Torrance Learning eLearning User Data Analysis

UMich Portlab - Excerpt of Project Components Created by Riddhisha Prabu

Executive Summary

Problem Statement:

Torrance Learning ("TL") provides elearning training courses and webinars to a variety of clients. For this project TL, would like to obtain more information on the the course taking patterns for one of its clients the American Spinal Injury Association ("ASIA").

Observations Summary:

The sample data provided by TL is a snapshot from ~ Nov 2019 to June 2022 and consists of ASIA professional users to student users in the ration ~3:1. Based on an exploratory analysis of sample data, the following observations can be made:

(1) **Number of Courses per User** : Most Professionals take ~1 course each while Students take close to 2 courses. (See Fig. 1)

(2) **Course Popularity** : Torrance Learning's InStep (International Standards 2019) ands AStep Autonomic Anatomy & Function) courses appear to be the most popular amongst students and professionals alike. A majority of students take InStep (~70%) while for professionals, the distribution is more even (See Fig. 2)

(3) **Initial Courses and Continuing Training** : (See Fig. 3)

- 65% of Professionals start with InStep and ~30% start with AStep.
  - A majority (~80%) of those starting with InStep do not continue
- Students start with either InStep (51%) or AStep (48%)
  - ~2/3 of the students starting with InStep, do not continue (62%) and ~1/3 take AStep next(31%)
  - A majority of the Students starting with AStep continue with InStep (83%)

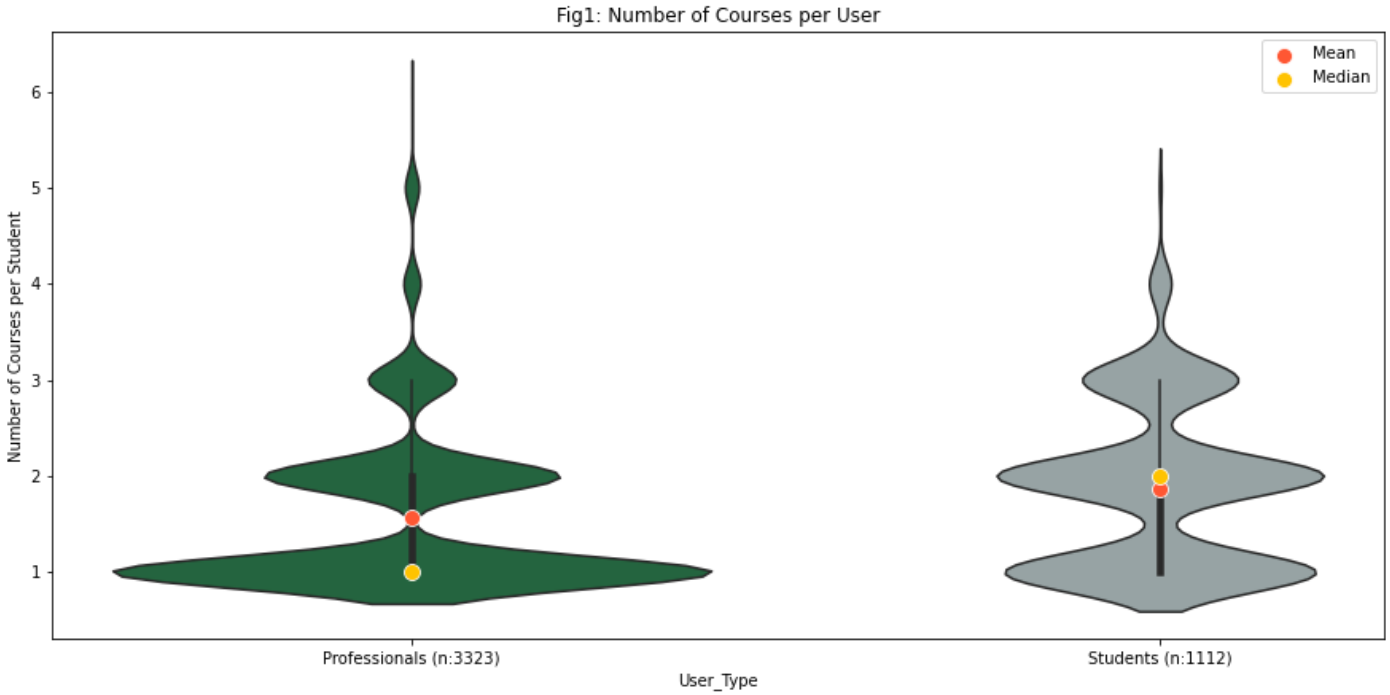


Fig1: Number of Courses per User
Mean
Median
Number of Courses per Student
1
2
3
4
5
6
Professionals (n:3323)
Students (n:1112)
User_Type

