

EFFECTS ON LEARNING WHEN STUDENTS HAVE INFORMATION ABOUT GAMES AND THEIR OUTCOMES WHEN PLAYING THEM

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ABSTRACT

Since playing games is commonly used as a teaching method in business and in economics, students can find information about games and their outcomes before they play them. A concern is that this information may have negative effects on learning as students then may put less effort into playing the games and consequently, the students do not learn the concepts within the games. However, the information can also have positive effects if the students understand the games and their outcomes better. In this paper, we study the effects of providing students with various amounts of information prior to playing three games commonly used in economics. We find that decisions are closer to the theoretical outcomes when information about outcomes is provided. In addition, scores are higher on a related test when information about the game is provided. Still, the students report similar learning experiences as when this information is not provided. Our results indicate that having information about the games and their outcomes when playing them has positive effects on learning.

INTRODUCTION

Shubik (2002) summarized after years of using of games for teaching that the games appear to be of considerable aid in involving the students in actively trying to utilize or challenge the concepts they are being taught. Edman (2004) found that differences in available information when playing a business game had effect on decisions. Since the use of information requires related knowledge, differences in decisions can be used to assess learning and knowledge of concepts. In their review, Gosen and Washbush (2004) found a number of studies showing support for the learning effectiveness of games, but they emphasized that validation of learning is a major focus of concern. With the extensive use of games (Faria & Wellington, 2004; Becker & Watts, 2001), there is an additional concern. Students can obtain information about

the games, their theoretical outcomes and the outcomes when they are played in experiments (hereafter called experimental outcomes). This can have effects on their learning from playing the games.

Two scenarios emerge if students have such information. The first scenario is that this information has negative effects on learning. The concern is that students may make the same decisions as either of the theoretical or the experimental outcomes in the games without putting effort into playing them. Consequently, the students may not learn the concepts within the games. The second scenario is that the information can have positive effects on learning. The students may then understand the games and their outcomes better. The question we pose in this study is: What are the effects on learning when students have information about games and their outcomes when playing games?

We use an experiment to study a situation in which the playing of games is part of a course and students may be able to obtain information about the games before playing them. For instance, the students can read about the games, hear about the games from students who have played the games in previous classes, or even receive information about the games from their instructor.

We will study the effects of providing the information on games and their outcomes on three categories of learning (Hoover & Whitebread, 1975; Faria, 2001). First, behavioral learning where this information can have an effect on the decisions made when the games are played. Second, cognitive learning where the information can have an effect on scores on a related test. Third, affective learning where the information can have an effect on how much the participants perceive that they learned and also on their attitude towards playing games as a teaching method. Our focus is on short term effects of playing games. We use information about the games and their outcomes as treatments in the experiment and give different groups various amount of information before they play the games.

We use the following three well-known games to assess behavioral learning: the Ultimatum game (Dickinson, 2001; Guth, Schmittberger, & Schwartz, 1982; Oosterbeek,

Sloof, & Van der Kuillen, 2004), the Bertrand oligopoly game (Dufwenberg & Gneezy, 2000; Ortmann, 2003), and the Public Goods game (Ledyard, 1995; Pickhardt, 2005). We select these games since they are widely used and have simple designs. The simple designs put the focus on the concepts within the games. Furthermore, the games have noticeable differences between their theoretical and experimental outcomes. If information about the theoretical outcomes is available when the games are played, the decisions may differ from the experimental outcomes.

We create a test with 15 multiple choice questions to assess cognitive learning. Compared to the testbank created by Gosen, Washbush, Patz, Scott and Wolfe (1999) and compared to the TUCE, Test of Understanding of College Economics (Saunders, 1991), used by Emerson and Taylor (2004), we use only specific questions about the games. That is, the purpose of our test is to measure learning about the concepts within the games (Gosen & Washbush, 2004; McDonald, 1999). It should be pointed out that it is debatable if a test is a good proxy for learning (Emerson & Taylor, 2004). Two problems arise when assessing learning with tests. First, questions and answers may be ambiguous. Second, tests may not accurately assess learning. Tests are, however, the most common method for assessing learning and for giving grades in courses (Becker & Johnston, 1999).

