

Stop Shooting in the Dark

HOW TEST AND LEARN ANALYTICS CAN HELP ORGANIZATIONS ACE
EVERYDAY DECISION MAKING

At a glance

In today's fast-moving online world of e-commerce, traditional retailers are facing major hardships. They need to innovate and test new strategies fast to remain competitive. Test and Learn analytics is vital for today's retailers to be effective in fast experimentation.

Test and Learn analytics, however, is a complex analytical problem which comprises challenges. The answers to these challenges lie in being able to apply methods which amalgamate business understanding and statistical methods. The key challenges are:

- 1. Appropriate test and control group identification:** Identification of test and control groups is critical to rolling out the experiments to other stores of the company
- 2. Measuring the effectiveness of the experiment:** It is imperative to identify the right metrics to evaluate for comparing test and control stores.

Solution to these challenges requires an end-to-end application which enables retailers to execute innovative and profitable business strategies. The key steps needed for this application are: create hypothesis, design, execute, analyze and evaluate results, and roll out solutions based on outcomes. Test and Learn implementation is challenging but with right guidance and tools, favorable results can be achieved.

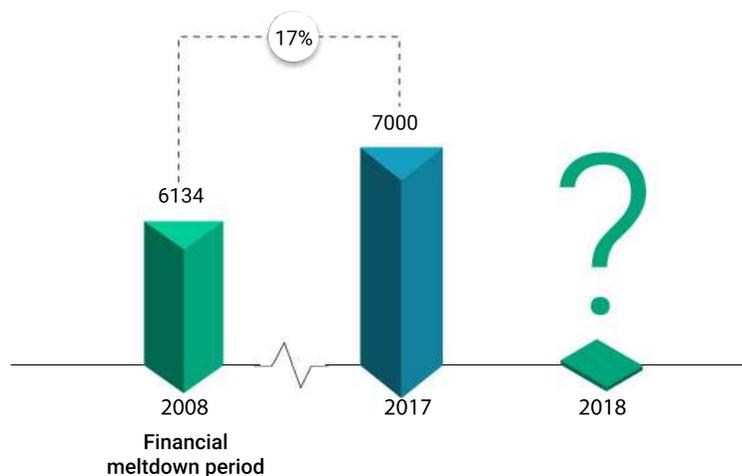
BRICK-AND-MORTAR STORES: THE GOING IS TOUGH

Brick-and-mortar stores are undoubtedly facing a spate of tough challenges. After running a successful business for more than 4 decades, a retail bookstore giant (which had more than 500 physical stores) had to down its shutters. An estimated 7000 stores closed in 2017, which is 17% higher than the number during the financial meltdown period, i.e., 2008. The US media termed this closure of stores as “Retail Apocalypse” (refer to Exhibit 1). Today, retailers across industries are facing multiple challenges in operating their stores, be it ‘Mom & Pop’ stores or even retail giants. According to industry experts, here are some of the major challenges:

- **Online threat:** E-Commerce has pampered its customers with a myriad of services like vast product options, latest product designs, free returns/exchange, personalized marketing strategies, greater discounts, etc. The range of services keep expanding which is a major threat to retailers as they do not have the bandwidth to provide these services.
- **Eroding margins:** Retail stores do not have much leeway to change the prices of their products as frequently as online retailers. In addition to that, online competitors can easily provide differential and specialized prices based on the data collected and other methods such as customer segmentation. Price change restrictions and higher inventory costs eat into the bottom-line margins of brick-and-mortar stores.
- **Personalized offering:** Online stores can provide relevant offerings whereas retail stores struggle to do that. Increased demand for the personalized shopping experience and a shift in buying patterns have become major issues for retail stores to continue making a profit.

Brick-and-mortar stores are facing multiple challenges in operating their stores

Store closures in US



Source: <https://www.cbinsights.com>

Exhibit 1: Number of store closures over the years in US

BRICK-AND-MORTAR STORES CAN INNOVATE AND WIN THROUGH TEST AND LEARN

While there are many challenges that retail stores face, they have one major advantage over the online channels, i.e., physical space. Physical spaces allow customers to have an engaging experience while browsing for more options in person. Retail stores help all the brands to stand out and improve their market visibility too. The brands present in these retail stores also encourage customers to spread the word about them and enable them to efficiently run their marketing strategies.