Fig2: Course Popularity

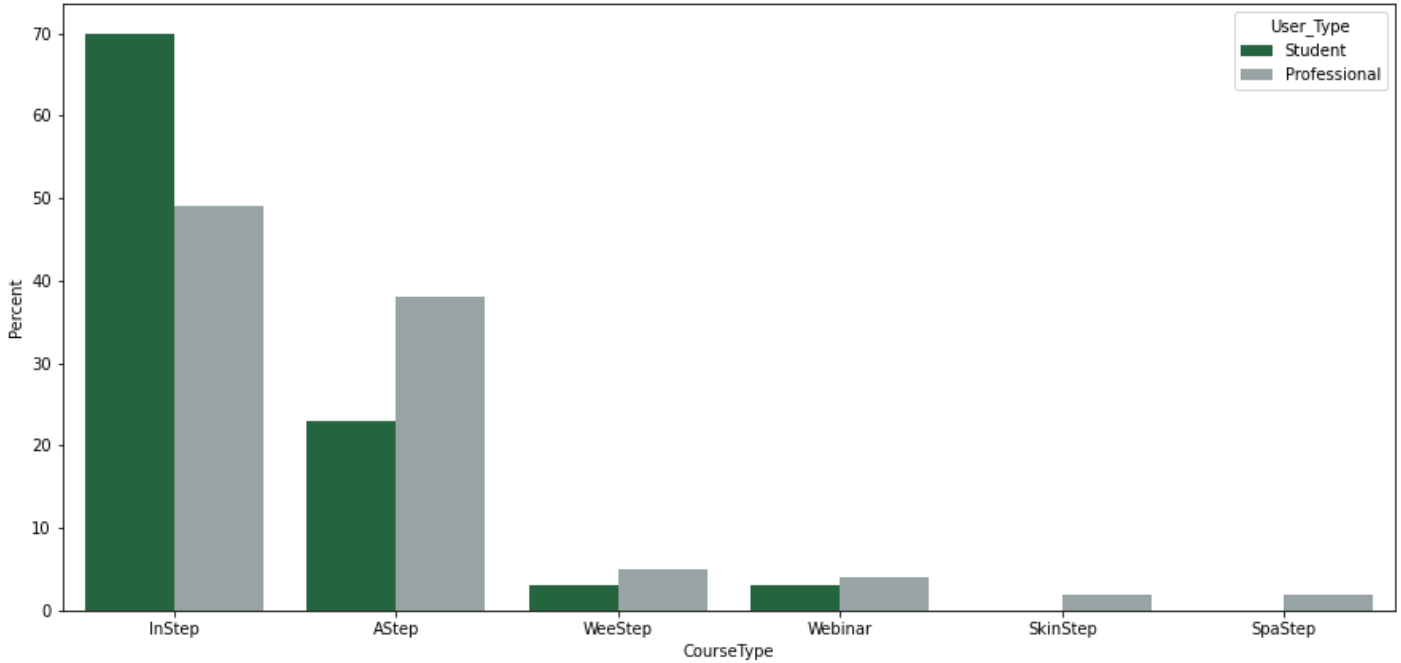
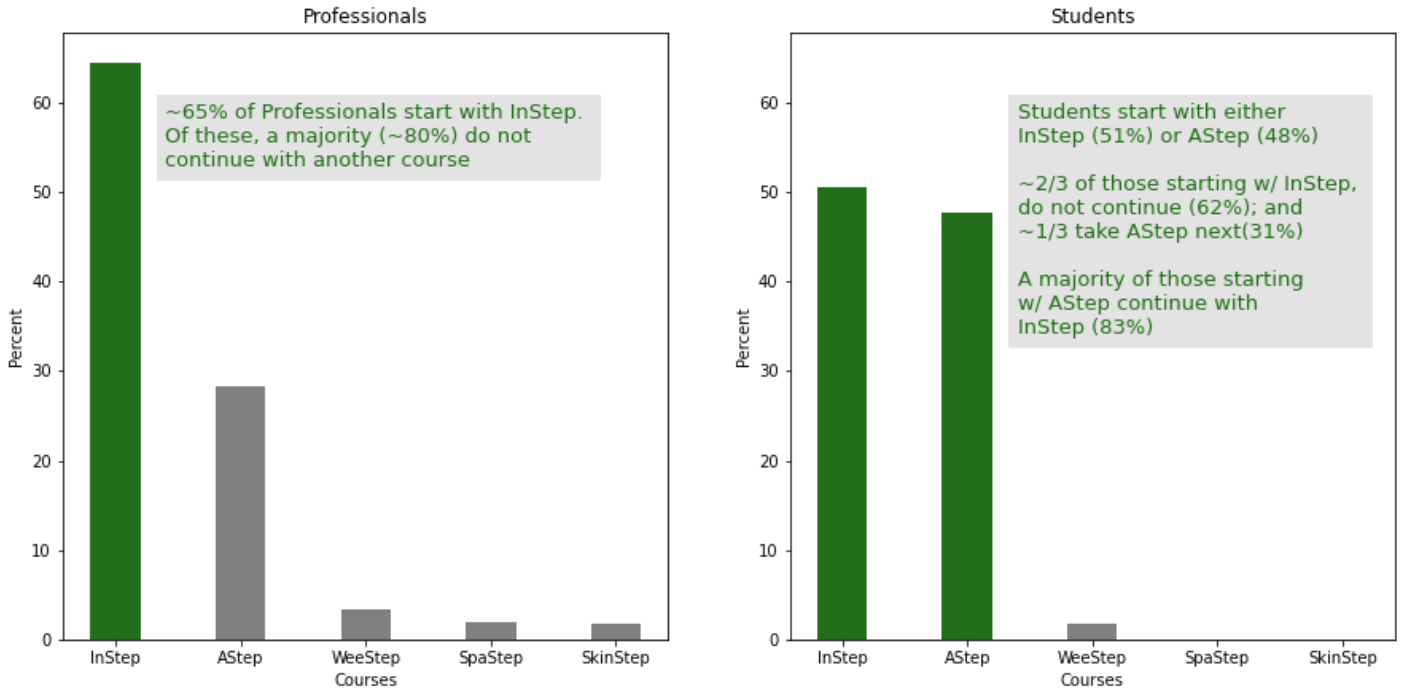


