E-news Express – New Landing Page Analysis

Business Statistics

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Contents

- Executive Summary

- Business Problem

- Solution Approach

- Data Overview

- EDA Results

- Hypotheses Tested and Results

- Key Takeaways

- Business Recommendations

Executive Summary

E-News is testing a new landing page's effectiveness against the existing one in terms of subscriptions. Statistical analysis conducted on user behavior related to both landing pages uncovered important insights:

Users spend more time on the new landing page than the existing one, and the new landing page has a higher conversion rate than the existing one. Furthermore, the choice of language does not significantly affect user engagement or subscription rates. Based on these findings, E-News should focus on promoting the new landing page to potential subscribers, prioritize creating high-quality content and a user-friendly layout over language, continuously test and optimize the new landing page, and consider offering localized content to attract a wider audience.

By implementing these recommendations, E-News can improve the effectiveness of its landing pages, attract more subscribers, and ultimately increase its revenue and customer base.

Business Problem

E-News Express is an online news portal that offers it's users an easy and quick access to updates on day-to-day global events with a subscribe option.

Executives at E-News suspect that there has been a decrease in subscribers from the previous year due to the current website's weak outline and lack of engaging content.

The design team has created a new landing page with a new outline and more relevant content in an effort to gain more subscribers by prolonging the time visitor's spend on it's portal.

E-News would like to test effectiveness of the new landing page in gaining more subscribers.

Solution Approach

Multiple hypothesis tests are conducted on a randomly selected sample of 100 users. The users are divided into two groups: Control and Treatment. The control group is served the existing landing page, while the treatment group is tested on the new landing page. The effectiveness of the new landing page will be judged by answering the following important questions:

● Do users spend more time on the new landing page than on the existing one?

● Is the conversion rate(proportion of visitor's who subscribe) for the new page greater than the rate for the existing one?

● Does the converted status depend on the preferred language?

● Is the time spent on the new page the same for different language users?

Prior to conducting the hypothesis tests, EDA will be presented to provide a thorough understanding of the data.

Data Overview

- The experiment is conducted on a random sample of 100 selected users, thereby containing 100 records.

- Users are divided equally into two groups: Control and Treatment. The control group is served the existing landing page, while the treatment group is served the new landing page.

- Each record includes the User ID, Group(Control/Treatment), Landing Page(Existing/New), Time spent on the page, Converted(Yes/No) and Language Preferred(English/Spanish/French).

- The categorical variables are objects, the User ID is an integer and the time spent on the page is of a float data type.

- There are no missing values or duplicates in the data, and the User ID is unique.

First 5 Records

user_id	group	landing_page	time_spent_on_the_page	converted	language_preferred
546592	control	old	3.48	no	Spanish
546468	treatment	new	7.13	yes	English
546462	treatment	new	4.40	no	Spanish
546567	control	old	3.02	no	French
546459	treatment	new	4.75	yes	Spanish

Stat Summary of Categorical Variables

	group	landing_page	converted	language_preferred
count	100	100	100	100
unique	2	2	2	3
top	control	old	yes	Spanish
freq	50	50	54	34

# EDA: Univariate(Time Spent on Page)

- The average time spent on the page is roughly 5 and a half minutes.

- The least time someone spent on the page is only 12 seconds.

- 11 minutes is the maximum amount of time spent by a user on a page.

- 75% of the users spent less than 7 minutes on the page.

- Time spent on the page from the sample follows a roughly normal distribution.
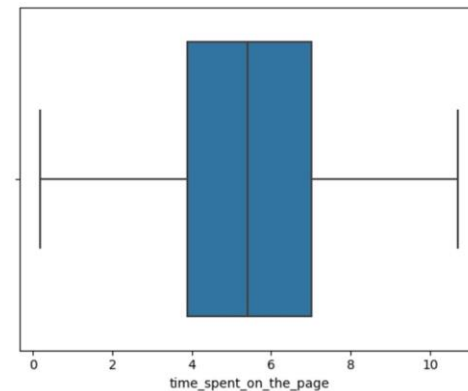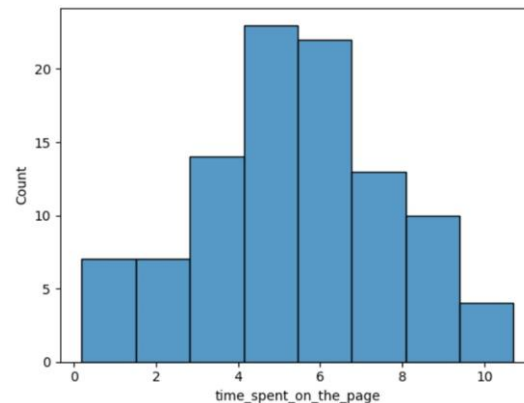
| Statistical Summary(Minutes)	
Mean	5.37
Median	5.41
STD	2.38
Minimum	0.19
Maximum	10.71