We use a survey to assess affective learning about playing the games. The survey contains statements about self-reported learning and motivation. It can be argued that surveys only measure opinions at best, and that the students do not have any incentive to answer them according to their opinions. It should be pointed out that most universities use surveys for teaching evaluations, which are taken seriously when evaluating courses as well as instructors (Becker & Watts, 1999; Boex, 2000). It does not ensure that the students answer teaching evaluations or our survey accurately, but it indicates that the students are used to answering surveys and it enhances the prospect of students giving answers that are well thought out.

The remainder of this paper is as follows. First, we describe the experimental methodology. Then, we present the results. Finally, we make conclusions and discuss possible extensions.

EXPERIMENTAL METHODOLOGY

One hundred eighty four students were recruited from economics classes at a university to participate voluntarily in the experiment. Most of the participants were taking their

first or second course in economics in their first year at the university.

The VECON lab site¹ was used to play the Ultimatum, the Bertrand, and the Public Goods games. All instructions for playing the games are in Appendix A. The games were all played for three rounds. In the Ultimatum game, participants had the same role in all three rounds either being the proposer or the responder. The Ultimatum game and the Bertrand game were conducted with randomized pairs of participants. The Public Goods game was played with groups of four randomized participants.

The information about the theoretical and experimental outcomes were here called the best (optimal) decisions and average decisions, respectively. The experimental outcomes were based on decisions of three periods of play. In the Ultimatum game, the theoretical demand is 99 and the experimental outcome given was 50 for the proposer, and for the responder to accept in both outcomes and gets 1 or 50, respectively. In the Bertrand game, where the cost is 2, the two outcomes were 2 and 15, respectively. In the Public Goods game, the two outcomes were to contribute 0 and 40 tokens, respectively.

The test was designed with the purpose of addressing different types of learning (Bloom, Englehart, First, Hill & Krathwohl, 1956; Saunders, 1991²). The test consisted of five questions on each of the three games (U – Ultimatum game, B – Bertrand game, P - Public Goods game). Question 1 was a general question about the game and its relation to economic theory. Question 2 was about the rules of the game. Question 3 was about the theoretical outcome in the game. Question 4 was about the rationale for the theoretical outcome. Question 5 was about possible reasons for deviations or effects of the theoretical outcome. Appendix B shows the questions with their codes, for example, questions U1 – U5 are for the Ultimatum game.

After the participants had taken the test they were asked to answer questions in a survey. The first question was how many questions they thought they had answered correctly. The participants also answered questions based on students' evaluations of educational quality (SEEQ)³. Table 4 shows ten statements, seven about learning and three about motivation. The survey used scales for the statements (from 1 strongly disagree, to 7 strongly agree).

The participants in the experiment were divided into four treatment groups. Three of the groups played the game with different amounts of information. These three groups, Info1, Info2, and Info3, received instructions to play the games, they played the games, they took the test, and they

Table 1. Treatment groups and treatments.

Treatment Groups	Played games	Took test	Took survey	Information about			Number of participants
				rules	outcomes	games	
NoPlay	N	Y	N	N	N	N	48
Info1	Y	Y	Y	Y	N	N	44
Info2	Y	Y	Y	Y	Y	N	40
Info3	Y	Y	Y	Y	Y	Y	52

answered the questions in a survey about their experience. The fourth group of participants, NoPlay, was used as a control group for the test. The participants in this group took the test, but they did not receive any instructions about the games and they did not play the games. Furthermore, they only answered the first question in the survey, which was how many correct answers they thought they would have. The instructions for each group are shown in Appendix A.

The rules of each game were shown on the wall and read out loud to the participants in groups Info1, Info2 and Info3 before they played that game. Participants in group Info2 were provided additional information about the theoretical and experimental outcomes of the games before they played them. Participants in group Info3 were also provided information about the outcomes, and additionally what is here called “information about the games” before they played the games. The information about the games and their outcomes included all correct answers to the questions in the test (marked in Appendix A).

The participants received credits toward their course grade for participation, for the number of correct answers in the test, and also if their expected number of correct answers on the test was the same as their actual number of correct answers.

RESULTS

Table 2 shows that the participants in treatment groups Info2 and Info3 made decisions in the games that were

significantly different compared to the participants in group Info1. When information about outcomes was provided, the mean decisions were closer to the theoretical outcomes. That is, demands made by the proposer were higher in the Ultimatum game, prices were lower in the Bertrand game, and the amounts invested in the Public Goods game were lower.

