

Economics externalities

I n t e r a t i o n	21st Century Theme: Global Awareness		
	Concepts for STEM Disciplines	Mathematics Modelling	Economics Demand and Supply model (in preparation to externalities)
		Technology GeoGebra	Science Education Real world articles outlining environmental issues and problems around the world
Prerequisite Knowledge			
<p>Mathematics 11th-grade. Students will understand the use of models consisting of linear functions; will be able to explain changes in the model (shifts and/or movement along each line); will be able to relate the changes in the model to real life events; some will be able to critically evaluate the issues arising from using a model to describe real world problems; some may be able to algebraically explain the model.</p> <p>Economics 11th-grade. Students will understand the the relationship between the model and real world event; most will be able to use the model to indicate changes in the real world; some will be able to create a model to chosen real world problems.</p> <p>Information Technologies 11th-grade. Students will be able to illustrate and are able to carry out the editing processes related to the visuals. By using open-source or free-access visual processing programs, activities such as cutting, changing the colour, and drawing a new image is performed on images.</p> <p>Learning Outcomes for Environmental Education 11th-grade. Together with their peers, students will be able to develop ideas for the solution of local and global environmental problems. Differentiation opportunity: articles can be chosen by the educator or for a higher ability group, students can be instructed to find relevant articles. The latter also indicates inquiry-based approach.</p>			
Learning Objectives			
<p>Grade Level: 16-17 years old Duration: 180 minutes</p> <p>Learning Outcomes for Mathematics Students will understand the use of models consisting of linear functions; will be able to explain changes in the model (shifts and/or movement along each line); will be able to relate the changes in the model to real life events;</p> <ol style="list-style-type: none"> a) using the GeoGebra applet to investigate the model and its structure; students have to explain with their own words what the model shows when certain changes are made. b) using the GeoGebra applet to investigate the model and its structure; students will explain each area and their changes when the model changes. <p>Students will be able to critically evaluate the issues arising from using a model to describe real world problems; some may be able to algebraically explain the model)</p> <ol style="list-style-type: none"> a) improve students' application as well as critical thinking skills by connecting the model to the real world problem; students write the paragraph explaining the issues of using models to illustrate real world problems b) some may be able to calculate the area when the functions change (ie shift) 			
<p>Learning Outcomes for Economics Students will understand the the relationship between the model and real world event; most will be able to use and explain the model to indicate changes in the real world;</p> <ol style="list-style-type: none"> a) improve students' application skills by outlining the benefits of using models in a given case. <p>Students will be able to create a model to chosen real world problems; some will be able to evaluate the the use of models (limitations) in illustrating real world problems.</p>			

	<p>a) students work on the evaluation skills and develop synthesis by comparing and contrasting critically the use of the model in the chosen real world problem.</p> <p>Learning Outcomes for Information Technologies Students are able to design a presentation in which they skillfully use mathematical modelling to illustrate and offer solution(s) to real world problems; Students will be able to manipulate a GeoGebra animation to fit the purpose. Students will be able to offer effective visualisation to such issues.</p> <p>Learning Outcomes for Environmental Education Students will be able to develop ideas for the solution of local and global environmental problems.</p> <p>a) By responding to local and global environmental, microeconomic related articles, students develop an understanding of complex environmental problems, while enabling them to use appropriate tools to offer solutions to such problems.</p>
R	<p>Problem Situation In order to find solutions to microeconomic environmental problems, students are expected to understand the complex nature of real world problems.</p>
L	<p>Materials</p> <ul style="list-style-type: none"> ● Appendix 1 (example article if given by educator) ● Internet connection ● Computer
S	<p>Preparation for the lesson Teachers will prepare for the lesson by searching for appropriate articles for students to use OR show as example (see appendix 1) NQTs (fresh graduates) may wish to do some background research on</p> <ul style="list-style-type: none"> ● Current microeconomic environmental issues ● Currently used policies to deal with such issues (global awareness) ● Getting familiar with D-S model use
o	<p>Resources https://www.geogebra.org/m/NmxNzYeF#material/VGWtkPU5</p>
S	<p>Ask The lesson begins by brainstorming. Students are asked the following questions:</p> <ul style="list-style-type: none"> ● What is the market? ● What could change that would have an impact on a market? (supply, demand - tax, subsidy, laws and regulations, income etc) ● Elicit examples of changes in the market from students - write them up on the board/electronically <p>Some articles are given to students (discretion of educator), each group read their respective articles and outline the</p> <ul style="list-style-type: none"> - real world issue/problem - solution (if given) - brainstorm for solution (if not given) <p>After the reading and brainstorming,, the following questions are asked from the students, and a discussion environment is created in the classroom:</p> <ul style="list-style-type: none"> ● Why are the real world issues? What problems stem from each? ● What would happen if we couldn't offer solutions? ● To what extent the offered solutions are effective? (given or brainstormed)
	<p>Research Students after the discussion above, do research in small groups to find articles in topics of interest (but relevant to environmental issues, globally). Answer the same set of questions after finding appropriate articles.</p> <p>Students may use appropriate sources to investigate potential solutions to such problems (eg. https://www.studysmarter.co.uk/explanations/microeconomics/market-efficiency/correcting-externalities/)</p>
	<p>Imagine After collecting relevant information from the internet, students in groups discuss about:</p> <ul style="list-style-type: none"> - outline the issue - show model (with and without problem)