Physical space comes with its own set of challenges. For example, “What is the ideal location to place snacks in a retail store? Should the juices be placed next to chips? Should the store invest in an attractive entertainment zone?” Providing a great in-store experience can result in great traction in footfalls via positive word of mouth. The “WOW” effect is one of the most sought-after responses while deciding a customer experience strategy, however, one must also balance this with profitability and financial sustainability.

Brick-and-mortar retailers need to innovate to find suitable strategies to engage customers and test them efficiently. There are many retailers who use Test and Learn approach regularly to achieve business goals. One such retailer used Test and Learn to understand if the prices of few products could be increased without the loss of customers. Another food retailer wanted to test if decreasing sandwich prices could attract more customers. Some retailers employ Test and Learn approach to quantify the effectiveness of promotions.



Source for Exhibit 2 images: <https://pixabay.com/>

Testing multiple store layouts and evaluating the response to each strategy at a smaller number of units can help a retailer fine-tune changes and develop the perfect customer engagement strategy.

Retailers need to take advantage of their biggest asset, i.e., physical space

Testing multiple store layouts and evaluating the response to each strategy at a smaller number of units can help a retailer fine-tune changes and develop the perfect customer engagement strategy.

Exhibit 2: Physical spaces allow customers to have an engaging experience

TEST AND LEARN IS NOT EASY FOR BRICK-AND-MORTAR RETAILERS

Ideal Test and Learn strategies cannot be devised overnight. Most of the experiments go through a painful process of trial and error with extensive target measurements. Online companies have a natural advantage in testing out their innovative ideas. Their Test and Learn cost is lower in comparison to the brick-and-mortar retailers. The execution time for Test and Learn can be significantly low on online platforms than on offline channels.

Test and Learn strategies cannot be devised overnight

Test and Learn is quite challenging for all retailers. Even with in-depth insights and advanced data analytics solutions, retailers face the major challenge of designing the test and interpreting the results. However, the most significant challenge is to convince a store to completely accept the results of analytics without having the assurance of profitability or scalability of results.

The concept was adopted in the retail industry after it was championed by other industries, especially by e-commerce giants. Test and Learn was initially championed by a bank for some of its small projects but later the process was encouraged across multiple domains. Test and Learn can become quite challenging in the mathematical complexity of inferring results, and some of these challenges include:

CHALLENGES 1: APPROPRIATE TEST AND CONTROL GROUP IDENTIFICATION

1. Test group identification

A retailer with many stores needed to test out a strategy that would achieve its business requirements such as increased margin. The major drawback was that the retailer could not employ the strategy in all stores. It was important to carry out the experiment in a small number of stores that represent the brand. This implies that the cost attached to experimentation also increases with increasing number of stores. Thus, identification of test stores becomes critical. The challenge associated with identifying a group of test stores is how to ensure the group represents all the stores. The better the test stores representation, the better is the accuracy of tests in other stores. Generally, test stores are identified after the store segmentation is finished and then selected from various clusters. Numerous challenges can be present in clustering but all of them can be solved with the right algorithms.

2. Control group identification

In a Test and Learn experiment, the Test Group (TG) is a group of stores where a fresh strategy action is piloted, and the Control Group (CG) is a group of stores against which the performance of the TG is measured. The CG, therefore, represents the status quo (a scenario of not taking any new action or new experimentation). The challenge, therefore, in Test and Learn analysis is to identify test and control groups that are as identical to each other as possible. For example, the performance of a 10% cashback deal at a large store must be evaluated against not running any deal or status quo at another large store. Comparing sales of a large store with that of a smaller one would be misleading, even if both stores are in the same county and possibly have similar consumer profiles with them.

Exhibit 3 shows how different stores can be grouped or clustered together based on similarities, and test stores and their corresponding control stores can be identified from a group. Here, the clustering is only based on two metrics for ease of visual illustration. However, in real world situations, the clustering is often based on multiple factors.