Table 3 shows that the mean correct answers ranged from 5.4 to 7.9 out of 15 for the four treatment groups. The participants in treatment group Info3, who received information about the games, had significantly higher scores on the test than participants in the other groups. However, participants in group Info2, who received information about the outcomes, did not have significantly higher scores than participants in Info1, who did not receive this information.

Analysis of the answers on the test (Appendix B) showed significant differences in answers between the treatment groups. When participants received more information about the games and their outcomes, they had more correct answers on questions U4, B5, P3, P4, and P5, while they had fewer correct answers on questions U2 and B3. It is noteworthy that only 4 – 8 % of the participants in all treatment groups had the correct answer on question B4. Furthermore, the number of correct answers was higher for the Ultimatum game than for the Bertrand and the Public Goods game for all groups.

For all four treatments, the participants expected to have 2 - 3 more correct answers than they actually had. The numbers of correct answers were weakly correlated to the

Table 2. Mean decisions (standard deviation) for treatment groups in the games.

Games	Periods			
	1	2	3	1-3
Ultimatum				
Info1	59.8 (14.2)	56.7 (8.7)	59.9 (14.0)	58.8 (12.4) ^a
Info2	60.4 (19.2)	62.0 (15.6)	60.4 (16.8)	60.9 (17.0)
Info3	67.4 (18.7)	64.9 (14.0)	65.1 (14.7)	65.8 (15.8) ^a
Bertrand				
Info1	21.9 (19.0)	12.4 (12.5)	11.5 (10.1)	15.3 (15.0) ^{b,c}
Info2	9.2 (13.3)	11.6 (22.5)	7.0 (8.6)	9.2 (15.9) ^b
Info3	9.7 (8.5)	8.7 (8.1)	7.8 (6.4)	8.7 (12.1) ^c
Public Goods				
Info1	26.3 (21.9)	38.2 (29.5)	37.6 (26.7)	34.2 (26.6) ^{d,e}
Info2	12.3 (17.0)	16.7 (21.5)	18.9 (26.9)	16.0 (22.1) ^{d,f}
Info3	21.4 (19.2)	23.5 (18.0)	29.9 (25.7)	25.0 (22.4) ^{e,f}

Pair-wise comparisons with *t* test ^{a, b, c, d, e, f} *p* < .01.

Table 3. Actual and expected number of correct answers on test.

Treatment	Games			Total	Expected
	Ultimatum	Bertrand	Public Goods		
NoPlay	2.7 (1.2)	1.3 (.9)	1.4 (1.1)	5.4 (2.0) ^a	7.9 (3.1) ^{d,e}
Info1	3.1 (1.0)	1.7 (.8)	1.1 (1.0)	5.9 (1.8) ^b	8.5 (2.8) ^f
Info2	2.7 (1.3)	1.5 (1.1)	1.9 (1.2)	6.2 (2.6) ^c	9.1 (2.3) ^e
Info3	3.5 (.9)	2.0 (1.3)	2.3 (1.3)	7.9 (2.3) ^{a,b,c}	9.4 (2.1) ^{d,f}

Pair-wise comparisons with *t* test ^{a, b, c, d} *p* < .01, ^{e, f} *p* < .05.

Table 4. Reported experience about learning and motivation.

Statements	Mean (SD)
Learning	
You prefer experiments as method for some of the teaching compared to lectures	5.7 (1.4)
You have learned and understood the materials in the experiment	5.0 (1.4)
You have learned something by doing the experiment which you consider valuable	4.9 (1.3)
You learned more than you expected by doing the experiments	4.8 (1.5)
You found the experiment intellectually challenging and stimulating	4.7 (1.4)
Your interest in economics has increased as a consequence of the experiment	4.4 (1.4)
You expected to learn a lot about economics by doing the experiments	4.2 (1.5)
Motivation	
You are motivated when taking the course your are currently taking	5.1 (1.3)
You were motivated when doing the experiments	5.0 (1.4)
You were motivated when answering the 15 questions in the test	4.6 (1.4)

Note: The survey used scales for the statements (from 1 strongly disagree, to 7 strongly agree).

expected number of correct answers in all treatments groups.