Fig3: Initial Course and Continuing Training



Project Code and Analysis Details

Data Loading & Preprocessing

The client has provided data mainly in the form of two cvs files:

(1) Course Metadata : as the name implies, this file contains metadata about each course, such as the courseID and the underlying modules within each course. Our analysis for this project is limited to the course level and not the underlying module level

(2) ASIA Master Data de-ID: contains eLearning platform usage data for each user. This is the primary data for our analysis

In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

```
import warnings
warnings.filterwarnings('ignore')
pd.set_option("display.max_columns",None)
pd.set_option("display.max_rows",None)
```

In [2]:

```
df_meta = pd.read_excel("Course Metadata.xlsx")
df_meta.head(2)
# df_meta.info()
```

Out[2]:

	Course ID	Course	Type	Type2	Language
0	E-As-EN-001-1	ASTeP Part 1 - Autonomic Anatomy & Function(87...	Elearning	Module	English
1	E-As-EN-001-1	ASTeP: Autonomic Anatomy & Function(875005)	Elearning	Module	English

In [3]:

```
df_asia = pd.read_excel("ASIA Master Data de-ID.xlsx")
df_asia.head(2)
# df_asia.info()
```

Out[3]:

	UserID	User Domain	Enrollment Date	First Launch Date	Status	Completion Date	Price	Time (in Hours)	Score	Course	Column11	GroupByColumn1	GroupByCc
0	A002223	ASIA User	2019-11-12 14:50:34	2021-10-08	Complete	2021-10-08 12:08:22	50	0.0	0	InSTeP: International Standards 2019(874713)	NaN	InSTeP: International Standards 2019	
1	A004695	ASIA User	2019-11-12 14:50:34	2019-11-27	Complete	2019-11-27 12:34:00	50	0.0	0	InSTeP: International Standards 2019(874713)	NaN	InSTeP: International Standards 2019	

Data Transformation:

The following data transformation tasks were performed per internal review and discussions with the client:

(1) dropping rows with no UserID
(2) dropping those courses that were never launched
(3) dropping columns with blanks/non useful information

The next few functions append the data with markers based on the info shared by the client:

(4) adding columns to identify student as "User Domain" == "Bulk Upload Instep" and everyone else as a professional
(5) adding Pre/Pandemic/Post information per First Launch Date [def period(x)]
(6) adding information on coursetype [def course_type(x)]
(7) excluding surveys

Note also that both "ASIA" and "Steel Assembly" providers should be included in our analysis per the client; (Steel Assembly is the sponsor and for the purposes of this analysis, they should be treated the same).

In [4]:

```
## (1 and 2)
# df_asia["UserID"].unique().shape                                          ## 4978 unique users
# df_asia[df_asia["First Launch Date"].isnull()].shape                      ## ~6500 never lauched the course
df_asia.dropna(axis = 0, subset = ["UserID","First Launch Date"], inplace = True)      ## (1 and 2)


##(3)
df_asia.drop(["Column11","GroupByColumn1","GroupByColumn3","Category",
"Enrollment Date","Score","Provider","Media"], axis = 1, inplace = True)               ## (3)


## (4) student vs professional
def categorize(x):
    if x =="Bulk Upload Instep":
        return "Student"
    else: return "Professional"


## (5) Pre-pandemic is before Mar 1, 2020; Pandemic is March 1 - Dec 31, 2021; and Post is Jan 1,2022 – through current)
def period(x):
    if x < pd.to_datetime('03/01/2020'):
        return "Pre-pandemic"
    elif x>= pd.to_datetime('03/01/2020') and x <= pd.to_datetime('12/31/2021'):
```

```
        return "Pandemic"
    else: return "Post-pandemic"


df_asia["User_Type"] = df_asia["User Domain"].apply(lambda x: categorize(x))            ## (4)
df_asia["Period"] = df_asia["First Launch Date"].apply(lambda x: period(x))             ## (5)


df_asia.sort_values("First Launch Date", inplace = True)
df_asia.head(2)
```

Out[4]:

	UserID	User Domain	First Launch Date	Status	Completion Date	Price	Time (in Hours)	Course	User_Type	Period
5215	A002223	ASIA User	2019-11-13	Waived	NaT	0	0.000000	InSTeP Module 1 - Basic Anatomy(874714)	Professional	Pre-pandemic
5210	A002063	ASIA User	2019-11-15	Complete	2019-11-18 10:10:37	0	1.383333	InSTeP Module 1 - Basic Anatomy(874714)	Professional	Pre-pandemic

In [5]:

```
##merging both datasets
merged_df = pd.merge(df_asia,df_meta, how="left", left_on="Course", right_on="Course")
merged_df.head(2)
# merged_df.shape
```

Out[5]:

	UserID	User Domain	First Launch Date	Status	Completion Date	Price	Time (in Hours)	Course	User_Type	Period	Course ID	Type	Type2	Lang
0	A002223	ASIA User	2019-11-13	Waived	NaT	0	0.000000	InSTeP Module 1 - Basic Anatomy(874714)	Professional	Pre-pandemic	E-In-EN-001-1	Elearning	Module	E
1	A002063	ASIA User	2019-11-15	Complete	2019-11-18 10:10:37	0	1.383333	InSTeP Module 1 - Basic Anatomy(874714)	Professional	Pre-pandemic	E-In-EN-001-1	Elearning	Module	E

In [6]:

```
## (6) course_type original
def course_type(x):
    courses = {"E-As":"AStep",
```

```
                "E-In":"InStep",
                "E-Sk":"SkinStep",
                "E-SP":"SpaStep",
                "E-We":"WeeStep",
                "W-EN":"Webinar",
                "W-SP":"Webinar", #Treating Spanish and English webinars the same
                "E-SU":"Survey",
                "W-SU":"Survey"}
    return courses[x[0:4]]

merged_df["CourseType"] = merged_df["Course ID"].apply(lambda x:course_type(x))       #(6)
merged_df = merged_df[merged_df["CourseType"]!= "Survey"]
# merged_df.shape

merged_df.head(2)
```

Out[6]:

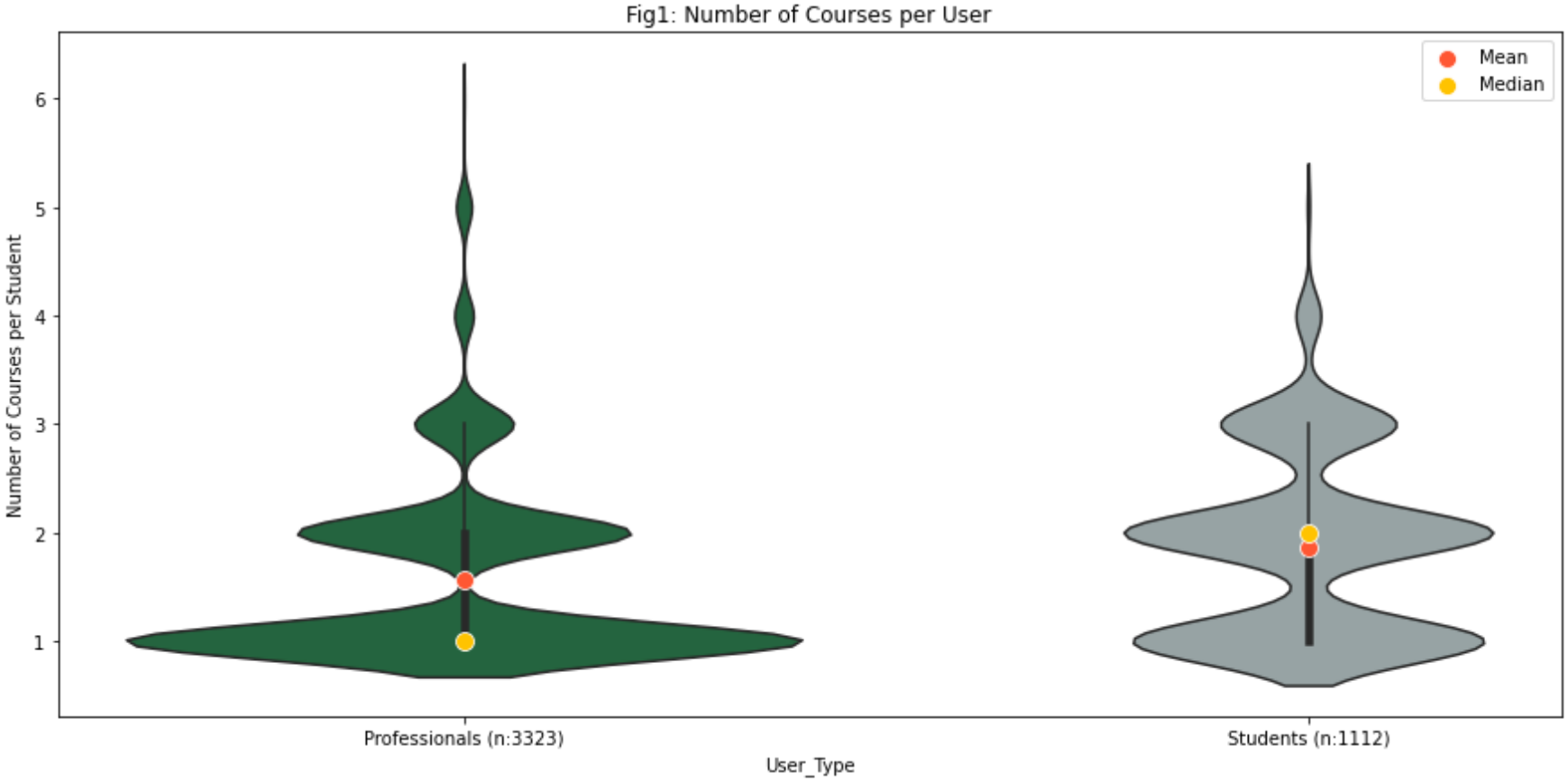
	UserID	User Domain	First Launch Date	Status	Completion Date	Price	Time (in Hours)	Course	User_Type	Period	Course ID	Type	Type2	Lang
0	A002223	ASIA User	2019-11-13	Waived	NaT	0	0.000000	InSTeP Module 1 - Basic Anatomy(874714)	Professional	Pre-pandemic	E-In-EN-001-1	Elearning	Module	E
1	A002063	ASIA User	2019-11-15	Complete	2019-11-18 10:10:37	0	1.383333	InSTeP Module 1 - Basic Anatomy(874714)	Professional	Pre-pandemic	E-In-EN-001-1	Elearning	Module	E