The right algorithms and solutions can help overcome the biggest challenges of Test and Learn

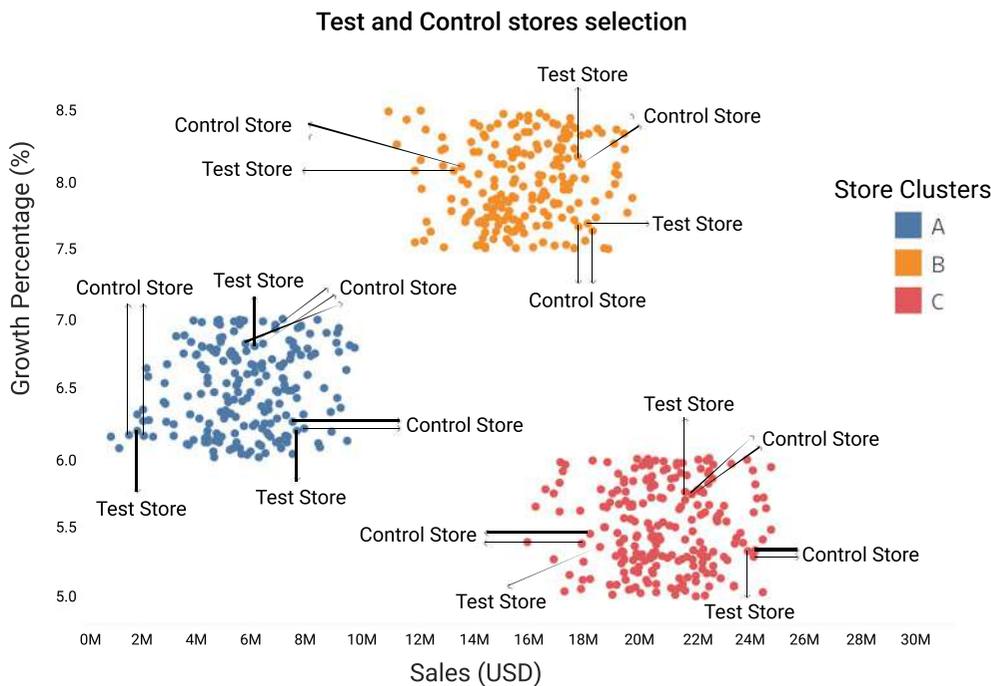


Exhibit 3: Clusters of stores required for best control store matches

3. Multiple tests or parallel tests: How to separate individual impact?

Many retailers have a limited number of stores and want to utilize these stores for numerous tests. There is always a possibility where a single store may have multiple tests running. In such scenarios, the challenge is to accurately allocate contribution from each test to the sales/margin lift observed in the stores. If there exists a condition in which tests are completely independent of each other, one can assume that there is no overlap in results from the tests. To isolate the test effects is tricky and if tests are not done properly, effort and money are lost for good.

CHALLENGE 2: MEASURING THE EFFECTIVENESS OF A TEST AND LEARN EXPERIMENT

1. Lack of correct base reference

Typically, several simultaneous marketing actions and seasonality confound the calculation of base metrics. The base metrics have two references: performance of test units vis-à-vis their own past and performance of test units vis-à-vis the control units. This can be addressed in 3 specific steps:

- **Multiple measures for matching test and control stores**

Matching the test and control units only on revenues (as better performance in terms of revenue is the intended outcome) can be insufficient. Take the example of two food outlets, one each in Las Vegas and Miami. The two stores may have similar annual total sales, yet the seasonality of demand can dominate the impact of the test if it is carried out during peak travel season. Matching the outlets based on seasonal sales, category sales, demographics, etc. may give the extra confidence needed in comparing 'oranges with oranges'.

- **Lift as a performance measure**

Lift in sales/margin in the test store or Y-o-Y (Year over Year) change accounts for seasonality and is always a better comparison than measuring the absolute change in revenue.

- **Several comparisons instead of one pairwise comparison**

The test and control groups could be one-to-one or one-to-many. If the results are robust across all one-to-one and one-to-many comparisons, then the analysis presents results with more confidence for the roll-out.

