

# How Classical Conditioning Theory Can Damage or Improve University Students' Attitude towards Inferential Statistics

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### Abstract

A quasi experiment study embedded with phenomenology design was conducted with a sample of 52 master students and 42 university teachers. Among the objectives of the study was to examine the applicability and link between classical conditioning and university students' attitudes towards inferential statistics. A modified Students' Attitudes Towards Statistics -36 (SATS-36) was used to collect data as pretest and posttest together with a teacher made test and an interview guide. SPSS and Nvivo were used to analyze quantitative and qualitative data respectively. The study

observed that attitudes of university students towards inferential statistics are not inherent but can be changed by the classical conditioning process. A Cohen's d of 0.559 (medium effect) was observed between pretest and posttest attitude scores. University professors were recommended to administer SATS-36 or its equivalent before sessions of statistics training and encouraged to teach statistics via computer at university level rather than manual.

Keywords: Classical conditioning, Attitudes towards inferential statistics, SATS-36, quasi experiment, perceptions and attitudes.



# **Classical Conditioning Theory**

The behavior or attitude of humans is not inherent, but can change overtime depending with the nature and magnitude of classical conditioning. There are circumstances when human beings normalize the abnormal, it is incredible to observe that quite a number of youths worldwide have been recruited to become suicide bombers. The process of changing one's attitude to appreciate and practice an act of suicide bombing is enhanced by classical conditioning. The performance of university students in statistics has been steady worldwide, with quite a number of university students hating statistics. Therefore, there is need for scholars to examine the relationship between classical conditioning and the attitudes of students towards inferential university statistics. The stimuli found in the environment can be damaging to the attitudes of university students towards statistics and the classical condition process has a great potential of shaping the attitudes of university students towards inferential statistics. It is true that inheritance or hereditary shapes the behaviors and attitudes of individuals but the role of classical

conditioning's stimulus-response should not be underrated.

# **Proponents of the Theory**

There is no doubt that Ivan P. Pavlov and John B Watson were the founding fathers of classical conditioning theory. Pavlov survived between 1849-1936 and was the Nobel Prize winner in 1904 because of his great and exceptional work in academic arena. Watson was inspired by Pavlov and is credited for giving the theory of classical conditioning its fuller picture. He survived between 1878-1958, worked as a professor at Hopking university and was later terminated following his sexual love encounter with his student Rosalie Rayner (Cherry 2018). Pavlov and Watson scientifically demonstrated their theory using non-humans and humans. Their theory later became a serious critique to the hereditary theory, that subscribe to the opinion that behavior/attitude is an intrinsic creation adopted from the genes of the parents. Pavlov and Watson saw it differently, they believed that. behavior/attitude is a product of the environmental stimuli and can be changed due to the dynamism of the environment.



Pavlov

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his

### **Tenets of Classical Conditioning Theory**

According to Watson (1913), classical conditioning is the changing of an individual's behavior/attitude because conscious or unconscious processes of stimulus-response. Stimuli is anything that is in the environment that is able to change behavior or attract response. For example, the use of computers in teaching inferential statistics can be a stimulus that can improve the attitudes of university students' attitudes towards inferential statistics. Lack of qualified statistics professors at university level can be a 'damaging stimulus' to the attitude of university students towards inferential statistics. Therefore, stimuli can be damaging or good for the attitudes of university students towards statistics. In the context of statistics attitudes of university students, classical condition can be defined as the impact of the learning environmental stimuli towards the attitudes of university students towards statistics. Pavlov and Watson used both non-humans and humans to demonstrate the impact of classical conditioning in behavior/attitude change.

**Pavlovian Conditioning** 

theory scientifically using his dogs. The demonstration can be divided into three stages according to McLeod (2013) that is; pre-conditioning stage (before conditioning), conditioning stage (during conditioning) and post conditioning stage (after conditioning). Pavlov demonstrated by showing food powder to a dog before conditioning and the dog salivated. The next step was for Pavlov to 'conditioning' the dog by ringing a bell followed by presentation of food powder to a dog and it salivated again. The bell was used to condition the dog, when that conditioned dog heard a bell ringing, it used to salivate even when Pavlov had no food powder. After conditioning, Pavlov used to ring the bell (even without food powder) and the conditioned dogs used to salivate. This is why my feeling is that. classical conditioning is the normalization of the abnormal. In the context of the university students towards statistics, discouraging comment from the professor may condition students to dislike/hate statistics.

demonstrated

### Watson's Experiment

According to McLeod (2013), there is no doubt that Watson was provoked by Pavlov. He gave the theory of classical conditioning



its fuller picture. In 1926 while addressing parents in United States of America, Watson challenged them to provide him their healthy children so that he could train them to be any kind of a specialist like chiefs, thieves, lawyers, beggars etc (Watson 1926). The request shocked the parents, Watson was trying to demonstrate that. the behavior/attitudes of humans can be shaped by the stimuli in the environment, a position that was demonstrated by his experiment with a child called Albert. According to Watson and Rayner (1920), Albert was a friend to a white rat before the experiment. During the conditioning stage, they paired a rat with a loud sound and Albert stated to fear the rat. Sometimes incompetent professors of statistics intimidate their students consciously/unconsciously and that could be the reason why statistics is hated by quite a number of university students.

# Literature Review on University Students Towards Statistics

The attitudes of university students vary according to disciplines of study, students from Science Technology Engineering and Mathematics (STEM) have a better perception of statistics compared to those from arts and humanities. Studies discussed in this section observed that, the attitudes of students towards inferential university statistics is largely negative and that the poor performance in statistics was mainly because of the students' negative attitude. Therefore, the attitudes of university students may be dangerous to their performance if they are not controlled for the better.

