Research for Marketing Decisions

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Lecture - 21

Causal Research Design: Experiments and its Types

If you look at three experimental designs, are very similar to the ones we conducted for sales training program. The first one one-shot study. What is happening? Who will tell me in the one-shot study what is written? So, we have an experimental group.

Very good Jayant. So there is even the last hit there is an impact. Very good. So there is experimental group only. Treatment is given

at time T1 which is denoted by X and after certain period of time at time, T2 observation is taken, and what I have written below in red color this is what will be the confounding or external variables that, have that, disturb the internal validity that would not allow us to conclude that X is a cause of Y, because their impact is also coming. History, HS, MA is maturity, SB is selection bias, MO is mortality. All these have impact in addition to X having impact on the observation. It is simply saying you gave the treatment and then you noted down the Y variable. Which means, let us say in the sales training program, you did not even take the readings before the sales training program.

You gave the sales training program and then took the reading. Only one observation are taken post the experiment. That is what is one-shot study. So, why is it called pre-experimental? We are still doing something.

It is not, it is not, pre-experimental means, it is not a, it is, we are not doing randomization. We are not Doing matching of units, we are not doing randomization. We are not using control group. They are not the true way of conducting experiments.

They are not the true way of conducting experiment. That is why they are written pre-experiment. They might act as a starter for your main course true experiment which will come. So this is just to get you started. Why we conduct one-shot study?

Because sometimes this context, our situations are such that we cannot have multiple groups and we cannot have pre and post. In real life, when we have to conduct experiments, we do not have the time resources for having multiple groups sometimes and taking pre and post readings. So there we have to conduct with, we have to be satisfied with the one-shot study. We have done one-shot study for a chatbot particular experiment.

But the results, yes, the results, you cannot confidently say that Y is because of X. In one-shot study, that problem is there. The next one is one group, but it is a good way. Next one is one group pre-test, post-test in which you are conducting a test before the treatment you are conducting an observation taking an observation before the treatment after the observation and after the treatment so which means you know you will notice the change in earlier case you are not even noticing the change and in this case, the number of problems are even more there is history, maturity, selection bias, mortality, Interactive instrumentation, mortality, the interactive testing effect and statistical regression.

All these problems are there. The last one is static group comparison. So, the control group has come. Generally, it does not come in pre-experiment, but this is one of the case. In static group comparison, what is happening in static group comparison?

Who will tell me? So, very similar to the doctor case, but doctor actually, you know, let us assume that doctor did not take the observation, but directly gave the treatment. So, Observation means they did not conduct blood sample test. So observations are not there.

Definitely we will look at the symptoms. So static group comparison is when the treatment is given to one of the groups, but there is a control group also going through the experiment but observations are taken only post the time T2. So there are selection bias and mortality. If one could control those then it will become a very good experiment. Now, the next one is true experiments true experiment, where there is a randomization, where there is a control group, so we take care of many of these things. Just wanted to highlight one aspect, let's say we are doing this one group pre-test, post-test. We have observations before and after let's say there are 25 people you have observation before the experiment

and after the experiment you have 25 observations. What statistical test you will use here to see whether there is a significant impact? Truly whether there is an impact of X1. Although there are so many confounding variables. But just to see whether the change in the observations is substantial.

What statistical test you will use? You have 25 observations. From the same people. Who went through the experiment? O1 and O2.

Same people. Pre-experiment, post-experiment. What statistical test you will use to see whether there is a significant change in the Y variable post the experiment? You have pre and post. Pair T test.

Very good. So you will use pair T test. We will learn about these tests. But it was very important to tell you because I am telling you experiment. but once you have data how you will analyze the data, you should also know how to analyze the data, simply you have to use paired sample t-test. When paired sample we use when this the respondents are same pre and post for the same respondent you are looking at their two readings but if the respondents would be let's say when we conduct for two different genders we take reading on some metric variable then we use independent sample T test.

In this case, we are, so you should also not only know how to conduct the experiment, but how to actually, once you have readings, you should also know what is the right test to do. Mortality. Oh sorry, MT is, MA is maturity, main testing effect, sorry. Main testing effect, I is instrumentation, IT is interactive testing effect, SR is statistical regression. So, true experimental designs, there is randomization of not only the respondent but also of the groups, and this is a pre-test post-test control group where only interactive testing effect will be there, which is a problem; otherwise, there is no.