2. Performance metrics are too noisy

As the tests are run for a certain duration and there could be several other factors that drive sales during the test period, example, seasonality, promotions, new product launch, etc. When the test data is available on daily basis, these factors will appear as a random variation in sales. There are three possible ways to handle these noise measurement issues:

- **Aggregate data over test timeframe**

Aggregated sales or aggregated conversion rates may be better matched to those of control stores. This works best when the test is carried out in at least 20 or more stores.

- **Increase units in the test/control group**

Increasing the sample size of the TG reduces the variance in the data. Furthermore, it is an accurate representation of all stores or overall customers and gives better confidence in possibilities with a rollout.

There could be several factors that drive sales during the test period, which can appear as random

■ Include additional variables that influence performance metrics

The measurement of test impact is complete while considering additional sales driver variables such as brand preference, category preference, etc. in ANCOVA (analysis of covariance) regression. ANCOVA accounts for other drivers of performance that systematically influence performance in addition to the test that is piloted.

TEST AND LEARN EXPERIMENT STEPS

Efficient Test and Learn needs all users to use one application which can enable automation of Test and Learn and allow stakeholders to collaborate. The key functionalities needed in such an application are:

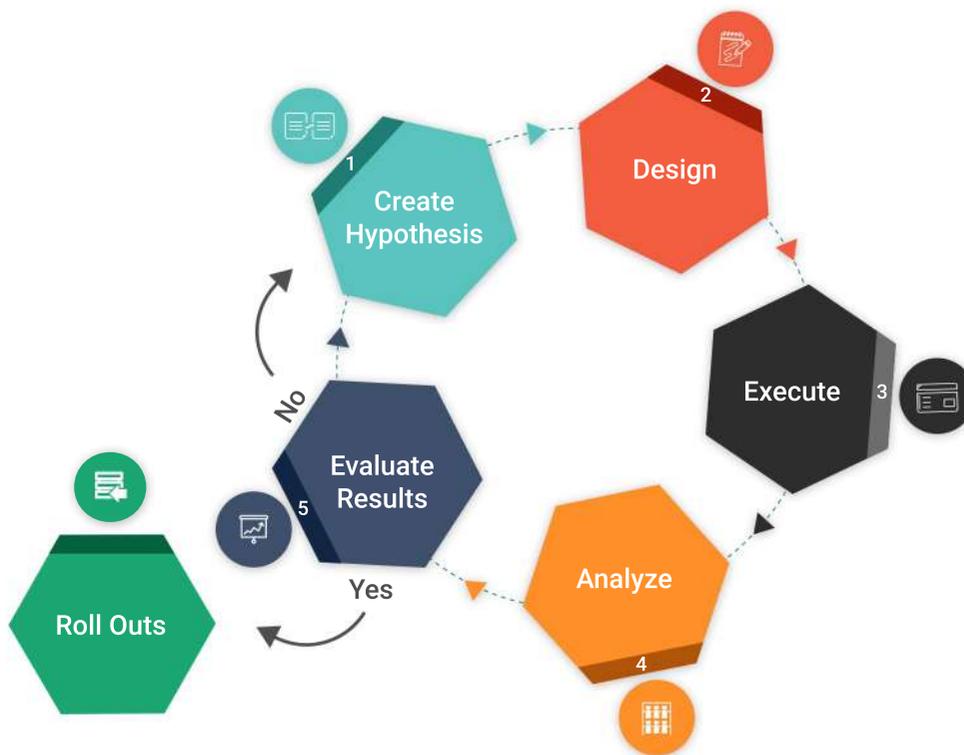


Exhibit 4: Steps to follow for Test and Learn experiment

■ **Create Hypothesis:** The first step in any Test and Learn experiment is to identify the overall objective of the experiment. The objective can be represented as a hypothesis which needs to be proved/disproved. For example, a fast-food chain wanted to reduce costs by removing mid-sized beverage cups from their menu as they believed it will not affect sales. In this case, the null hypothesis (H_0) will state that mid-sized cups do not have high sales volume and can be easily substituted with other sized cups.