The participants in groups Info1, Info2, and Info3 reported similar experiences from playing the games and taking the test, as there were no significant differences between their answers in the survey. Table 4 shows that the participants gave the statement about learning “preferred experiments compared to lectures” the highest ratings (5.7). The lowest ratings were statements about “increase of interest in economics” and “learn a lot about economics” due to the experiments (4.4 and 4.2). Moreover, the reported motivation was higher for taking the course and playing the games (5.1 and 5.0) compared to taking the test (4.6).

CONCLUSION

The results indicate that having information about the games and their outcomes when playing them has positive effects on learning. The concern that this information would have negative effects when playing the games was not justified.

The difference in decisions when information about outcomes was provided showed behavioral learning, as the decisions were closer to the theoretical outcomes when this information was provided. It should be pointed out that the purpose is not to teach students to make the theoretical decisions, but it is inevitable that students will learn about these decisions when playing the games. The best (optimal) decisions in the Ultimatum game and the Public Goods games were the same as the theoretical outcomes. However, in the Bertrand game, the best decisions would have been decisions on prices higher than the cost, if the other participants made the same decisions as the experimental outcomes.

The improvement in scores on the test when information about the games was provided showed cognitive learning. However, the differences in test scores were not significant between the control group who did not play the game, and groups who played the game but did not have information about the games. The correct answers

ranged from 36% for the control group to 53% for the group with information about the game. This range is somewhat lower than the range for pre-test of 53% to post-test 60% in Gosen *et al* (1999). The reason the number of correct answers was higher for the Ultimatum game than for the Bertrand and the Public Goods game may be that the participants are more familiar with bargaining situations similar to the Ultimatum game than the situations in the other two games.

Most participants thought they were going to have more correct answers than they actually had. One reason for this is that some questions could have been ambiguous. Another reason is that the participants thought they learned more about the games than they actually did. The participants who had information about the games and the outcomes thought they were going to have more correct answers on the test than participants who did not have this information. The number of expected correct answers ranged from 53% to 63%.

The participants self-reported positive effects on affective learning in the survey. Similar to what Faria (2001) found, the self-reported experience of playing the games was generally positive. The experience of playing the games was the same whether information about games and their outcomes was provided or not. Playing the games was preferred over lectures. It received higher ratings on motivation than taking the test despite the fact that bonus points were given for the number of correct answers on the test.

For future research, replications of this study at other universities and with other games would answer the question of the generality of the results. The questions and answers in the test, and also the statements in the survey could then be altered. Furthermore, additional activities that increase scores on the test are of interest. For example, the scores may increase if information about the games and the outcomes are provided well in advance before playing the game and if the rationales for the outcomes in the games are explained in detail. Additionally, the students may need more time to reflect on the games and their decisions before

taking the test. Finally, the results from this study can be used as hypotheses for research on the effects of providing information about games and their outcomes when playing more complex games, for example, business games (Gold & Pray, 2001; Gold, 2005).

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APPENDIX A – INSTRUCTIONS

GENERAL INSTRUCTIONS

You will take a test [treatment NoPlay].

You will play the three games, the Ultimatum game, the Bertrand game and a Public Goods game, then take a related test and answer a survey [treatments Info1, Info2, Info3].

- You play one game at a time. That is, you will receive instructions for one game, and then play that game before continuing on to the next game.
- Each game will be played 3 times/rounds.
- In the two first games, 2 persons will interact. In the third game, 4 persons will interact. The opponent(s) will be chosen randomly, and may be different in the 3 times/rounds.
- The games wait for all participants to make their decisions. When participants have made their decisions the game automatically continues to the next round. After three rounds the games end.

Objectives [treatments Info1, Info2, Info3].

- In the games: Each participant should act to earn as much money as possible.
- In the test: Each participant should try to get as many correct answers as possible.
- In the survey: Each participant should answer truthfully, answers will be kept apart from identities.

You will receive credit points toward your grade in the related course [all treatments].

- For your participation.
- For the number of correct answers you have on the test.
- If you correctly can estimate how many correct answers you will have on the test.

INSTRUCTIONS FOR THE ULTIMATUM GAME

Information about the game [treatment Info3].

- Bargaining is usually between two parties/persons.
- The good or/and money is scarce [question U1].
- Both parties want as much as possible [question U2].
- The bargaining/negotiation can differ, the bargaining can consist of only one offer, or a number of offers and counteroffers.
- The division need to be agreed upon by both parties.
- The problem is to figure out what is acceptable for the other party [question U3].
- What is acceptable may differ depending on the value of the good or the money amount.

