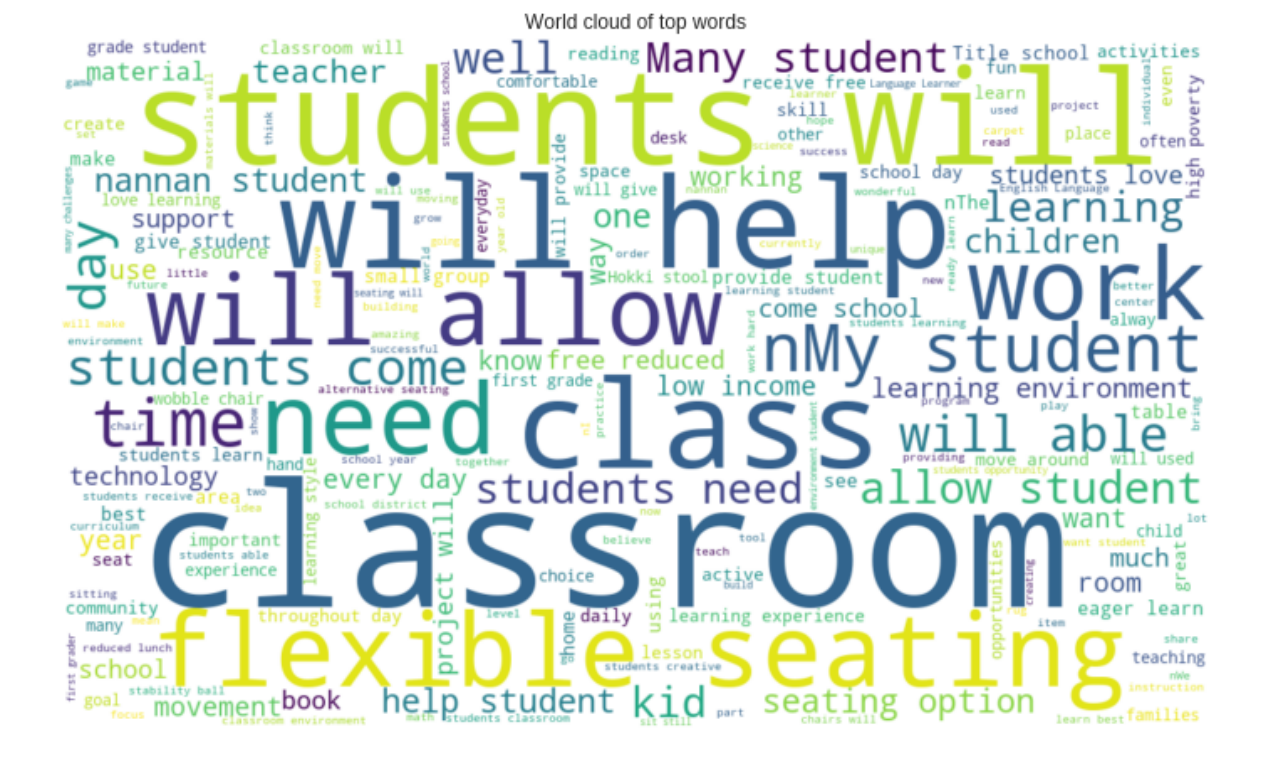
```
plot_wordcloud(cluster[0])
```



These are the words that are used in cluster 1

cluster 2

```
plot_wordcloud(cluster[1])
```

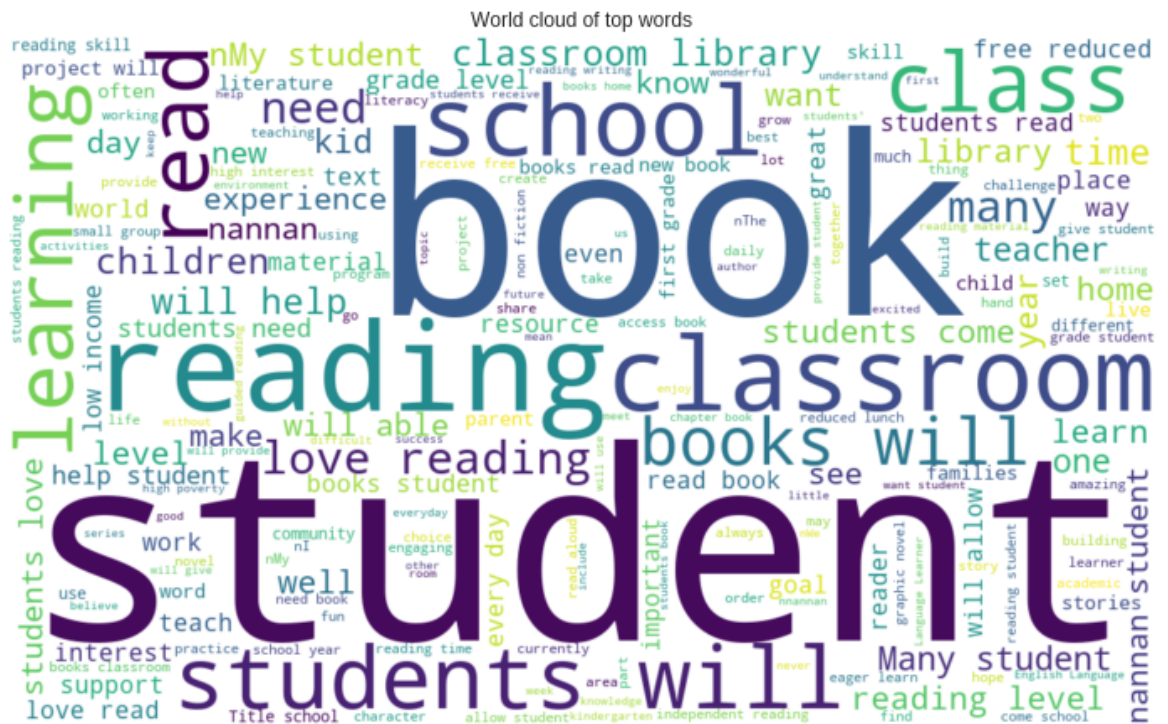


cluster 3

[illegible]

