

# Disrupting Learning of Statistics: Using an Appreciative Inquiry Approach to Create Smart Learning Designs

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## EXECUTIVE SUMMARY

*Saudi Arabia, with its deeply conservative yet rapidly changing society, has adopted an ambitious blueprint for the future in Vision 2030. One of its goals is to increase women's participation in the workforce from 22% to 30%. This case study focused on Saudi female undergraduates undertaking an introductory statistics course. With an emphasis on disruption and smart learning, the author created interventions and tracked changes in attitudes and perceptions of students towards statistics from the beginning to the end of the course. Reusable online resources in the form of a series of content and problem-solving videos were introduced as the semester progressed. At the same time, an appreciative inquiry approach was used to foster a positive change environment. An online forum was created to encourage student discussion and feedback throughout the semester, and anonymous course evaluations were conducted at the end of course. Qualitative and quantitative results are presented here.*

## INTRODUCTION

Saudi Arabia's ambitious blueprint for the future, Vision 2030, has as one of its goals as to increase women's participation in the workforce from 22% to 30% via the National Transformation Program for Education Reform. This program aims to provide the young Saudi workforce with a strong basis for employment. The case study described here focuses on the education of Saudi female undergraduates undertaking an introductory course in statistics. The emphasis on female education is a significant one as the role of women in this society is now moving into national prominence in line with Vision 2030. In addition, while many studies on attitudes towards studying statistics have been carried out in English-speaking target groups, this case study provides a rich opportunity to examine how attitudes may differ

across regions and cultures. On a broader level, it offers insights on attitudes towards education among women in a deeply conservative and yet rapidly changing society.

Undertaking a course in statistics can be a source of anxiety for undergraduates. Statistics involves the study of essential concepts that are abstract and complex, for example, what does randomness mean, what is a sampling distribution and how do you come to a statistically significant conclusion?

Increasingly, a wide range of degree programs require students from non-mathematics or non-science majors to undertake an introductory course in statistics. Thus, students enroll out of necessity, typically needing the statistics course to graduate. These students often lack a strong background in mathematics. Their anxiety about the subject is compounded by anecdotal stories of how difficult the subject is and past negative experiences with courses in mathematics or the instructors teaching the subject. Often, this means that students enroll in a mandatory statistics course towards the end of their degree program and are faced with the added pressure of needing to pass the course to graduate.

Added to this is the challenge of tackling the course as an English Language Learner (ELL). To be able to understand and clearly communicate the results of statistical analysis is already challenging, and the added difficulty of using a second language presents yet another source of anxiety.

The motivation for this case study was the recognition that attitudes and perceptions towards an area of study can greatly affect learning outcomes. The main goals of this study were to introduce elements of a smart learning environment (SLE) into the delivery of an undergraduate introductory course in statistics for female students and to determine if student attitudes towards the course had changed throughout the duration of the course. In addition, this case study sought to report on student emotional responses at different times during the semester following an appreciative inquiry approach used in the classroom. This study recognized that students of ELL backgrounds from Saudi Arabia may have different attitudes, perceptions, and emotional responses towards statistics compared with studies based on English-speaking student populations.

## **THEORETICAL FRAMEWORK**

Statistics is a discipline which provides a set of tools for dealing with data. The study of statistics and the value of being able to apply critical thinking skills in statistics is recognized to be an integral part of a university student's repertoire, so much so that introductory courses in statistics are now mandatory in many undergraduate degree programs worldwide.

The traditional concept of mathematics is that of being able to operate on and manipulate numbers. The study of statistics requires a different kind of critical thinking because it is not concerned only with the skillful manipulation of numbers, but it extracts a *story* from groups of numbers, referred to as data. It is unique because "data are not just numbers, they are numbers with a context" (Cobb & Moore, 1997, p. 801), and it is this context which provides meaning in data analysis (Cobb & Moore, 1997). In statistics, context dictates procedure and interpretation of results (Gal & Garfield, 1997). Statistics is a highly conceptual field, not simply a collection of methods to solve problems, and it is this that distinguishes it from the study of mathematics (Brown & Kass, 2009).

Anxiety towards the study of statistics has long been reported and can lead to numerous problems: learning difficulty, postponement in taking courses in statistics, and poor exam performance (Macher, Paechter, Papousek, & Ruggeri, 2012). Crucially, students may develop a long-term dislike of statistics, resulting in avoidance of further enrollment in more advanced statistics courses. Avoidance or dislike

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