Information about the rules [treatments Info1, Info2 and Info3].

- Two persons will divide \$100.
- One person will be the proposer and propose a division of the \$100.
- The other person will be the responder, who either accepts or rejects the division.
- If the responder accepts the offer, both persons receive the amounts according to the division.
- If the responder rejects the offer, both persons do not receive any of the amounts.
- You will be either the proposer or the responder in the 3 rounds.
- The other person will be selected by randomization, and you will not know who that person is.

Information about the outcomes [treatments Info2 and Info3].

The best (optimal) decisions for both parties in this bargaining situation, the ultimatum game, are for:

- The proposer to keep all but a very small amount, i.e, \$99 (\$1 for the responder),
- The responder to accept this very small amount.
- The reason is that the responder is better off accepting any amount than to receive nothing (\$0) [question U4].

The average decisions when the game is played for 3 periods are for:

- The proposer to offer about half of the amount, i.e., \$50,
- The responder to accept this amount.
- This division can be explained with fairness [question U5]

INSTRUCTIONS FOR THE BERTRAND GAME

Information about the game [treatment Info3].

- Many consumers want to buy a product.
- The product can differ somewhat (heterogeneous) or be exactly the same (homogeneous).
- Firms make decisions at the same time (simultaneously) at a beginning of a time period, the consumers select firms to buy from, firms then receive information about their sales.
- The number of firms competing in the same market can vary: one firm is a monopoly, two firms (duopoly) to many firms are oligopolies.

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- When two firms (duopoly) compete in the same market their maximum combined profit is the same as for one firm (monopoly) [question B1].
- The problem for the firms is that their profit depends on the other firms in the same market [question B2].
- Competing firms are not allowed to make agreements about price.

Information about the rules [treatments Info1, Info2 and Info3].

- Two firms compete in the same market.
- The two firms can sell products in the same market.
- The cost for each product is \$2.
- The firms can make decisions on price between \$2 - \$100.
- The demand of the product is determined by standard economic assumptions:
High price -> low demand, low price -> high demand.
- The firm of the two firms in the same market with the lowest price obtains all sales and profit.
- The firm with the higher price does not sell any products and does not obtain any profit.
- If the two firms have exactly the same price, they receive half of the demand/sales for the product. If the price is above \$2 they both earn profits. [question B3].
- You will make decisions as a firm in 3 rounds.
- The other firm in the same market (as your firm) will be selected by randomization and you will not know who that firm/person is.

Information about outcomes [treatments Info2 and Info3].

The best (optimal) decisions for the firms in this market, the Bertrand game, are to:

- Set prices equal to minimum price (cost for the product), i.e., \$2.
- This price is optimal since the firms cannot increase their profits by altering only their own decision [question B4]

The average decisions when this game is played for 3 periods are:

- Prices about \$15.
- Prices higher than minimum price (\$2) shows that two firms can make profits without making agreements [question B5]

INSTRUCTIONS FOR THE PUBLIC GOODS GAME

Information about the game [treatment Info3].

- Examples of public goods are: libraries, public parks, streetlights, national defense.
- When rivalrous goods are used, other cannot use the goods at the same time.
- Public goods should be provided when the benefits exceed their costs [question P1].
- Public goods can be used by many persons at the same time.
- People cannot be excluded from public goods [question P2].
- Governments can finance public goods through non-voluntary means (mainly taxation).
- People can use public goods, but not contribute to them [question P3].

Information about the rules [treatments Info1, Info2 and Info3].

- Four persons can contribute to the goods.
- Each person will have 100 tokens.
- Tokens could be contributed to the public goods or kept.
- Each person decides how many tokens the person will contribute to the public goods.

Earnings:

- \$ 1.0 for each token kept,
- \$ 0.5 for each token contributed,
- \$ 0.5 for each token contributed by the other 3 people you are matched with.
- You will make decisions as a person in 3 rounds.
- The other 3 persons will be selected by randomization and you will not know who that person is.

Information about the outcomes [treatments Info2 and Info3]

The best (optimal) decisions for the persons in this game, is to:

- Not contribute at all, i.e., 0 tokens [question P4].
- The public goods may then be underprovided [question P5]

The average decisions when this game is played for 3 periods are:

- To contribute with about 40 tokens.

