

# Linear Algebra as A Pre-Requisite for A Course in Machine Learning: Interactive Online Vs Traditional Class Vs Self-Study Delivery Modes and Their Effects on Performance and Retention

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## Abstract

Any advanced class in Science, Technology, Engineering, and Mathematics fields requires prerequisite knowledge. It is natural to expect that different students will have different levels of knowledge in each of these prerequisite areas. We considered case of a Linear Algebra prerequisite for a Machine Learning course that was implemented as an interactive online self-paced Concept Inventory enabled course using Jupyter Notebooks and nbgrader and compare it from student's performance, retention, and satisfaction points of view with the traditional classroom mode as well as the self-study mode. We use three comparison metrics: post-assessment performance test based on Concept Inventory, satisfaction survey, and retention rate in the major course based on the prerequisite mode used. The post-assessment test shows that the traditional classroom mode provides a better level of the required prerequisite knowledge understanding comparing to the interactive online mode, which, in its turn, provides a better understanding level comparing to the self-study mode. However, the satisfaction survey administered after each class shows a preference by both the students and the instructors for the interactive mode compared to the traditional classroom mode, which, in turn, was preferred to the self-study mode. We also observed a better student retention in the subsequent Machine Learning class in the cases of the interactive and the traditional modes for the Linear Algebra prerequisite modes comparing to the self-study prerequisite mode. Our study shows that the least beneficial mode by all the metrics used is the self-study mode.

**Keywords:** prerequisites, machine learning, linear algebra, interactive self-study course, traditional course delivery