■ **Design:** Metrics are then identified which can help quantify the success of the objective. In this case, number of mid-sized beverage cups sold (quantity), margins generated and their association with other items become key metrics to approve/reject H_0 . The next step is to select a few stores for the experiment before the results can be rolled out to all the stores.

Test and control stores must be identified through store clustering and similarities among stores based on automated analytics. The application should suggest the best test and control groups.

- **Execute:** Once the test and control stores are identified, the experiment needs to be rolled out in a phased manner to provide opportunities to iron out the wrinkles experienced in the first few stores. These stores also need to be tagged as test and control stores for accurate tracking of results.
- **Analyze:** The application then records and analyzes the data after the test and tracks the performance of the key metrics. These results can also be visualized using a simple dashboard that records the metrics at a store level.
- **Evaluate Results:** By comparing the key metrics between TG and CG stores using techniques such as t-tests, ANOVA and ANCOVA, the hypothesis can be approved/rejected with certain statistical confidence. Exhibit 5 below is an illustration that shows a 2% positive growth in TG stores.
- **Roll Outs:** The final step is to estimate the impact if the experiment is to be rolled out to all stores. Users should be able to visualize the impact through in-built simulations in the application.

In Exhibit 5, it is shown how test and control stores were identified and their performance during test period was compared with same period, the previous year. Control stores showed a natural growth of 3%, while test stores showed a growth of 5%, which includes the natural growth of 3%. Thus, 2% is the net impact of the Test and Learn experiment conducted. These results can be generated by ANOVA method which can provide confidence values on the results.

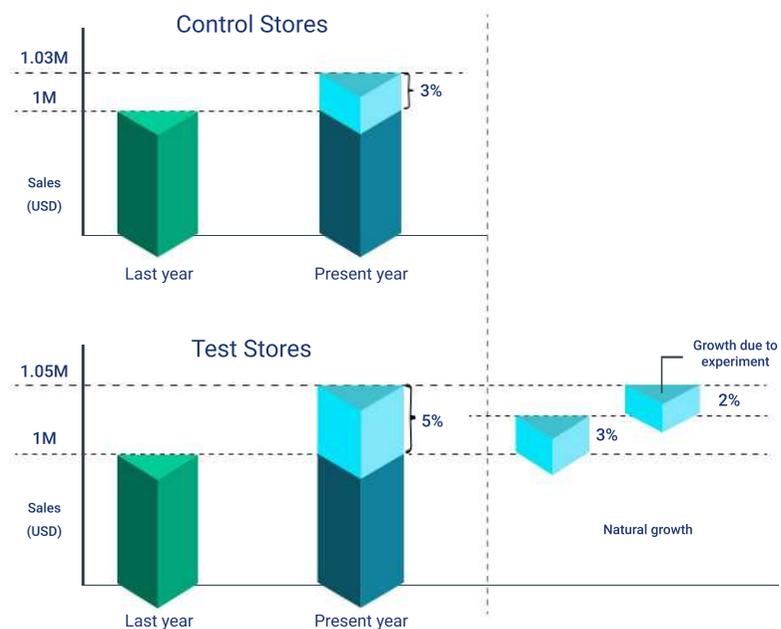


Exhibit 5: ANOVA analytics showing the impact of the test when compared to the performance of control actions

CASE STUDIES

Impact Analytics has done several Test and Learn projects for multiple clients in the retail sector and implemented the Test and Learn application. Here are a few case studies showing our approach to Test and Learn for major US retailers:

CASE STUDY I: INVENTORY MANAGEMENT FOR A SPECIALTY RETAILER

IA has worked with a retailer struggling with decreasing transaction size, declining revenues and old stock inventory. A strategy to reduce the old inventories by putting them in prominent positions was designed. The business objective was analyzed based on several parameters such as an increase in revenue, increase in affinity related categories, cannibalization in other categories, a decrease in revenue of replaced categories, etc. Some of the insights were:

- Stores were clustered based on business parameters and clustering algorithms. Ideal test and control stores were identified, and the pilot project was rolled out in 60 stores.
- The results were tracked for 6 weeks and it was discovered that there was a net increase of 9.75% in revenue per transaction. The experiment also led to increased inventory space for high moving items, which should increase basket size further.
- The pilot test was then rolled out to a set of next 100 stores.