	<ul style="list-style-type: none"> - explain the change in model - outline (or offer) solution - explain advantages and disadvantages of solution - offer critical evaluation of the solution overall based on the above
	<p>Plan</p> <p>After the discussion, the students will begin working in groups to create a presentation that includes all the points discussed. The students will be required to work with GeoGebra, using the GeoGebra applet to investigate the model and its structure. They will also need to explain in their own words what the model shows when certain changes are made.</p> <p>In addition, the students will be expected to use the GeoGebra applet to investigate the model and its structure, and explain each area and the changes that occur when the model is altered.</p>
	<p>Create</p> <p>Students must create a presentation with the points discussed above to present in front of the class.</p>
	<p>Test - peer assessment rubric for presentation and economics relevance</p> <p>Students present their presentation while peers and educators listen attentively and take notes to support detailed rubric information. (rubric attached) Both peers and educator (in this order) give feedback to student group, focusing on</p> <ul style="list-style-type: none"> - delivery of presentation - economic relevance (solution, consideration given to applicability of given solution; eg. how realistic it is to implement such solution in given country) - model use - presentation of changes on diagram, explanation of changes of diagram, link to real world problem) - shown awareness of environmental issues (eg. relevance of chosen article)
	<p>Improve</p> <p>After feedback given, student groups are then asked to act on the given feedback and make further research if needed, to improve their answer (act on feedback)</p> <ul style="list-style-type: none"> - if changes made: explain why (data support) - if no changes made - explain why (Data support)
<p>M a t e r i a l s</p>	<p>Appendix 1. Article attached - either as examples (with more able students) or used as is.</p> <p>Appendix 2. Peer assessment rubric</p>
<p>I m p r o v e</p>	<p>Lessons can be designed so that after the selection of appropriate articles, students design their relevant diagrams on GeoGebra.</p>

Annex 1. Relevant article links

<https://www.bbc.com/future/article/20230103-how-plastic-is-getting-into-our-food>

(reducing demand as a solution for example)

<https://www.abc.net.au/news/2023-02-24/australia-vaping-problem-health-policy-solution/102012768>

<https://tobaccoreporter.com/2022/08/30/cigarette-smugglers-busted-in-hungary/>

(smuggling and impact on supply)

<https://www.globenewswire.com/news-release/2023/02/28/2616869/0/en/The-Global-Paper-Cups-Market-Estimated-to-reach-US-14-billion-by-2033-Exclusive-report-by-Future-Market-Insights-Inc.html>

(link between ban on plastic and surge in paper cup production; issues?)

<https://www.nytimes.com/2023/02/08/business/china-pork-farms.html>

(pig production, issues?)

<https://www.nature.com/articles/s41598-023-29480-5>

(potential solution to pig production problem)

<https://www.rnz.co.nz/news/political/483481/government-s-fuel-subsidy-extension-extremely-dumb-economic-policy>

(fossil fuel subsidy)

<https://retail.economictimes.indiatimes.com/blog/rising-input-costs-coupled-with-higher-taxation-lead-to-a-bitter-after-taste-for-indias-beer-industry/97729648?redirect=1>

(tax on alcohol)