EDA – Univariate(Group&Landing Page)

100 users are split equally between the control and treatment group. The control group is assigned to the old(existing) landing page, while the treatment group is served to the new landing page.
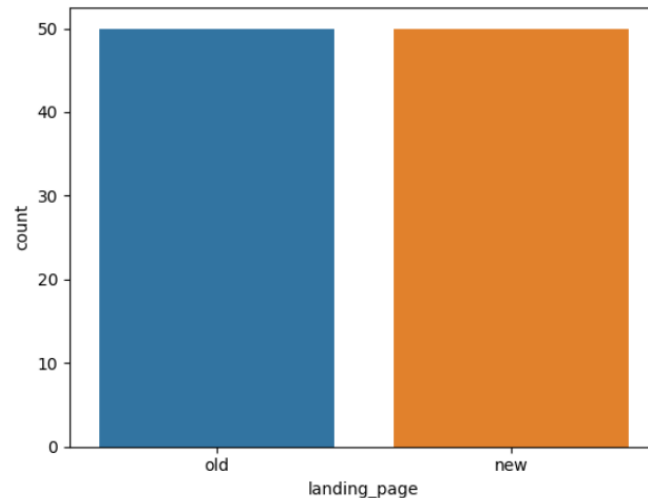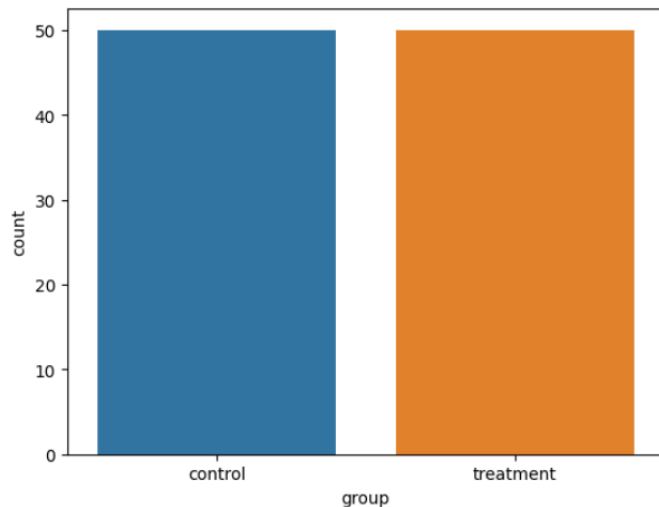
EDA – Univariate(Converted)

- 54% of all users converted to subscribing to E-News once they visited the page.

- 46 users did not subscribe to E-News Express.

- Bi-variate analysis will be required to understand potential reasons for users to subscribe.