APPENDIX B – TEST

QUESTIONS ON THE ULTIMATUM GAME

Proposer

When prompted, enter a proposed money amount for yourself, between \$0.00 and \$100.00. The remainder (between \$0.00 and \$100.00) is what is proposed for the responder.

Round	\$ Amount for You	\$ Amount for Other	Other's Response	Earnings	Total Earnings
1	X (amount for yourself)		*	*	*

Responder

Round	Amount for Other	Amount for You	Response	Earnings	Total Earnings
1	X Proposer	100 - X Acceptor	<input type="radio"/> Accept <input type="radio"/> Reject		Submit Response

U1 In a bargaining situation where in order for a person to get more money another person gets less, money can be referred to as:

- a. Wanted
- b. Desirable
- c. Plentiful
- d. Preferable
- e. Scarce [correct answer]

Relative frequencies of answers in percent

	NoPlay	Info1	Info2	Info3
a	23	11	10	21
b	23	30	53	25
c	4	0	0	0
d	6	15	13	8
e	44	43	25	46

U2 What is the problem in the bargaining situation?

- a. People think differently about money
- b. People like to haggle over money
- c. People like to share money
- d. People want to get more money than the other person
- e. People want as much as money as possible [correct answer]

	NoPlay	Info1	Info2	Info3
a	6	4	10	8
b	8	0	0	2
c	0	0	0	0
d	15	35	30	38
e	71	61	60	52

U3 In the bargaining situation the proposer needs to:

- a. Think differently than the responder
- b. Figure out of the two people bargaining who needs the money the most
- c. Figure out what could be acceptable for the other person [correct answer]
- d. Haggle, since it is the essence of bargaining
- e. Share, since it is the essence of bargaining

	NoPlay	Info1	Info2	Info3
a	8	9	5	8
b	6	0	10	4
c	56	70	65	79
d	23	17	18	10
e	6	4	3	0

U4 The best (optimal) decisions for the both parties in the bargaining situation are for the proposer to offer only a very small amount to the responder, and for the responder to accept this very small amount. The reason for this is:

- a. The responder is better off rejecting since a very small amount is nothing to have
- b. The responder is better off accepting any amount than getting nothing [correct answer]
- c. The proposer wants the responder to earn something
- d. The proposer thinks the responder will not accept more money
- e. This is incorrect, the optimal decision is to set split the money in half

	NoPlay	Info1	Info2	Info3
a	10	4	10	2
b	38	46	58	90
c	6	4	13	4
d	2	2	3	2
e	44	43	18	2

U5 _____ may explain why the proposer may offer about half of the money or why the responder may only accept offers of about half of the money.

- a. Fairness [correct answer]
- b. Guilt
- c. Greed
- d. Foolishness
- e. Desire

	NoPlay	Info1	Info2	Info3
a	60	85	65	83
b	8	0	8	0
c	17	7	13	13
d	2	4	5	0
e	13	4	10	4

QUESTIONS ON THE BERTRAND GAME

Choose a price between \$2.00 and \$100.00. Quantity is determined: The seller with the lowest price will obtain all sales. If prices are equal, the quantity demanded will be divided equally among the sellers. Your cost will be \$2.00 for each unit of output that you sell.

Round	Your Price	Other's Price	Your Quantity	Total Cost	Total Revenue	Your Earnings	Cumulative Earnings
1	<input type="text"/>	*	*	*	*	*	\$0.00

Submit Decision

B1 How high could the maximum combined profit for two firms (a duopoly) be when competing in the same market?

- a. Zero
- b. Half of one single firm (a monopoly)
- c. The same as one single firm (a monopoly) [correct answer]
- d. More than one single firm (a monopoly)
- e. Cannot be determined since the two firms compete

Relative frequencies of answers in percent

	NoPlay	Info1	Info2	Info3
a	8	0	3	8
b	15	17	23	21
c	19	37	33	46
d	25	17	13	6
e	33	28	30	19

B2 What is the problem when two firms (a duopoly) compete in the same market?