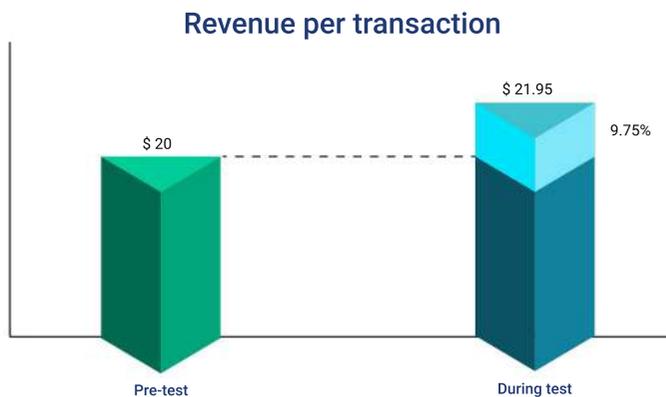


Exhibit 6: Revenue per transaction size during test period

CASE STUDY II: PRICE EFFECTIVENESS FOR A BEVERAGE RETAILER

Another famous retailer wanted to increase the margins through raising the prices of beverages across categories and decided to test this out by running an experiment. IA developed a specialized store segmentation and multiple pricing models with the help of machine learning algorithms. The pricing models suggested many products to be price inelastic, i.e., the demand would not change significantly even if the prices were increased. The following approach was used:

- In the test stores, prices of certain items were increased by 3% on average after the products were carefully selected. Products with cannibalization capability were removed and affinity related items were not introduced either.
- The pilot ran for 3 months and results showed an increase of 5.2% in margin. The number of units sold decreased marginally which was expected but overall the revenue increased leading to an increase in the margin.

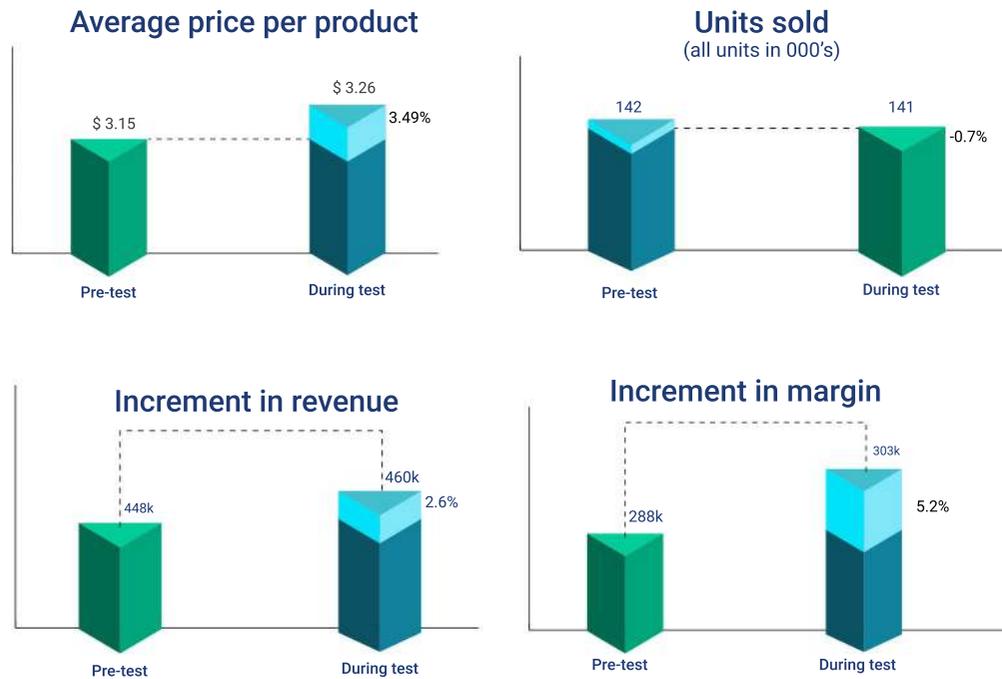


Exhibit 7: Effects of Test and Learn on different business metrics for a beverage retailer

CASE STUDY III: TARGETING CAMPAIGN FOR A SPECIALTY RETAILER

Customer segmentation was done for a pet supplies retailer. 12 distinct clusters were created after computing customer behavior metrics in an 8-dimensional hyperplane and by measuring Euclidean distances between them.