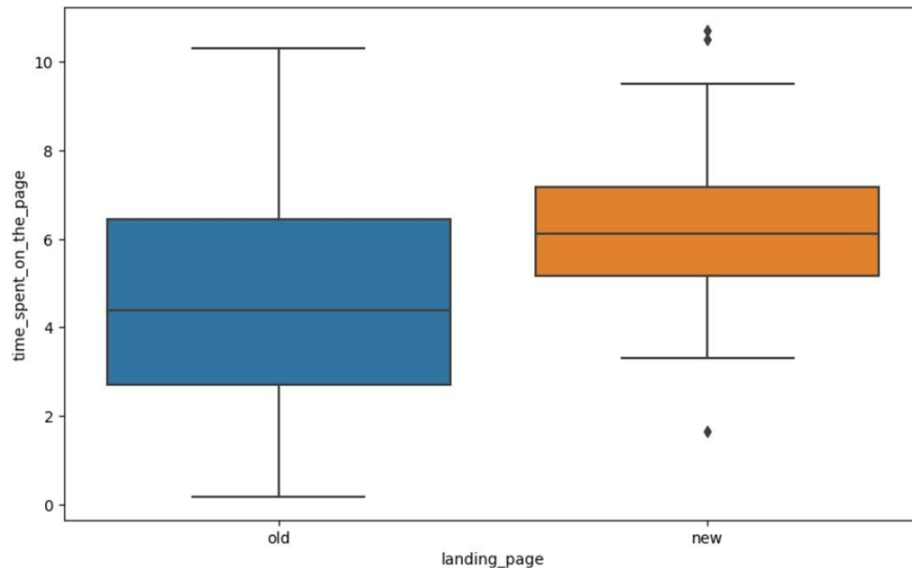| Converted	
Yes	54
No	46
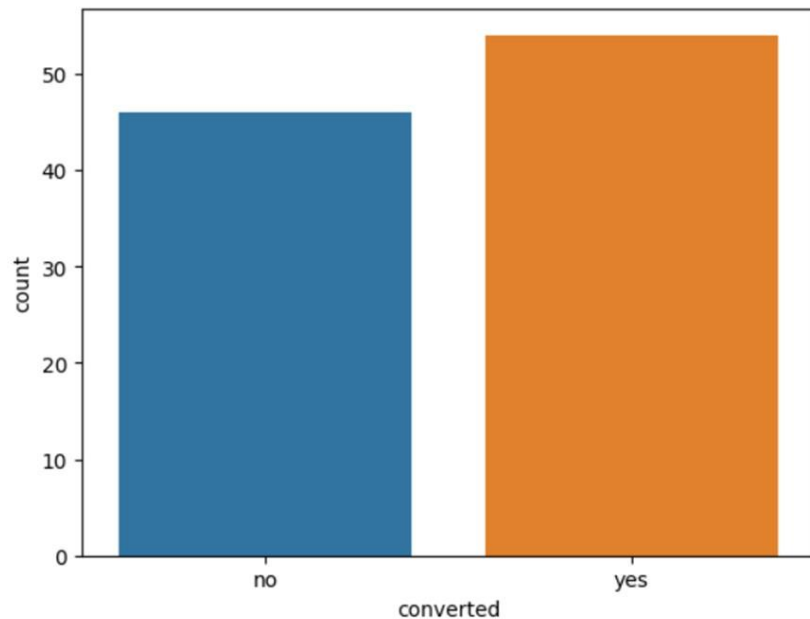
EDA – Univariate(Language Preferred)

- Only 32% of users prefer their news in English.

- Two thirds of users prefer their news in either French or Spanish.

- There is roughly an equal split between the 3 preferred languages.