cluster 4

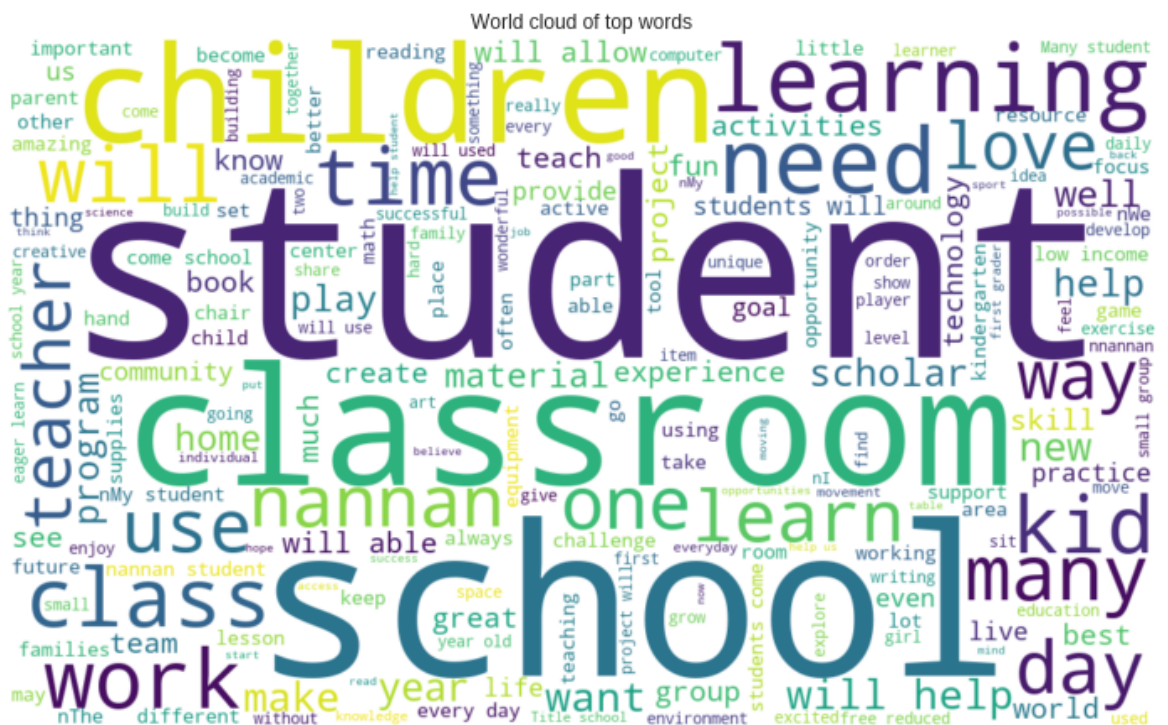

```
plot_wordcloud(cluster[3])
```



These are the words that are used in cluster 4

cluster 5

```
plot_wordcloud(cluster[4])
```



These are the words that are used in cluster 5

DBSCAN

```
In [0]: !pip install kneed
```

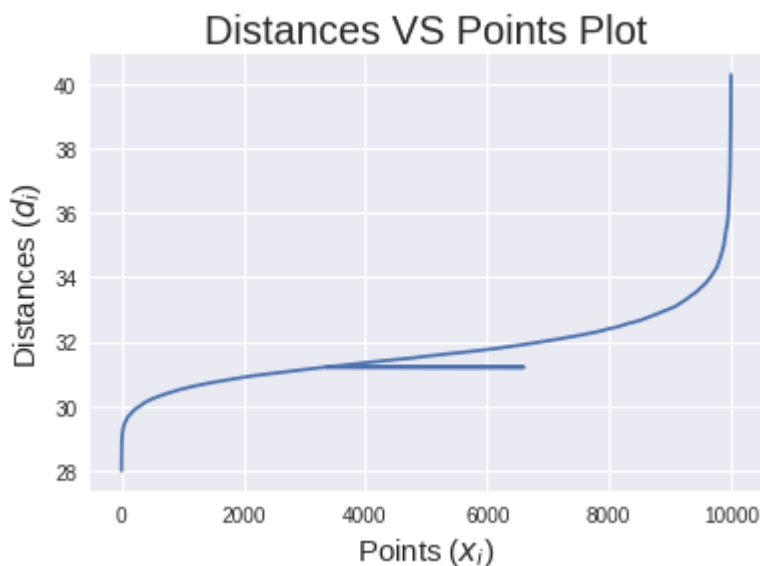
```
In [0]: %%time
small_sample = X_tr_new[:10000]
essay_text = X_train['essay'][:10000].values
```

CPU times: user 14.3 ms, sys: 146 μ s, total: 14.5 ms
Wall time: 14.7 ms

Elbow method to find eps

```
In [0]: %%time
minpts = 2*small_sample.shape[1]
nbrs = NearestNeighbors(n_neighbors=minpts).fit(small_sample.toarray())
distances, indices = nbrs.kneighbors(small_sample.toarray())
distanceDec = sorted(distances[:,minpts-1])
plt.plot(indices[:,0], distanceDec)
'''from kneed import KneeLocator
kn = KneeLocator(indices[:,0], distanceDec, curve='convex', direction='increasing
print(kn.knee)'''
plt.xlabel('Points ($x_i$)',size=15)
plt.ylabel('Distances ($d_i$)',size=15)
plt.title('Distances VS Points Plot',size=20)
```

CPU times: user 1min 10s, sys: 317 ms, total: 1min 10s
Wall time: 42 s



```
In [0]: from kneed import KneLocator
kn = KneLocator(indices[:,0], distanceDec, curve='convex', direction='increasing')