According to a study on attitude towards statistics that was done by Winguist and Carlos (2014) in United States of America with undergraduate students of psychology, statistics phobia has a negative effect on students' attitudes. The study concluded that the negative attitudes of university students was linked to statistics phobia. The same was also observed by Gundlack, Richards, Nelson and Bristol (2015). The purpose of the study was to examine the factors influencing the attitudes of university students towards statistics in USA and statistics phobia was observed to be among the key factors of attitude towards statistics. However, the studies did not explore on the major causes of statistics phobia and the its link to classical conditioning process.

In a study done via literature search by White and Gorard (2017), shortage of



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experts in inferential statistics was observed globally. They also observed that, United States of America and United Kingdom had a shortage of statisticians in psychology and economics. White and Gorard (2017) went further to raise questions on the credibility of p-values. According to a study done by Madondo (2017) in Tanzania, some journals are no longer encouraging their authors to use inferential statistics in data analysis because of the questions raised against them. The p-values are said to be based on probability and filing to pass a test during the replication of experiments and the relevance of the levels of significance have also been questioned. All these questions raised are likely to have an impact on the attitudes of university students towards inferential statistics and the credibility of pvalues.

In South Africa, Coetzee and Merwe did a study on the attitudes of 235 industrial psychology students towards statistics. The study concluded that, students perceived statistics to be hard/difficult, technical and a complicated discipline that was unfriendly. There is therefore need to check on the relationship between classical conditioning and these negative attitudes of university students towards statistics. Another study the relationship between attitudes and performance in statistics was done by Rosli and Maat (2017) and a moderate correlation between attitudes and performance was Stanisavljevic, observed. Trajkovic, Marinkovic, Bukumiric, and Cirkovic (2014) observed the same in their study done in Serbia with 417 medical student. They observed a weak correlation of 0.025 between attitudes and performance in statistics. Their conclusion basing on the correlation coefficient is that, attitude can affect performance in statistics positively but the relationship was very weak.

The study pointed out that the performance of university students in statistics is average across disciplines. A lot of questions can be raised on the poor performance in statistics. Is the poor performance in statistics a product of Intelligence Quotient or classical conditioning?

### Methodology

A study on the attitudes of the Master of Community Development students was conducted at a university in Arusha City, Tanzania. The theoretical framework was based on classical conditioning theory and



part of the aim of the study was to explore the applicability of the theory to the attitudes of community development students towards inferential statistics. The study adopted a quasi experimental design embedded with phenomenology. A modified Students' Attitude Towards Statistics -36 (SATS-36) was the major data collection tool (used as pretest and posttest) supported by a teacher made test and structured interviews. Ninety eight respondents participated on the study, 52 were master of community development 46 while were university students instructors. The data was analyzed via SPSS (quantitative data) and Nvivo (qualitative). The processes of coding was done according to the rules and consent agreement was signed by the researcher and the participants.

# Discussion

# **Classical Conditioning Process**

The researcher started the quasi experiment by giving SATS-36 as a pretest and the analysis of data for the pretest exposed that the students had a negative attitude towards inferential statistics with an average mean score of 2.1 on a scale of 5. It was also observed that students were afraid of inferential statistics because of its possible with mathematics. The connection researcher used several techniques to 'conditioning' students and made sure that they were comfortable with learning before inferential statistics the commencement of the quasi experiment.

The first step taken by the researcher was to offer guidance and counseling to the students before the implementation of the quasi experiment intervention. Counseling was only given to 3 students who had extreme negative attitude towards inferential statistics and scored 1 on a scale of 5. During the guidance session students were encouraged to study inferential statistics and the importance of inferential statistics in life was stressed. It was also explained to the students that statistics can be studied by anyone contrary to the notion that the discipline is for the physical scientists. The researcher also managed to stress to the students that statistics and mathematics are different because the scores of the SATS-36 had shown that mathematics and statistics were the same according to their perspective. They hated inferential statistics because of their negative perception of



mathematics and were not willing to study inferential statistics.

The other methods used to improve the attitudes of the students during the quasi experiment was the teaching of inferential statistics via SPSS. The teaching was largely via a computer software. The researcher also used positive comments during teaching as well as live examples of the application of inferential statistics in life.

The results of the posttest improved greatly to an average of 4.1 on a scale of 5 from a pretest average of 2.1 on a scale of 5. Effect Sizes (Cohen's d) was used to used to measure the effect of the quasi experiment intervention or the significance difference between pretest and posttest scores. A Cohen's of 0.559 was observed which signified a medium or moderate effect, meaning that the there was a significant difference between pretest and posttest scores.

# Conclusion

It was observed that classical conditioning had a great influence on shaping the university students towards inferential statistics. The attitudes of participants were

negative at the beginning of the quasi experiment and later changed to positive by the end of the experiment. Above all, a Cohen's d of 0.559 reflected a significant difference between pretest and posttest scores. The process of classical conditioning put in place by the researcher produced positive results by improving students' towards attitudes inferential statistics. Classical conditioning can be used to damage or improve university students' perceptions towards inferential statistics. Therefore, statistics professors should be very careful before, during and after the trainings related to statistics.

# Recommendations

Statistics professors should make sure that they administer SATS-36 or its equivalent to their students before the training of statistics. The outcome should then give them direction on whether to offer guidance or counseling depending with the magnitude of the problems of individual trainees. The teaching of inferential statistics should be 100% via computer because statistics computations are not done manually in industries and will help to improve the external efficiency of statistics programs.



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