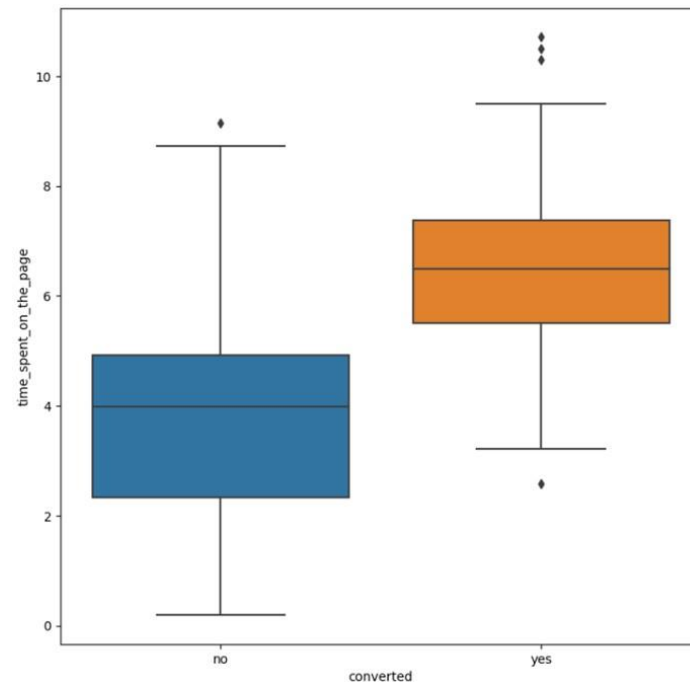| Language Preferred	Count
English	32
Spanish	34
French	34
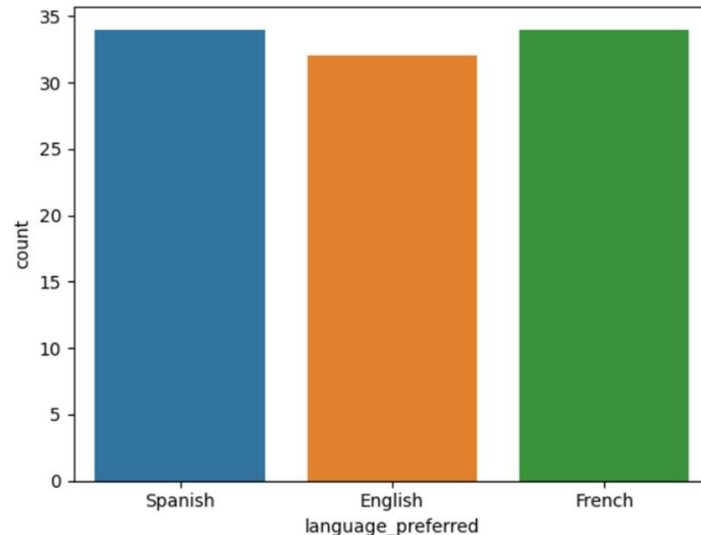
EDA – Bivariate(Time Spent on Page v Landing Page)

- Users are spending more time on the new landing page on average.

- The maximum time spent was on the new page, whilst the minimum was on the old page.

- There is a lot more variation in time spent on the old page as compared to the new one.

- More than 75% of users are spending at least 5 minutes on the new page, whilst more than 75% of users are spending lesser than 7 minutes on the old page.

EDA – Bivariate(Time Spent on Page v Converted)

- Users who spend more time on the page tend to subscribe.

- Time spent by users who did not convert varies a lot more than the time spent by users who did.

- On average, subscribed users tend to spend 6-7 minutes on the page.

- The minimum amount of time spent on a page for a subscribed user is about 3 minutes, while the maximum time on a page for a non-converted user is about 9 minutes.

- More than 75% of users who did not convert spent less than 5 minutes on the page.

- Most subscribed users spent at least 5 minutes on the page.

EDA – Bivariate(Time Spent on Page v Language Preferred)

- The language preferred does not seem to affect time spent on the page by users.

- Most users that prefer Spanish spend at least a minute on the page.

- Time spent by users who prefer English or French varies a lot more than the time spent by users who prefer Spanish.

- Users who spent the least time on the page preferred Spanish or English.

- Only 1 outlier exists, a user who prefers Spanish but spent only a few seconds on the page.

- Considering more time means greater chances of subscription, Spanish users are the safest bets to convert.
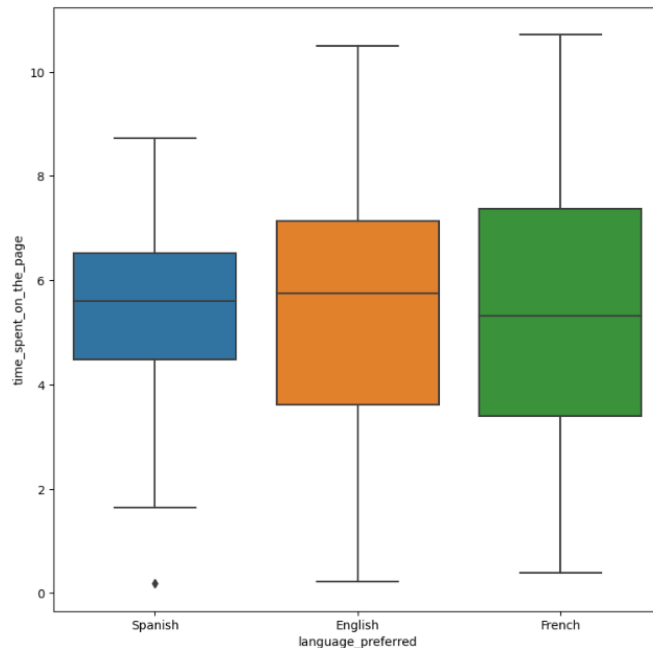
EDA – Bivariate(Converted v Language Preferred)

- English and Spanish languages witnessed more users who converted than those who did not.