Analysis 1: How many courses do users take?

In [7]:

```
# merged_df.shape  #17430
_ = merged_df[["User_Type","UserID","CourseType"]].drop_duplicates()              ##7303 unique
# _.shape
# _.head()

__ = _.groupby(["User_Type","UserID"]).agg({"CourseType":len}).reset_index()      ##__ contains number of courses per stu
# __.shape                                                                        ##4435
# __.head(2)


plt.figure(figsize = (15,7));
```

```
colors = ["#196F3D","#95A5A6"]
sns.violinplot(data = __, x= "User_Type", y = "CourseType", palette = colors).set_title("Fig1: Number of Courses per User

p_count = __[__["User_Type"] == "Professional"].shape[0]
s_count = __[__["User_Type"] == "Student"].shape[0]
p_mean = float(__[__["User_Type"] == "Professional"].mean().round(2))
p_median = float(__[__["User_Type"] == "Professional"].median().round(2))
s_mean = float(__[__["User_Type"] == "Student"].mean().round(2))
s_median = float(__[__["User_Type"] == "Student"].median().round(2))

sns.scatterplot([0,1],[p_mean, s_mean], zorder = 3, s=100, color = "#FF5733", marker="o", label = "Mean");
sns.scatterplot([0,1],[p_median, s_median], zorder = 3, s=100, color="#FFC300", marker="o", label = "Median");
plt.ylabel("Number of Courses per Student");
plt.gca().set_xticklabels([("Professionals (n:"+str(p_count)+")"),("Students (n:"+str(s_count)+")")])
plt.savefig("CoursesPerUser.png")
```



Observation:

Most Professionals take ~1 course each while Students take closer to 2 courses

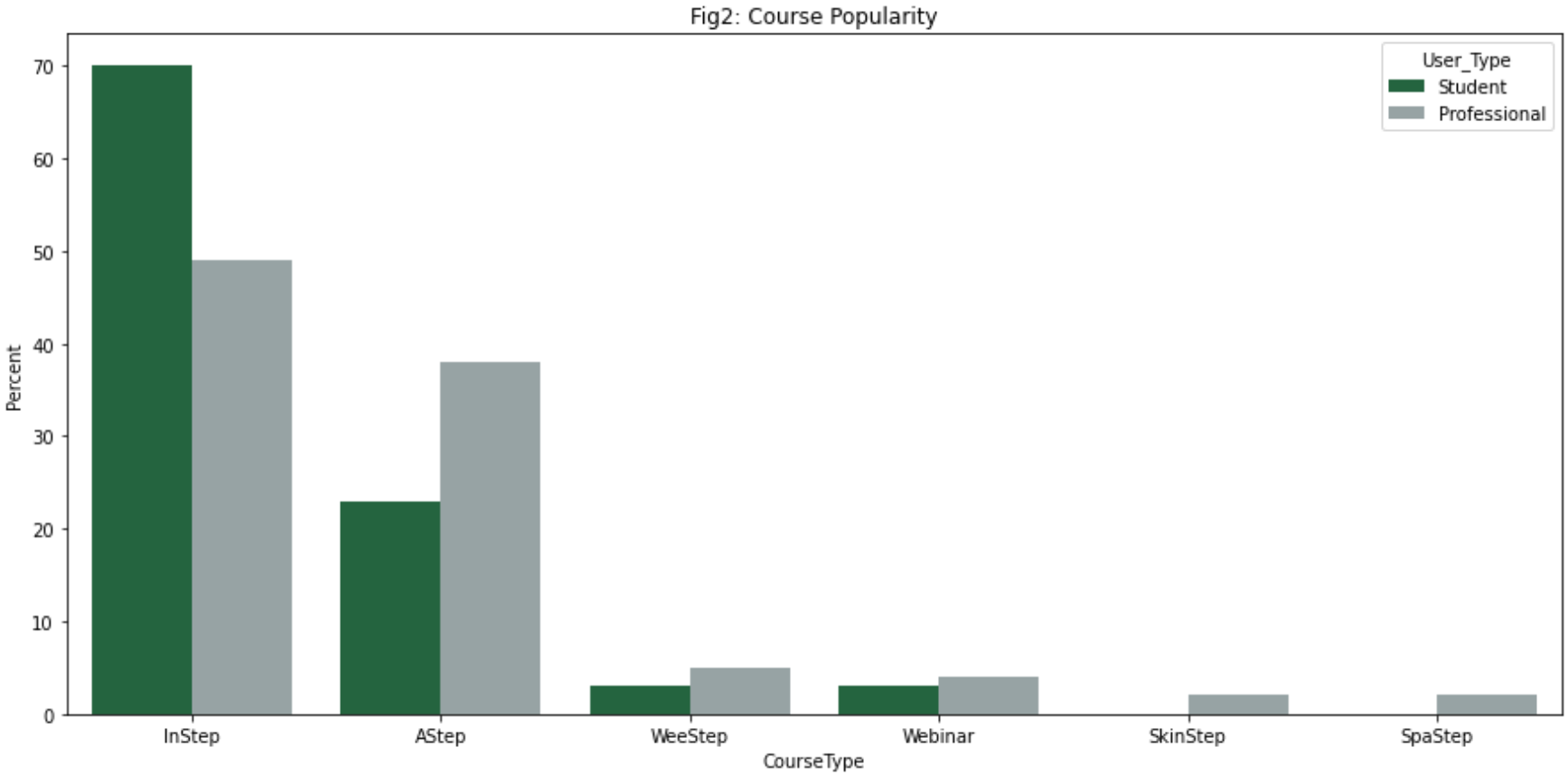
Analysis 2: Which courses are most popular?

In [8]:
```
_ = (merged_df.groupby(["User_Type","CourseType"]).size() / merged_df.groupby(["User_Type"]).size()).round(2).reset_index
_.rename(columns = {0:"Percent"}, inplace = True)
_.sort_values("Percent", ascending = False, inplace = True)
_.head(4)
```

Out[8]:

	User_Type	CourseType	Percent
7	Student	InStep	0.70
1	Professional	InStep	0.49
0	Professional	AStep	0.38
6	Student	AStep	0.23

In [9]:
```
plt.figure(figsize = (15,7))
colors = ["#196F3D","#95A5A6"]
sns.barplot(data =_, x = "CourseType", y = "Percent", hue = "User_Type", palette = colors).set_title("Fig2: Course Popula
plt.gca().set_yticklabels(np.arange(0,80,10));
plt.savefig("CoursePopularity.png")
```



Observation:

Torrance Learning's InStep (International Standards 2019) ands AStep Autonomic Anatomy & Function) courses appear to be the most popular amongst students and professionals alike.

- For students, about ~70% take InStep while ~23% take AStep.
- For professionals, the distribution is more even. ~50% of Professionals take InStep and ~38% take AStep

Analysis 3: Which course do Professionals/Students start with? How do they continue?

In [10]:

```
merged_df = merged_df[~merged_df["Status"].isin(["Not Started", "Waived"])]
usertype = ["Professional","Student"]
# merged_df.columns

test = {}
```

```
for user in usertype:
    sub_df = merged_df[merged_df["User_Type"]==user]
#     print(sub_df.shape)


    ##find first course:
    starts = {}      #absolute number of users starting with each course
    startsp = {}     #of users starting with each course


    ##we group by each studentID and we increase the counter(starts) based on the course this student started with
    for group, frame in sub_df.groupby("UserID"):
        frame.sort_values("First Launch Date", inplace = True)

        if frame.iloc[0,14] == "InStep":
            starts["InStep"] = starts.get("InStep",0) + 1
        elif frame.iloc[0,14] == "AStep":
            starts["AStep"] = starts.get("AStep",0) + 1
        elif frame.iloc[0,14] == "SpaStep":
            starts["SpaStep"] = starts.get("SpaStep",0) + 1
        elif frame.iloc[0,14] == "SkinStep":
            starts["SkinStep"] = starts.get("SkinStep",0) + 1
        elif frame.iloc[0,14] == "WeeStep":
            starts["WeeStep"] = starts.get("WeeStep",0) + 1

#     print(starts)
    total = 0
    for v in starts.values():
        total += v
    for k,v in starts.items():
        startsp[k] = round(v/total *100,2)
#     print(startsp)

    test[user] = startsp
    test_pd = pd.DataFrame(test)

test_pd
```