print(kn.knee)
```

9981

```
In [0]: ind = indices[0].tolist().index(kn.knee)
distanceDec[ind]
```

Out[74]: 32.494271031314824

```
In [0]: %%time
optimal_eps = 32
model = DBSCAN(eps = optimal_eps, min_samples = minpts)
model.fit(small_sample)
```

CPU times: user 10.1 s, sys: 228 ms, total: 10.3 s
Wall time: 10.3 s

```
In [0]: print("Total number of cluster with label -1 is: ", list(model.labels_).count(-1))
print("total number of cluster with label 0 is: ", list(model.labels_).count(0))
```

Total number of cluster with label -1 is: 0
total number of cluster with label 0 is: 10000

```
In [0]: labels = model.labels_
# Number of clusters in labels, ignoring noise if present.
n_clusters_ = len(set(labels)) - (1 if -1 in labels else 0)
n_noise_ = list(labels).count(-1)

print('Estimated number of clusters: %d' % n_clusters_)
print('Estimated number of noise points: %d' % n_noise_)
```

Estimated number of clusters: 1
Estimated number of noise points: 0

```
In [0]: cluster = [[] for i in range(2)]
for i in range(model.labels_.shape[0]):
    cluster[model.labels_[i]].append(essay_text[i])
```

cluster 1


```
In [0]: print_clusters(1, cluster[0])
```

4 datapoints of cluster 1:

Let me introduce you to my 5th grade classroom. It is made up of approximately 150 young scientists who love to explore, investigate, and learn. Each day they come in with lots of energy to be channeled in the right direction for science. However, they do not always have the necessary materials to do the work. Our school serves students in grades 3-5 and provides rigorous academics, fantastic teachers and a safe learning environment. As a result, we are consistently one of the top-performing schools in the state every year. \r\n\r\nOur students come from a variety of different economic backgrounds with over 60% of our students receiving free lunch.\r\nMy Project Red, Blue, Purple and Green Makes Science Fun! will help my students in the constructions of their own interactivity science book. Our textbooks are old and we only have a classroom set so my students are making their own interactivity science notebook to study. With the markers students will be able to add color to their notebook. They will use to glue sticks to place items in their notebook.. With the materials from this projects students will be able to design their own interactive science book.\r\n\r\nColor makes learning more enjoyable.\r\nThese supplies will give each student the same opportunity to create and design their interactivity notebook with pride. Color code different topics will make studying at home easier thus increasing student knowledge and learning. This will be knowledge that they carry with them throughout the rest of their schooling and into adulthood.

There are 18 students in this first grade class. I have a very diverse group of students. I find that classrooms are full of magical learning moments. It will be exciting to see the growth these students will make this year and I am excited to see how these supplies impact our class.

This is my 17th year teaching and this group of students are amazing! The students' learning styles and abilities are very diverse, but they are eager to learn and always try to do their best. Our school is rural with predominately low-income to middle class families. There are approximately 500 students at our pre-k to 5th grade elementary school. We have a very supportive and active parent-teacher association. Fluency is such an important part of reading. Without fluency, comprehension is a struggle. Not only do students need to be able to read fluently, but they also need to be able to hear what fluent readers sound like. The partner cards will allow a struggling reader to partner read with a student who is strong with fluency. I would be able to differentiate for my wide variety of students, since most of the materials come with different levels. I have requested both fluency activities as well as leveled readers, since the level of the students in my classroom have a wide level of abilities.

Fluency is the ability to read text quickly and accurately, and with proper expression.

When students are fluent readers, it leads to greater motivation because they feel successful and it helps to increase their reading comprehension.

Gardener, doctor, chemist, veterinarian, teacher, football player. Just like all other children, my students have big dreams beyond our classroom. They have dreams to grow up and make the world a better place. Dreams of becoming rich and famous. Dreams of being the first in their family to do something different.

I believe that the students I teach can change the world. These students are bright, funny, and talented...they are like many other children across the country. The difference between my students and many others is the fact they come from homes that cannot always provide for their basic needs. Most of the students I teach receive free lunch, school supplies, and sometimes clothing. S

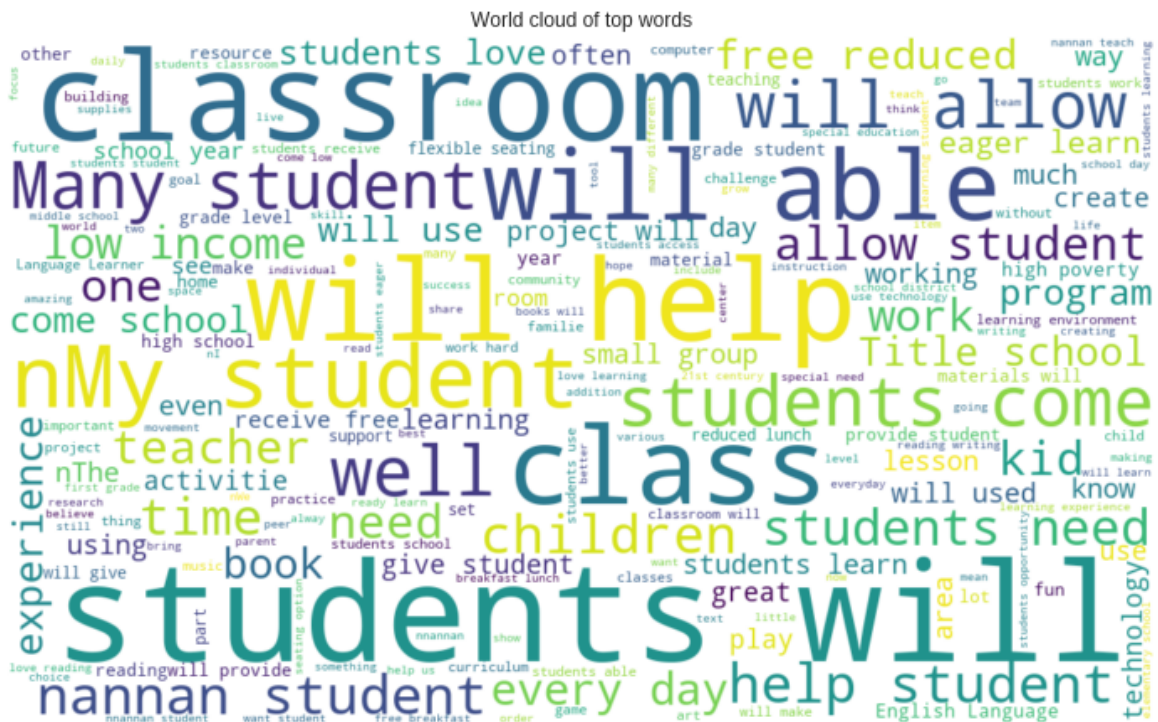
ome live in single bedroom homes with multiple families. Many must translate for their parents to understand basic communication. \r\nDespite the adversity my students face, they make the best of their learning experiences. Many of them never miss a day of school. Several request special projects. All of them dream of living a life beyond their current reality. As the saying goes, variety is the spice of life. That is more true than you'll ever know when it comes to a 4th grade classroom. When you're 9, things can get old fast. \r\nThe materials requested will help keep my students actively engaged and on their feet at all times. By providing storage sacks, they will have more room to complete daily work. Not only is it essential to have children discussing their learning with their peers, but it is equally important that we are teaching our children how to communicate with one another. The Kagan materials requested will aid in accomplishing those goals. By providing my students with whiteboards, they will be actively engaged and allow for quick checks of mastery. Reading comprehension is essential to all education. Several reading folder games and comprehension practice activities were requested. My students will benefit from these materials by allowing for repeated practice of previously learned skills through learning rotations. \r\nMost importantly, your donation will help impact the leaders of tomorrow that we are building today.nannan
2192