- The French language had more users that did not convert than ones that did.

- English had the biggest difference between users that did and did not convert.

- The small difference in converted/not-converted users for the Spanish and French languages suggests that users who prefer these languages have mixed feelings about subscribing.
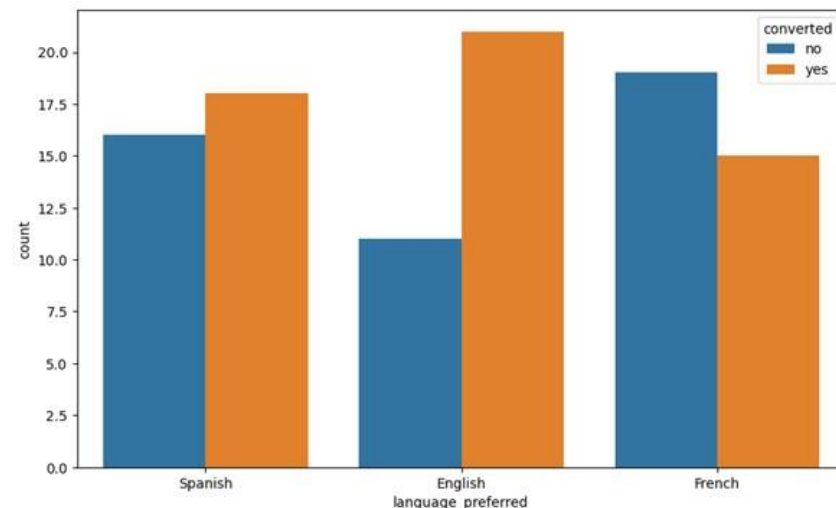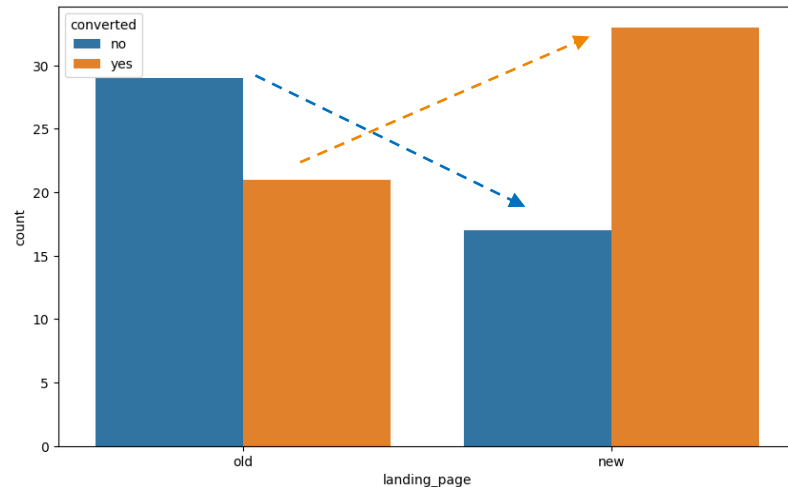

	Converted	
Preferred Language	Yes	No
English	21	11
French	15	19
Spanish	18	16

# EDA – Bivariate(Converted v Landing Page)

- There was a 57% increase in user subscriptions once E-News introduced its new landing page.

- Almost 60% of users on the old page did not convert, but 66% of the users on the new page did.

- There is a clear indication that users prefer the new landing page.

	Converted	
Landing Page	Yes	No
Old	21	29
New	33	17

EDA – Multivariate(Converted v Landing Page v Language)

- English users subscribed more on the old landing page than on the new one.