Out[10]:

	Professional	Student
AStep	28.29	47.66
InStep	64.52	50.63
WeeStep	3.44	1.71

	Professional	Student
SkinStep	1.71	NaN
SpaStep	2.04	NaN

In [11]:

```
##find second course:
       ## (A) For professionals, since a majority of the users start with InSTep, for simplicity,
       ## we just check what course, if any, users take after instep

       ## (B)For students, we check which course they move onto after starting (B1) AStep or (B2) InStep


##(A) Professional Users that start with Instep; what do they take next
sub_df = merged_df[merged_df["User_Type"]=="Professional"]

prof_next = {}
for group, frame in sub_df.groupby("UserID"):
    frame.sort_values("First Launch Date", inplace = True)

    if frame.iloc[0,14] == "InStep":
        temp = frame[frame["CourseType"] != "InStep"]
        if len(temp) == 0:
            prof_next["None"] = prof_next.get("None",0) + 1
        elif temp.iloc[0,14] == "AStep":
            prof_next["AStep"] = prof_next.get("AStep",0) + 1
        else:
            prof_next["Other"] = prof_next.get("Other",0) + 1

# print(nextcourse)

prof_nextp = {}
total = 0
for v in prof_next.values():
    total += v
for k,v in prof_next.items():
    prof_nextp[k] = round(v/total *100,2)

print("Which course do professionals take second?")
pd.Series(prof_nextp)
```

```
Which course do professionals take second?
```

Out[11]:

```
None     79.94
```

```
AStep    15.90
Other     4.15
dtype: float64
```

In [12]:

```python
##B
##(B) Student Users that start with (B1) ASTep and (B2) InStep; what do they take next
sub_df = merged_df[merged_df["User_Type"]=="Student"]

student_next_a = {}
student_next_i = {}
for group, frame in sub_df.groupby("UserID"):
    frame.sort_values("First Launch Date", inplace = True)

    ##(B1)
    if frame.iloc[0,14] == "AStep":
        temp = frame[frame["CourseType"] != "AStep"]
        if len(temp) == 0:
            student_next_a["None"] = student_next_a.get("None",0) + 1
        elif temp.iloc[0,14] == "InStep":
            student_next_a["InStep"] = student_next_a.get("InStep",0) + 1
        else:
            student_next_a["Other"] = student_next_a.get("Other",0) + 1

    ##(B2)
    elif frame.iloc[0,14] == "InStep":
        temp = frame[frame["CourseType"] != "InStep"]
        if len(temp) == 0:
            student_next_i["None"] = student_next_i.get("None",0) + 1
        elif temp.iloc[0,14] == "AStep":
            student_next_i["AStep"] = student_next_i.get("AStep",0) + 1
        else:
            student_next_i["Other"] = student_next_i.get("Other",0) + 1

# print(student_next_a)
# print(student_next_i)


student_next_ap = {}
student_next_ip = {}


total = 0
for v in student_next_a.values():
    total += v
for k,v in student_next_a.items():
```

```
    student_next_ap[k] = round(v/total *100,2)

print("AStep starter students:")
print(pd.Series(student_next_ap))
print("\n")

total = 0
for v in student_next_i.values():
    total += v
for k,v in student_next_i.items():
    student_next_ip[k] = round(v/total *100,2)

print("InStep starter students:")
print(pd.Series(student_next_ip))
```

