Teaching Plan

Title	Externalities
Instructional Objectives	➢ To illustrate the generation of a negative externality ➢ To show the application of the Coase Theorem
Keywords and Concepts Illustrated	1. Negative externality 2. Positive externality 3. Coase Theorem
Assumptions	➢ Students know what property right is.
Needed Time	➢ 80 minutes

Sessions	Details	Time Spent
Activity/ Announcement	1. A brief review of property rights and introduction of externalities. 2. T: Let's play a game. First of all, clear your desks except for a pencil and a rubber. Raise your hand if you don't have any, I will lend them to you. 3. Since students have to work in pairs in this game, please refer to Diagram 1 for the classroom setting. If the number of students is an odd number, one student should be chosen as your assistant for this game. 4. T: You will be working in pairs in this game. Everyone who is sitting on the odd roll represents Firm A. Those who are sitting on the even roll represent Firm B (refer to Diagram 1). 5. T: Now, I am going to give each pair of you a record sheet. (Sample of the record sheet can be seen in Diagram 2). 6. T: What Firm A produce are the answers of 20 math problems on this question paper. (The math problems should be a little bit complicated, so that some calculation on paper is needed. For example, 23x56). You can get one bonus point for each math problem answered correctly. You have three minutes to produce these answers. You have the following resources to help you: a) Question paper b) Five pieces of paper for your calculation (The size of these paper can be found in the "Tool" part.) c) One pencil 7. No calculators and other scratch paper can be used. Nor can you write anything on the table. You cannot communicate with others or you will lose your bonus	10 mins

	points. Your neighbor will be monitoring you.	
	8. T: Remember, you should write your answers on the space provided on the question paper. Calculation should be done ONLY on the 5 pieces of paper I give you.	5 mins
	9. Distribute each Firm A a question paper and 5 pieces of paper. Firm As have three minutes to do the calculation.	5 mins
	10. T: (After three minutes, project the answers on the screen) Now, Firm Bs check the answers and record Firm A's earnings on the record sheets.	5 mins
	11. T: After recording the earnings, Firm A should give their five pieces of paper to Firm B. What Firm B produce are paper airplanes by using the five pieces of paper. Firm B can receive two bonus points for each paper airplane you can produce in three minutes. However, the planes you produce MUST look exactly as same as mine (show students your plane). And they must be purely white, so if there is any pencil mark on your paper, you should use an eraser to erase it. You are advised not to tear off the part of paper that has pencil marks, otherwise, the plane produced will be in a smaller size.	5 mins
	12. Distributes one A4 size paper to each Firm B and ask them to follow the steps of folding the plane (use A4 paper for better demonstration result).	
	13. Show to students a qualified plane and three disqualified planes, i.e. one with some marks in the inner side of the paper airplane; one with no marks but dirt (like pencil marks not totally erased) and one in smaller size due to the use of a smaller paper.	5 mins
	14. T: (After three minutes) Now, Firm As help count the number of qualified airplanes made by Firm Bs and record the number on the record sheets.	5 mins

	15. T: This game can show a common problem that exists in our society. Firm As represent upstream firms which dump waste into the river during production. Firm Bs represent downstream firms which have to use clean water in their production. Therefore, Firm Bs must pay to purify the water before it can be used. In other words, Firm A imposes an external cost on Firm B. Since neither Firm A or B have control over the river, that is, lack of property rights, Firm As tend to overproduce as tjeu do not need to concern the external costs that impose on Firm Bs. From the social point of view, Firm As over-utilize clean water in their production. In economics, we call the waste dumped as negative externalities. Firm As will continue to over-utilize the clean water, over-produce their products and produce negative externalities as long as they need not consider the external costs imposed on Firm Bs.	5 mins
	16. T: In our game, who produced negative externality? (Ans: Firm As) What was the externality? (Ans: pencil marks on those small papers) What was the external cost of Firm Bs have to pay? (Ans: the time used to erase pencil marks) When Firm As calculated the answers of the problems, would they consider the cost imposed on Firm Bs? (Ans: No, because Firm As do not know Firm Bs existence and even if As know, As would not care about the costs imposed on Bs.) So, what can we do to make Firm As consider not only their own production costs, but also the cost it is imposed on Firm Bs? Should Firm As pay for using the paper? Should Firm Bs pay for the clean paper? If you think Firm As should pay, then who has the property right of blank paper? What if you think Firm B should pay?	5 mins
	17. T: Now, each pair of Firm A and Firm B can negotiate about the payment scheme among yourselves. You can decide who should pay for using the blank paper. That means you should decide who owns the property right of the blank paper.	
	18. Then the game is repeated with the payment scheme incorporated. Make sure that the old papers are collected back before the new paper is distributed. This time another set of 20 math problems is used.	5 mins