- A lot more French and Spanish users subscribed on the new landing page as compared to the old one.

- The new landing page seems to have positively affected French and Spanish users more than the English ones.

- The new landing page seems to have made the biggest difference to French users.

Count of Converted Users by Landing Page and Language Preferred
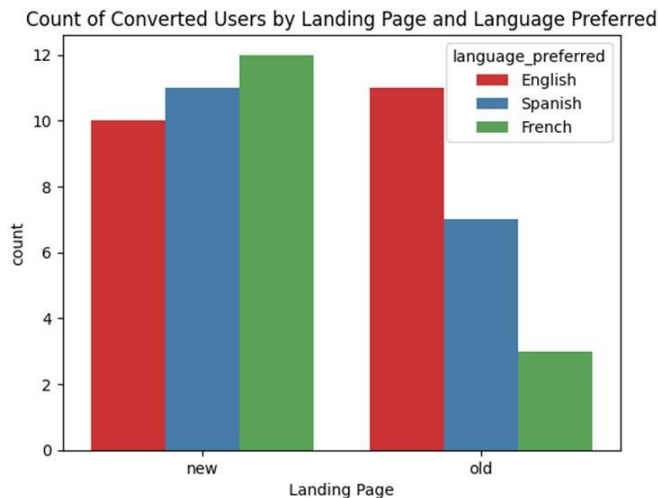
Converted Users		
	New	Old
English	10	11
French	12	3
Spanish	11	7

HYPOTHESIS TESTING

SEQUENCE:

- Question to be answered.

- Visual analysis performed on sample.

- Null and Alternative Hypothesis.

- Test selected and Assumptions.

- Significance Level.

- P-value.

- Test result and inference.

TIME SPENT ON BOTH PAGES

Do users spend more time on the new landing page than on the existing landing page?

- Users from the sample data do spend more time on the new landing page than the existing one.(Figure to the right)

- Null & Alternative Hypothesis Established:

    Let μ_1, μ_2 be the mean time spent on the new page and old page respectively.
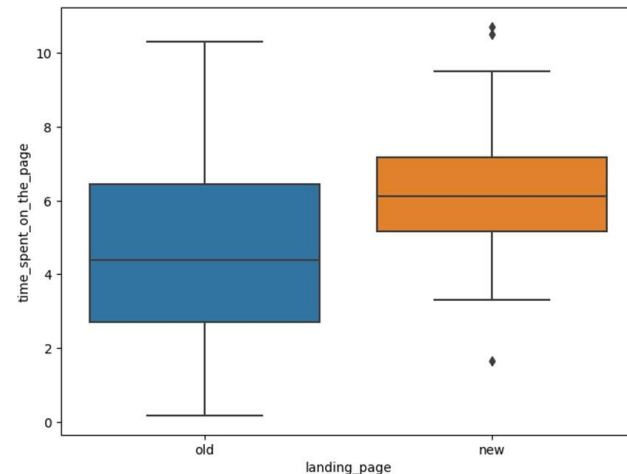
    Null Hypothesis:

    $H_0 : \mu_1 <= \mu_2$

    Alternative Hypothesis:

    $H_a : \mu_1 > \mu_2$

- Test Selected: 2-sample independent one-tailed T-test.

- Satisfied Assumptions:

    a) Continuous Data.(Time is continuous)   d) Independent Populations.

    b) Normally Distributed Populations.   e) Random Sampling.

    c) Unequal Population Variances.(Unequal Sample Variances)

Page	Sample Standard Deviation
New	1.82
Old	2.58

TIME SPENT ON BOTH PAGES

Do users spend more time on the new landing page than on the existing landing page?

- Significance Level = 0.05

- Computed P-Value = 0.000139

- Test Result and Inference:

    P-Value < Significance Level ⟶ Reject the Null Hypothesis

There is enough statistical evidence to infer that users spend more time on the new landing page than on the existing landing page.