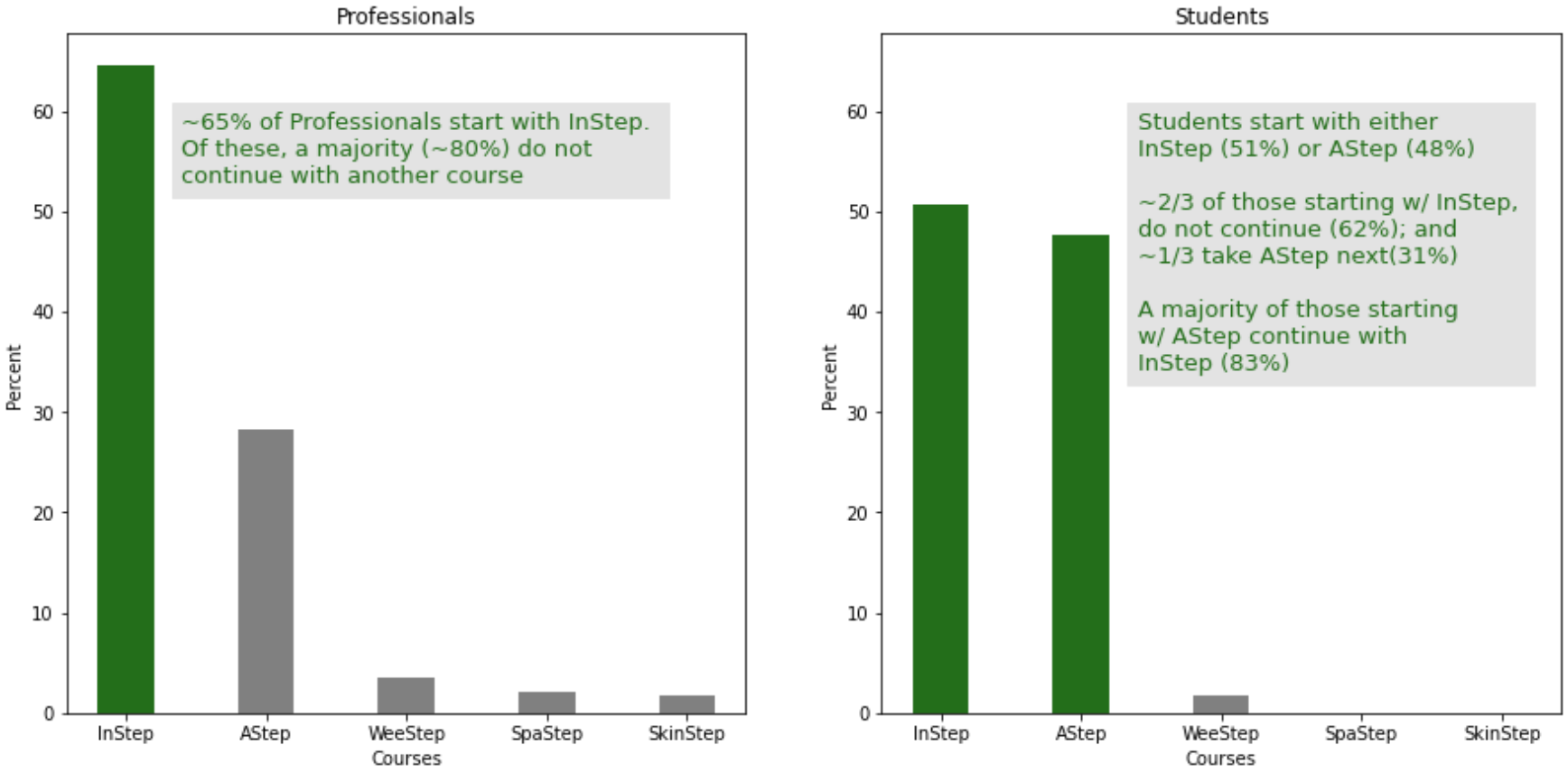
```
AStep starter students:
InStep    82.80
None      13.42
Other      3.78
dtype: float64


InStep starter students:
AStep    31.49
None     62.10
Other     6.41
dtype: float64
```

In [14]:

```
# %matplotlib inline
plt.figure(figsize = (15,7));
# xlist = ["InSTeP","ASTeP","SkinSTeP","WeeSTep","SpAsTeP"]

test_pd.sort_values("Professional", ascending = False, inplace = True)
plt.subplot(1,2,1);
clrs1 = ['grey' if (x < np.max(test_pd["Professional"])) else '#236E1A' for x in test_pd["Professional"]];
plt.bar(x =  test_pd.index, height = test_pd["Professional"], width =0.4, color = clrs1);
# plt.grid(axis = "y", alpha =0.2);
# plt.tick_params(axis='both');
plt.xlabel("Courses");
plt.ylabel("Percent");
plt.title("Professionals");

##Text is based on prof_nextp
plt.text(x =  0.4, y = 60, s = """~65% of Professionals start with InStep.
Of these, a majority (~80%) do not
```

```
continue with another course""",
va = "top", backgroundcolor = "#E3E3E3", color = "#236E1A", fontsize = 13);



test_pd.sort_values("Student", ascending = False, inplace = True)
plt.subplot(1,2,2, sharey = plt.subplot(1,2,1), sharex = plt.subplot(1,2,1));
clrs2 = ['grey' if x < float(40) else '#236E1A' for x in test_pd["Student"]];
plt.bar(x = test_pd.index, height = test_pd["Student"], width =0.4, color = clrs2);
# plt.grid(axis = "y", alpha =0.2);
# plt.tick_params(axis='both', labelsize=10, color = "grey");
plt.xlabel("Courses");
plt.ylabel("Percent");
plt.title("Students");

##Text is based on student_next_ap & student_next_ip
plt.text(x = 1.4 ,y = 60, s = """Students start with either
InStep (51%) or AStep (48%)

~2/3 of those starting w/ InStep,
do not continue (62%); and
~1/3 take AStep next(31%)

A majority of those starting
w/ AStep continue with
InStep (83%)""",va = "top", backgroundcolor = "#E3E3E3", color = "#236E1A", fontsize = 13);

plt.suptitle("Fig3: Initial Course and Continuing Training");
plt.savefig("Initial_Continuing.png")

# plt.show()
```

Fig3: Initial Course and Continuing Training



Observation:

65% of Professionals start with InStep and ~30% start with AStep.

- A majority (~80%) of those starting with InStep do not continue

Students start with either InStep (51%) or AStep (48%)

- ~2/3 of the students starting with InStep, do not continue (62%) and ~1/3 take AStep next(31%)
- A majority of the Students starting with AStep continue with InStep (83%)