Living in an urban community there are many challenges that my students face, more than I will ever understand. Some of my students have learning disabilities. Some of my students have emotional impairments. Some have both. Many of my students have faced severe trauma in their home lives. They have many 'negative' challenges that they face but they overcome adversity and work their hardest to succeed. These positive changes begin at school. They come into my classroom, where they feel safe and where they are accepted for who they are. Together we work towards reaching their goals, the goals of the classroom and ultimately their life goals.\r\nMy students are bright and beautiful. They are also very brave and strong willed. Every day is a fresh start for my students and every day we focus on learning something new that will help use become the best that we can be\r\nAs my students struggle with so many difficult challenges in their lives, they often find themselves behind in understanding what is happening in the world around them or what has happened in the past, shaping the world they live in today. \r\nFocusing on World War II and the Holocaust can help my students connect to the past. They can become inspired by others in history that have also overcome hardships and faced adversity head on. These historical figures, such as Elie Wiesel and Leon Leyson, will become role models for these students to look up to. \r\nThese books will help them understand that they can also come face to face with adversity and crush it.nannan
1561

Observation DbSCAN is giving 1 cluster and there is no noise when optimal eps is 32.

```
In [0]: '''count = 0
clust=cluster[1]
print("2 datapoints of cluster2 :\n")
for i in range(2):
    print(clust[i])
    print(len(clust[i]))
    print()
    count = count+1'''
```

```
In [0]: plot_wordcloud(cluster[0])
```



These are the words that are occurring frequently

```
In [0]: from prettytable import PrettyTable
import sys
sys.stdout.write("\033[1;30m")
x = PrettyTable()
x.field_names = ["Clustering technique", "n_cluster"]
x.add_row(["K-means", "5(optimal k = 5)"])
x.add_row(["Agglomerative Clustering", (2,5)])
x.add_row(["DBSCAN", "1(optimal eps = 32)"])

print("===== Clustering =====")
print(x)
```

Clustering	
Clustering technique	n_cluster
K-means	5(optimal k = 5)
Agglomerative Clustering	(2, 5)
DBSCAN	1(optimal eps = 32)

Steps Performed

- Text preprocessing
- Apply feature selection on bow vectorizer using selectkbest features.
- Apply all three kmeans, Agglomerative clustering, DBSCAN.

- **K-Means Clustering:**
 - Take all the points and apply K mean clustering with k values as 2,3,4,5,6,8,9,10.
 - Find the best 'k' using the elbow-knee method (plot k vs inertia_).
 - Using the optimal k find out the clusters.
- **Agglomerative Clustering:**
 - Take 20k points and perform it with no. of cluster as 2 and 5 respectively.
- **DBSCAN:**
 - Take 10k points and perform DBSCAN.
 - Plot distances vs points plot.
 - Using knee method, find the optimal eps.
 - Using optimal eps find out the number of cluster and noise points present.
- Print few datapoints from each cluster to summarize it and also display the word cloud for each of it.