CONVERSION RATE ON BOTH PAGES

Is the conversion rate for the new page greater than the conversion rate for the old page?
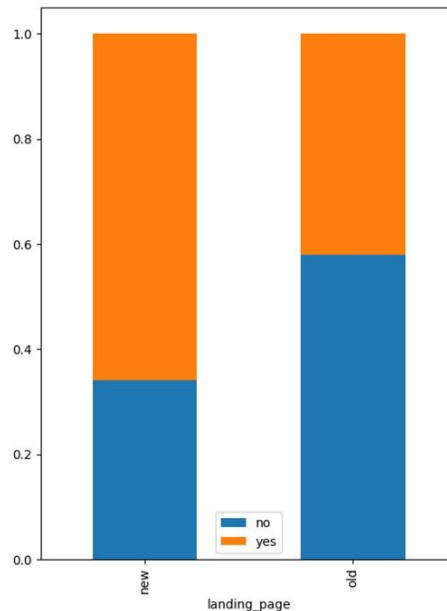
- The conversion rate is higher for the new page as compared to the old one for the sample data. (Figure to the right)

- Null & Alternative Hypothesis Established:

Let p_1, p_2 be the conversion rates of the new and old page respectively.

$$H_0 : p_1 <= p_2$$

$$H_a : p_1 > p_2$$

- Test Selected: 2-sample independent proportions Z-test.

- Satisfied Assumptions:

  a) Binomially Distributed Populations.

  b) Random Sampling.

  c) Binomial can be approximated to Normal Distribution.(np & n(p-1) >= 10 per table on page 15)

CONVERSION RATE ON BOTH PAGES

Is the conversion rate for the new page greater than the conversion rate for the old page?

- Significance Level = 0.05

- Computed P-Value = 0.008

- Test Result and Inference:

  P-Value < Significance Level $\longrightarrow$ Reject the Null Hypothesis

There is enough statistical evidence to infer that the conversion rate on the new page is greater than the conversion rate on the old page.
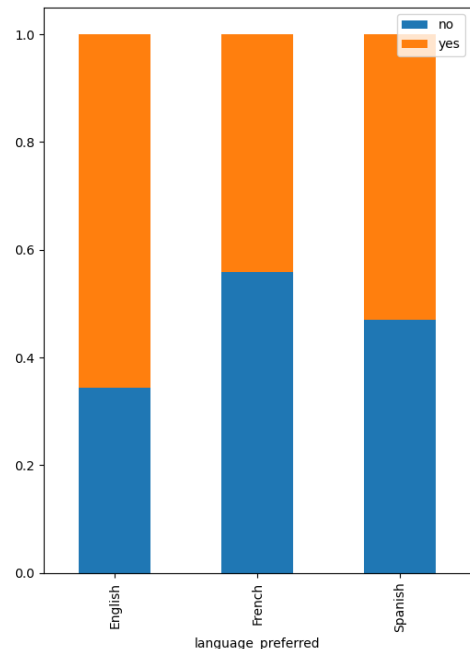
PREFERRED LANGUAGE AFFECTING CONVERSION

Does the converted status depend on the preferred language?

- Sample data does not present a clear answer to whether the converted status depends on the preferred language.(Figure to the right)

- Null & Alternative Hypothesis Established:

  H_0 : Converted Status is independent of the preferred language.

  H_a : Converted Status is dependent of the preferred language.

- Test Selected: Chi-Square Test of Independence.

- Satisfied Assumptions:

  a) Categorical Variables.

  b) Number of values in each sample > 5.

  c) Random Sampling from Population.

PREFERRED LANGUAGE AFFECTING CONVERSION

Does the converted status depend on the preferred language?

- Contingency Table created(Figure to the right).

- Significance Level = 0.05

- Computed P-Value = 0.213

- Test Result and Inference:

converted	no	yes
language_preferred		
English	11	21
French	19	15
Spanish	16	18

P-Value > Significance Level ⟶ Fail to Reject the Null Hypothesis

There is not enough statistical evidence to infer that the converted status depends on the preferred language.

TIME SPENT ON PAGE FOR DIFFERENT LANGUAGES

Is the time spent on the new page the same for different language users?

