

## Short Communication

# The Scope of Input-Process-Output Diagrams in Teaching Economics

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In this paper, we discuss the scope of input-process-output diagrams in teaching introductory economics. Research shows that teachers and students both benefit when visual aids are used in classrooms. Hence the simple and familiar visual nature of input-process-output diagrams can benefit the teaching and learning of important economic concepts, such as production, concepts related to production and economic modeling. In addition, since input-process-output diagrams are also used in other areas of study, such as computer science and business studies, its use in economics classrooms and text-books can lead to easier and better understanding.

**Keywords:** input-process-output diagrams in economics, teaching production, teaching production externalities, teaching economic modeling, teaching economics using visual aids

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## INTRODUCTION

This paper explains how Input-Process-Output Diagrams (IPOs)<sup>1</sup> can be used to teach the concept of *production*, certain *concepts related to production*, and as an easy-to-understand-example of *economic modeling*. According to research, both teachers and students benefit when visual aids are used in class-rooms (Rasul, Bukhsh, & Batool, 2011; Melor et al., 2013; Ghulam et al., 2015;). Hence the visual aspect of IPOs can improve the teaching and learning of certain important economic concepts. Since IPOs (and models in general) are also used in other areas of study, such as computer science and business studies, their use can lead to easier comprehension of concepts. IPOs can also be used to stimulate creative and conceptual thinking through class

work or assignments.

A review of the popular introductory economics textbooks by Arnold (2010) and Mankiw (2012), indicates that the discussion of economic models are done without a diagram making it difficult for students to understand the essence of economic modeling. Similarly, the discussion of production is also unaccompanied by a visual aid in all the textbooks that we have come across so far. In the following segment of this paper we discuss how an IPO can be easily used in textbooks and classrooms when discussing these important economic concepts.

<sup>1</sup> Henceforth input-process-output diagram will be abbreviated as IPO

## IMPLEMENTATION

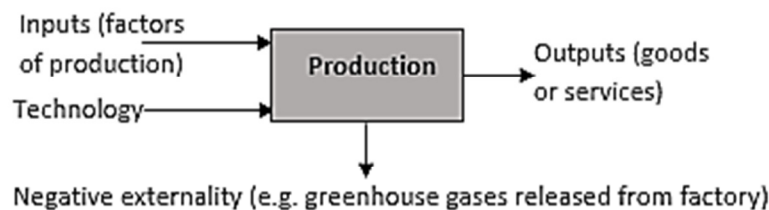
IPOs can be applied in situations where a process transforms given input(s) to output(s) and by-product(s). Production is defined as the transformation of inputs (factors of production) into outputs (goods or services) (Arnold, 2009). An IPO fits perfectly with the definition of production and hence it can be used to explain the concept of production as shown in the following figure (next page):



**Figure 1:** An IPO illustrating the economic activity of production

Firstly, the above illustration (Figure 1) can be used as an easy-to-understand example of economic models (or theories). A model is a simplified representation of something designed to better understand that something (Arnold, 2009; Mankiw, 2012). Figure 1 is a simplified representation of the production process which helps to better understand the process. The important role of assumptions in economic modeling can also be highlighted in this discussion. In the model in figure 1 it has been assumed that the only inputs (or factors of production) are necessary to produce the output and there are no by-products of this process.

Secondly, critical and creative thinking can be tested and stimulated by asking the students to analyze the assumption above (last line of last paragraph), then improve it and thereby incorporate the concept of technology and externality into the model of figure 1. This can be done by adding one more arrow for technology and one more arrow for negative or positive externality (a by-product of the production process) as illustrated in figure 2 below. Alternatively, the instructor may introduce the concept of an IPO first and then assign the students to use it to model the concept of production or consumption and its externalities.



**Figure 2:** Incorporating technology and negative externalities into the model in figure 1

Thirdly, the IPOs in figure 1 and 2 can also be used to illustrate the predictive power of models. For example, it can be predicted that an increase in inputs and/or technology will lead to an increase in outputs. Hence the instructor may explain the concept of economic growth (or GDP) as a part of the discussion.

The following YouTube video (until 2.55 mins) provides a sample on how an IPO can be used to discuss the concept of production and concepts related to production, such as fixed inputs, variable inputs, fixed costs and variable costs:

<https://www.youtube.com/watch?v=VX9PcHpYTYo&t=59s>

## EVIDENCE FROM CLASSROOMS

During an assignment on the topic of production, students were asked to explain the concept of production using the example of a small coffee shop. Full marks were awarded if the answer included a sensible discussion on inputs and the output (in this case, cups of coffee). Interestingly, all the students who used an IPO in their discussion, as shown in class, obtained full marks because they could clearly discuss both inputs and outputs in the given context. However, many students who did not use an IPO in their answers could not precisely discuss the output in the given case and thus received lower marks.

## CONCLUSION

Existing research already shows that both teachers and students benefit from visual aids and hence IPOs' simple visual nature can improve the teaching and learning of certain important economic concepts. In conclusion, IPOs similar to figure 1 and 2 can be included in textbooks and class discussions when discussing the concept of production (or consumption), concepts related to production (e.g., externalities and economic growth) and as an easy-to-understand-first-example of economic models. The IPOs (of figure 1 and 2) can precede the circular flow model and the PPF in textbooks and classrooms thus providing more exercise on the fundamentals of economics modeling. IPOs can also be used to teach other concepts of economics, such as production functions, and they can also be used to make simple animations in MS Power-point. Experimental research and surveys can be undertaken to assess the impact on students' learning, teachers' teaching and their perception about the use of IPOs in class-room and textbooks. Due to limitation of resources we could not conduct experimental research and surveys on the impact of IPOs which leaves room for further research.

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