- A promotion strategy was devised for a segment of customers who generally transact with a basket size of \$46, generating \$13 in margin. The objective of the promotion strategy was to increase the margin and revenue from the customers.
- A test was designed to introduce specific coupons for a segment of customers. The customers were provided with coupons through email which could be redeemed during weekends only. A similar set of customers were identified as the CG who would not receive the coupons.
- After the test was executed, it was found that the basket size for the targeted customers increased from \$46 to \$80, with margins increasing substantially. The CG did not show any significant increase in basket size or margin.
- The test was declared successful with 73% increase in basket size and an increase of 23.5% in margin for the customer segment.

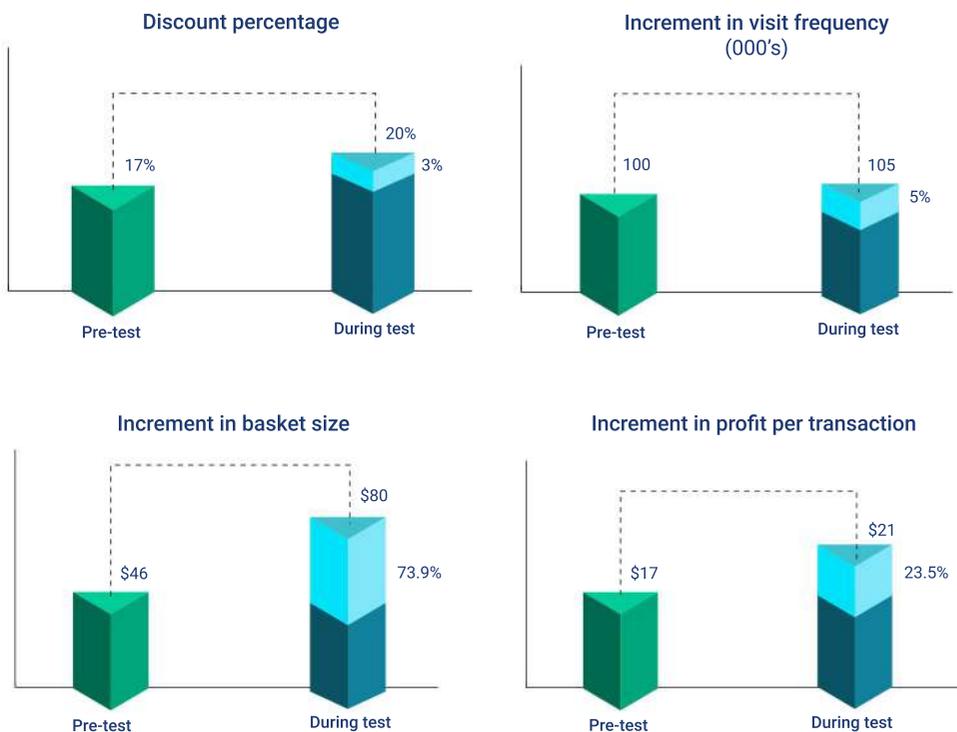


Exhibit 8: Effects of Test and Learn on different business metrics for a specialty retailer

CONCLUSION

Innovation is a must for any business to survive in the long run. Online platforms have a natural advantage when implementing innovative strategies, but brick-and-mortar retailers can also win. Retailers can leverage innovative strategies using the Test and Learn principles. Test and Learn implementation is challenging but with the right methodology and tools, favorable results can be achieved. Impact Analytics has provided its Test and Learn services to many retailers in the past and implemented an application which can be customized as per the clients' requirements.



At Impact Analytics, we conceptualize, develop and deploy 360 - degree data science solutions for data driven decision making. Our offerings span across forecasting, pricing and promotions management, consumer and marketing analytics, visualisation and reporting, etc.

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