	19. During the second round of the game, teacher should observe how different students are responding to the new incentive system, i.e. the payment scheme they used. Teacher should mentally select a few students to call upon later to explain how the new incentive system altered their production processes. Teacher should look for Firm A who may: a) do all their work on one piece of paper; b) choose to use two or three paper; c) choose to produce the answers without using any of the 5 paper provided, illustrating a firm choosing an alternative production method and d) choose not to produce at all.	5 mins
	20. After three minutes, Firm Bs check the answers for Firm As and keep the record. Then another three minutes will be given to Firm Bs to produce airplanes.	5 mins
	21. Teacher can call on the Firm As that were mentally selected before. T: (to each of these Firm As) How many problems did you solve in the first production round? Did you reduce the number of paper used in production and how did this affect your outputs in the second round? Why you behaved differently? Who paid for the use of blank papers between the two of you?	5 mins
	22. T: Some of you changed your production process to conserve the valued resource (the blank paper) because Firm As have now internalized the cost of your actions. No matter if Firm As have to pay for using the blank papers or to get a compensation for not using the blank papers, you have internalized the external costs imposed on Firm Bs, that is the time used to erase the marks on the paper. 23. Ask each pair of students to calculate their total output in both rounds of production and fill in their record sheets. 24. T: Which pair of students has more total output in the second round of production?	10 mins

	25. T: In the first round, large quantities of math answers were produced at the expense of paper airplanes. The existence of the externality caused math answers to be overproduced and led to the underproduction of paper airplanes. In the second round, the externality is corrected when the cost of producing the externality is internalized. So, there is a more efficient production of the two goods, math answers and paper airplanes. It is because Firm As considered the external cost of using the resources. They have to pay for the used paper if you guys assume that Firm B has the property right of the blank paper or Firm As lose the compensation as they use the blank paper if you assume that Firm As have the property right. Therefore, the resources can be allocated more efficiently and neither good is overproduced or underproduced. You can also see that the total number of bonus points earned by Firm As and Firm Bs together increase because of an overall increase in production. 26. Coase Theorem should be illustrated by explaining that regardless of which firm receives the property rights, if the externality is internalized, then the allocation of resources can be more efficient provided that the transaction costs are sufficiently low. Teacher can ask students whether the transaction cost between Firm As and B was high or low. Tell students how the transaction cost and negotiation cost will change if each of them is the only firm in their industry.	
Tools	➢ Some pencils and rubbers – in case some students don't bring them to class ➢ Blank papers – evenly cut a A4 sized paper into eight small pieces, the total number of blank papers prepared is based on the size of your class, make sure every Firm A student has five pieces ➢ Two transparencies – photocopy the two sets of math problems on them ➢ A projector	
Definitions	➢ Externalities – refer to the spillovers which are the consequences of the action that actors don't take into account and therefore don't influence their decision. (Leung, 1989)	

	➢ Negative externalities – are the detrimental consequences of the action that actors don't take into account and therefore don't influence their decision. They also refer to a divergence between private and social costs. ➢ Positive externality – are the advantageous consequences of the action that actors don't take into account and therefore don't influence their decision. They also refer to a divergence between private and social benefits. ➢ Coase Theorem – It states that if property rights are well-defined or specified and transaction costs are zero, then a) the allocation of resources will be efficient as there is no problem of externalities, b) the allocation of resources will be identical, regardless of the initial assignment of property rights. (Lam, 1989)	
Homework	1. What is externality? 2. Please give some examples of negative externality and positive externality. 3. What is the definition of Coase Theorem?	
References	➢ Experiment: ➢ Hoyt, Gail M., Patricia L. Ryan, and Robert G. Houston, Jr., Spring 1999, The Paper River: A Demonstration of Externalities and Coases Theorem, *Journal of Economic Education*, vol. 30(2), pp. 141-147. ➢ Definition: ➢ Leung, M. P., 1989, Hong Kong Advanced Level Examination Microeconomics: Hung Fung Book Co.Ltd. ➢ Kwok, W. K. and Chan, C. M., 1994, A-Level Microeconomics: Golden Crown Publication. ➢ Lam, P. L., 1989, Advanced Level Microeconomics: Illustrations Macmillan Publishers (HK) Ltd	

Appendix	**Materials for Teacher**
Diagram 1	Classroom Setting
Diagram 2	Record sheet
Table 1	Math Problems (Set 1)
Table 2	Math Problems (Set 2)