- Time spent on the page seems to be different for the different languages for the sample data.(Figure to the right)

- Null & Alternative Hypothesis Established:

Let μ_1, μ_2, μ_3 be the means of the time spent spent on the new page for the languages English, French and Spanish respectively.
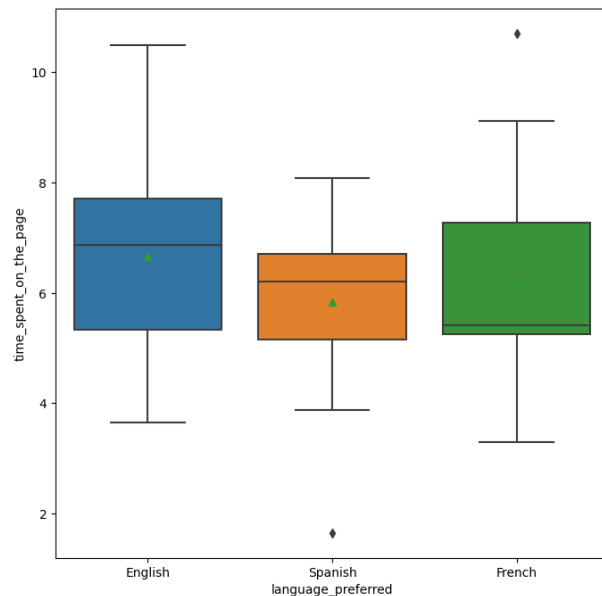
Null hypothesis

$H_0 : \mu_1 = \mu_2 = \mu_3$

Alternative hypothesis

H_a : At least one language's time spent on the page is different from the rest.

- Test Selected: One-Way ANOVA Test.

- Satisfied Assumptions:

  a) Normality(Shapiro-Wilk's Test)

  b) Equality of Variance(Levene Test).

TIME SPENT ON PAGE FOR DIFFERENT LANGUAGES
Is the time spent on the new page the same for different language users?

Shapiro-Wilk's Test for Normality

- Null and Alternative Hypothesis:

H_0 : Time spent on the new page follows a normal distribution

H_a : Time spent on the new page does not follow a normal distribution

- Significance Level = 0.05

- P-Value = 0.804

- Result: P-value > 0.05 → Fail to reject Null Hypothesis

Enough evidence to conclude that time spent on the new page follows a normal distribution.

Levene's Test for Population Variances

- Null and Alternative Hypothesis:

H_0 : All the population variances are equal

H_a : At least one variance is different from the rest

- Significance Level = 0.05

- P-Value = 0.8467

- Result: P-value > 0.05 → Fail to reject Null Hypothesis

Enough evidence to conclude that the population variances are equal.

TIME SPENT ON PAGE FOR DIFFERENT LANGUAGES

Is the time spent on the new page the same for different language users?

- Significance Level = 0.05

- Computed P-Value = 0.432

- Test Result and Inference:

    P-Value > Significance Level ⟶ Fail to Reject the Null Hypothesis

There is not enough statistical evidence to infer that the mean time spent on the new page by the different language users is different.

KEY TAKEAWAYS

- Users spend more time on the new landing page than the existing one.

- Choice of language does not necessarily affect the time spent by a user on the new landing page.

- The new landing page has a higher conversion rate than the existing landing page.

- A user's choice of language does not influence his or her decision to subscribe to E-News.

- Users who spend more time on the landing page are more likely to subscribe.

BUSINESS RECOMMENDATIONS

- Focus on the new landing page: Since the new landing page has more subscribers and users spend more time on it as compared to the existing page, E-News should focus its efforts on promoting the new landing page to potential subscribers. This could involve highlighting the new landing page on the website or in marketing materials, and emphasizing its unique features or benefits compared to the existing landing page.

- Emphasize content and layout over language: Users are spending a similar amount of time on the new landing page regardless of the language it is presented in, so E-News should prioritize creating high-quality content and a user-friendly layout, regardless of which language it is presented in.

- Continuously test and optimize landing pages: E-News should aim to continuously test and optimize landing pages to ensure maximum engagement and conversion rates. They should consider conducting A/B tests to determine elements of the landing page that are most effective in driving user engagement and subscriptions.

- Consider offering localized content: Although language does not significantly influence a user's decision to subscribe, offering localized content or newsletters in different languages could help attract a wider audience and increase overall subscriptions.

THANK YOU

Arpan Dinesh