History is not there see what you are doing is the control group is also going through the same events that would happen during the course of the experiment that are happening with the experimental group, so what you aredoing is you are not only taking the observations for the experimental group, but you are also taking the observation for the control group. If let's say some, let's say some event would have happened here it would impact both O2 and O4, now you are O4 minus O3 when you are doing and O2 minus O1 and you are using this particular for the total effect T is total effect you are taking care of maturity of of maturity of history and many other effects. So this I can clearly say it is because of when you are using control group maturity and history gets taken care of, when we are using randomization selection bias gets taken care of, and when you are

using actually mortality also gets taken care of when you are using total this control group. Is it ? mortality let us say if some people leave the experiment in the experimental group but do not leave the mortality would not be taken care of through the inclusion of control group. So maturity will be taken care of.

Selection bias is taken care of because of randomization. Main testing effect will be taken care of because both are being told they are participating in the experiment. So which one you are saying? Which mortality? One way of In relation to all the mean that is taken care of.

In both because when you do randomization, so you do not only select people at the extremes the idea is it would be spread over both the mortality one ways to control is to make sure that you conduct the experiment with people who would not leave the experiment because in this way if in the experimental group, they leave in the control group they don't leave so the numbers would be different so there will be still some problem. So So mortality, one way is that you you you if you are conducting, let's say, an experiment, which is for an hour, you are wanting people to come to a facility, showing them ads, very less likelihood that some people, some person will go in between and or will leave the experiment and so on. But if you are conducting a longer-term experiment, two months, three months, there is likelihood

or we can just increase the sample size. That is one way of increasing the sample size. But let's say if somebody doesn't leave, so it will be over-representing. That problem also comes. But these are very, very small problems.

One could actually have a little more sample size with the expectation that somebody leave. But minor differences would not be a big problem. If there is a size of 50 people and if one leaves, then there might not be any noticeables. Yeah, it will be very less, but whatever small will be there, it will show up in Y. This is another true experimental design. This is post-test only control group.

It has selection bias and mortality. What is the, how much time we have? So what is happening in this experiment? Randomization is there, but we are measuring only after the experiment is done. We are measuring only after the experiment is done.

And randomization is there. Why is the selection bias there when randomization is done? In this case, yes, when randomization is done, generally selection bias is taken care of. Mortality is here. Because if experimental group somebody leaves the experiment.

Selection bias should not come here. It might be there has to be something else. Because selection bias would only happen if you do not randomly select or randomly assign people to different groups. It may not be there. I think it might be a mistake but just check it.

whether it will still be there. This will be there. Both are different. Previous one. Yes, both are different.

The idea is we... So, once we have the group... We randomly allocate them to two different groups as well as randomly allocate the experimental and control group to them. Both randomization is there. So the idea of selection bias would be would not be here when we do randomization. But that is one of the question.

I think it should not be there, but just check it. Just check it maybe in your textbook just check it why whether there is a chance for statistical bias because then randomization we do both randomization in terms of allocation of sample to different groups and allocating the experimental and control group also randomly, this selection bias should not appear. Sir, maybe it could be because how we are how we are randomizing or Possible, possible.

We will check. You people check it and tell me. The idea is when we select people, we try to select people who have similar sort of background on their demographics. So, you select 30 who have similar sort of background in their demographics and then you randomly allocate. You do not select or similar sort of background on the variables

that are central to that topic. So, the sample that you select let us you select a particular 30 sample here and 1515 you put here. So, this 30 also you select the ones who are similar in the demographics or similar on those variables that are related to the topic in hand. Because we cannot, you know, 30 random people walking on the road, 30 people, not like this, 30 people who have similar sort of demographics, at least. The next one is quasi-experimental design.

Now they are not the true experimental designs. True experimental is the best form of experimental design where we use randomization, control group, and... what else we can mainly we use randomization and control group and even test units matching also we use in true we could use in true experiments but, quasi-experiment are different from true experiments one is quasi-experiment we say quasi-experiment which means they are not true experimental designs because of certain limitations in not able to do it in a true experimental way but they are more generally field based experiments field based

experiments is very difficult to control all the external extraneous variables but when we try to conduct experiments in a field setting we end up doing quasi experiment what is a quasi experiment now? One is in quasi-experiment, there is no randomization of test unit and the timing of the treatment presentation, as well as which test units are exposed to the treatment. may not be within the researchers control. The timing of the treatment at what time you will give the treatment and which test units will be exposed to the treatment at that time that is not within your control what is in your control in quasi-experiment

Who are the test units who will be exposed to the treatments, and when the treatments, even when the treatments will be given, is not under your when the treatments are given? and when the test units will be exposed to the treatment, this is not under your control, neither is the randomization possible. So what is possible is on whom the treatments will be given and when you will take the observation? these two are under your control. Now, what is the use of such a design when nothing is under my control, right? So, in quasi experiment this generally in done in field. So, what is under your control and what is not under your control?

Okay. Whatever I said from them, what is under the experimental control? What is under the control of the researcher? What is under the control is on whom? Who are the test units?