- a. There are too few buyers
- b. The firms need to have similar prices on their products
- c. The firms sell completely different products and the prices may therefore differ
- d. The firms do not attempt to maximize their profits
- e. The profit of a firm depends on the decision of the other firm [correct answer]

	NoPlay	Info1	Info2	Info3
a	10	2	8	6
b	56	48	35	29
c	6	4	8	2
d	8	4	13	10
e	19	41	38	54

B3 To earn profit a firm in the market has to have:

- a. A higher price than the other firm
- b. The same price as the other firm
- c. The same or lower price than the other firm [correct answer]
- d. A lower price than the other firm
- e. A low price

	NoPlay	Info1	Info2	Info3
a	8	2	8	6
b	4	2	3	6
c	69	67	58	44
d	8	28	33	38
e	10	0	0	6

B4 The best (=optimal) decision for the firms is to set prices equal to minimum price (cost for the product). The reason for this is:

- a. The firms cannot increase their profits by altering only their own decision [correct answer]
- b. The firms can increase their profits by altering only their own decision
- c. The firms sell products at a price all consumers can afford
- d. The firms sell most products if they set the minimum price
- e. This is incorrect, the optimal decision is to set prices above minimum price

	NoPlay	Info1	Info2	Info3
a	4	4	8	8
b	10	17	3	8
c	10	17	13	21
d	27	20	55	40
e	48	41	23	23

B5 Prices higher the minimum price show that:

- a. One of the two firms in the market can make a profit
- b. Firms earn more according to the theory than according to the outcome in experiments
- c. Firms with the highest price will earn the highest profit
- d. Two firms can make profits without making agreements [correct answer]
- e. Two firms can make profits by making agreements

	NoPlay	Info1	Info2	Info3
a	31	37	50	31
b	15	20	10	8
c	8	4	8	4
d	17	20	18	46
e	29	20	15	12

QUESTIONS ON THE PUBLIC GOODS GAME

Choose a number of tokens to invest (between and including 0 and 100). Your earnings: \$1.00 for each token you keep, \$0.50 for each token you invest, and \$0.50 for each token invested by the 3 other people.

	Token	Tokens	\$ from	Tokens	\$ from	Invested	\$ from	Total	Cumulative
	Rd. Endowment	Kept	Tokens	Kept	Tokens	Invested	Others'	Earnings	Earnings
			Kept	Kept	Invested	by Others	Investments		
1	25	Tokens to Invest:		<input type="text"/>					

P1 When should a public good be provided?

- a. When people want the good
- b. When the good will be used by all people
- c. When the good is expensive
- d. When the total benefit exceeds the cost of the good [correct answer]
- e. When people say they will contribute to the good

	NoPlay	Info1	Info2	Info3
a	29	28	23	10
b	17	28	21	19
c	4	2	0	2
d	46	39	46	58
e	4	2	10	12

P2 What is the problem with a public good?

- a. People can be excluded from the good
- b. People cannot be excluded from the good [correct answer]
- c. People can use the good at the same time
- d. People cannot use the good at the same time
- e. People do not like public goods

	NoPlay	Info1	Info2	Info3
a	44	48	49	27
b	35	11	31	29
c	13	22	5	19
d	4	17	13	19
e	4	2	3	6

P3 What would be preferable for a person regarding a public good?

- a. Contribute to the good, so the person gets the benefit of it
- b. Contribute to the good, so everybody gets the benefit of it
- c. Contribute to the good, but only at a minimum amount
- d. Do not contribute to the good, but get the benefit from it [correct answer]
- e. Do not contribute to the good, and do not get the benefit from it

	NoPlay	Info1	Info2	Info3
a	17	22	15	19
b	46	57	41	21
c	17	13	15	23
d	17	7	28	35
e	4	2	0	2

P4 The best (optimal) decisions for a person is to contribute. The reason for this is:

- a. That everyone needs the good
- b. That the good can be provided
- c. All people have some money so everybody should contribute
- d. People have different amount of money, they should contribute proportionally to what they have
- e. This is incorrect, the optimal decision is to not to contribute anything [correct answer]

	NoPlay	Info1	Info2	Info3
a	23	22	13	17
b	17	17	18	29
c	8	15	0	2
d	46	39	41	10
e	6	7	28	40

P5 The problem when people voluntarily can choose to contribute to public goods is that:

- a. Goods may be underprovided [correct answer]
- b. Goods may be overprovided
- c. Goods may be used only by a few persons
- d. Goods may be used only by people with little money
- e. Goods may be used only by people with a lot of money

	NoPlay	Info1	Info2	Info3
a	38	48	62	73
b	21	17	10	12
c	21	26	10	12
d	10	4	13	0
e	10	4	5	4