

A Perspective on Teaching Mathematical Concepts to Freshman Economics Students Using 3D-Visualisations

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Abstract : Cobb-Douglas production (utility) function is a fundamental function widely used in economics teaching and research. The key reason is the function's characteristics to describe the actual production using inputs like labour and capital. The characteristics of the function like returns to scale, marginal, and diminishing marginal productivities are covered in the introductory units in both microeconomics and macroeconomics with a 2-dimensional static visualisation of the function. However, less insight is provided regarding three-dimensional surface, changes in the curvature properties due to returns to scale, the linkage of the short-run production function with its long-run counterpart and marginal productivities, the level curves, and the constraint optimisation. Since (freshman) learners have diverse prior knowledge and cognitive skills, the existing "one size fits all" approach is not very helpful. The aim of this study is to bridge this gap by introducing technological intervention with interactive animations of the three-dimensional surface and sequential unveiling of the characteristics mentioned above using Python software. A small classroom intervention has helped students enhance their analytical and visualisation skills towards active and authentic learning of this topic. However, to authenticate the strength of our approach, a quasi-Delphi study will be conducted to ask domain-specific experts, "What value to the learning process in economics is there using a 2-dimensional static visualisation compared to using a 3-dimensional dynamic visualisation?" Here three perspectives of the intervention were reviewed by a panel comprising of novice students, experienced students, novice instructors, and experienced instructors in an effort to determine the learnings from each type of visualisations within a specific domain of knowledge. The value of this approach is key to suggesting different pedagogical methods which can enhance learning outcomes.

Keywords : cobb-douglas production function, quasi-Delphi method, effective teaching and learning, 3D-visualisations

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