Who are going to be test unit? That is under my control. And when I take the observations. But I do not have control over when the test units will receive treatment. I cannot do randomization.

And I cannot control which test units will be exposed to treatment. And you see in this there is time series design which means I take multiple observations before and after the treatment. Now what is the use of such when there is many things that is not under the control. Now the market research companies like Nielsen they conduct They have lot of panels who give them data on many questions on a periodic basis.

Let's say in Adyar, we want to see the impact of increase in the advertisement of a particular brand. Let's say Dove. Again, we select Dove. We want to see in Adyar. whether double the amount of advertisement what will be impact on the sales of dove in the Adyar. So what we will do is and let's keep it little simple go to the time when only televisions were there there was no YouTube or no digital mode only televisions used to be watched just to

you know think of this case keep it very simple. So in Adyar let's say the company selected about thousand families, so the test units who will be the test unit is selected by the company right? who will be the test unit selected by company? but I cannot but there is no randomization these test units are there I am not running first of all any control group and I am not selecting these families randomly, I am selecting them based upon their availability for participating somebody who volunteers to participate in this experiment, I selected them, there is no randomization. Now from those families observations are taken let's say every two weeks 01 02 03 04 05, observations related to purchase of a particular of of purchase in a soap category. The Dove brand soap, we want to see double the amount of advertisement, what will be the impact? Dove advertisements are running as it is in whatever frequency it is running, and the observations are taken from 1000 families.

O1 you know every interval is 2 weeks. So let us say it is time T1, T2, T3, T4, T5. Now in that, this two week period the 2X advertisement was given to these thousands homes of in the television screens of these thousand people thousand families. Now when they will see the advertisement , which means when they will be exposed to the treatment I don't know when they switch on I so that's why I said the timing of the treatment, When the channel will run the advertisement, it is not under my control.

But I have told the channel increase the advertisement by 2X. The brand manager has told at this point of time, at time T6, increase the advertisement by 2X. Now, when they will show the advertisements and when the test units will see the, when the families will see the advertisement, that is not under my control. Neither the randomization. But I know they will be running entire day for two weeks twice the amount of advertisements and sometime test units will see it.

I don't know at what time test units will see the advertisement and I don't know what time they will release the advertisement. They might do based upon their own convenience, the channel. Twice the amount of advertisement is given in this time. And then say this T7 the readings are taken again, and from this period then again X level of advertisement continues same as the before, here I put only 2X then observations are taken T8, T9, T10, T11, now you have multiple observations in this case so you would want to see at this point of time in these two weeks when you conducted twice the amount of advertisement what is the impact on sales? and how long this impact will be there? After these two weeks you are again bringing the advertisement back to X level, so you will be able to see the changes in the sales, this is an experiment example of quasi experimental design

which you conduct in field when you don't know when your respondents will see the advertisement,

when the channel will give them the advertisement, which will, so you will have to do quasi-experimental, right? You know, moving forward, because you do not have control, let's say you want to do on YouTube digital media, YouTube will not tell you, will not, you will not, you cannot control when your ad will be shown, at what particular time, and when your users will see the ad. So the kind of experiment which you will be running with your audience on YouTube let's say related to advertisement will be quasi experimental design. And when we use a control group then it becomes multiple time series design.

It's very difficult to have a control group actually. But if you have let's say then it will become multiple time series design where with control group you can control for many other factors but it will become more expensive. Now why we are taking multiple observations if you look at the screen? When we are conducting this time series design multiple observations are taken before and multiple observations are taken after and treatment is given in between. What is happening in A, B, C, D, E?

In A post treatment the effect is there and it is sustaining. You have an increase. In A, if you look at A, there was a certain level of observations and after the treatment, the observations level went up immediately and are there still. In B, what is happening? The impact is there just the next two weeks of the increase in advertisement.

But it came back to the same. So the duration by which the effect can be sustained can be known through multiple observations. If you look at C in C what is happening? immediately after the X treatment is given the effect is not noticed but if it is noted after in the third and fourth week after a delay so delayed effect can be noted down through multiple observations. In D if you look at D if you If you look at D, trend of D and you take only the immediate observations, pre and post, what you will conclude? Increase.

But what is happening? It is increasing on its own. This trend is like this. It is not because of D. So that is why we take multiple observations. So field experiments generally are good when we do with multiple observations and in a quasi-experimental way.

Okay, so I will not discuss more about the experiments now. I will share the slides and the textbook please read because the initiation into this experimental design I wanted to give you so that you develop your own interest and carry on with that. It is not easy to

conduct experiment but if you develop your skill, there is nothing like that. So thank you everybody. We will meet in the next class.