

Poker Is a Skill

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THE GAME OF POKER has been of interest to researchers in economics¹ and artificial intelligence.² Its attributes have been compared to striking a bargain in the market and to the clash of war.³

Throughout the study of poker, the question whether performance is due to skill or just to luck has been a topic of much debate.⁴ In 1986, a professional poker player took on the IRS and won a ruling based on his argument that poker is a skill.⁵ This past January, a jury in the United Kingdom decided that poker is a game of luck, not skill.⁶ While it is clear that there has been much speculation about this question, the authors are unaware of any study that has addressed this issue. The aim of our study was to determine conclusively if poker is a game of skill. To do this, some participants were taught strategies based on expert opinion while others were taught no strategies.

STUDY 1

In the first study conducted by the authors, participants played poker with or without instruction. Each person played eight games of 25 hands totaling 200 hands of poker. This was a preliminary study to see how effective instruction would be.

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Method

Participants

A total of 41 students from a selective private midwestern university participated in this study. There were 29 males and 12 females.

Procedures and materials

The application used for the present study was Turbo Texas Hold'em for Windows (version four, copyright 1997–2000 Wilson Software). This is a computerized simulation of a 10-player Hold'em poker game. Players selected one of various options that maximized earnings while minimizing losses.

The Turbo Texas Hold'em game began with two cards face down dealt to each simulated player and two cards facing up for the student. These first two cards are called pocket cards. After seeing his or her cards, the student had the option to fold, call, or raise the bet. If the

¹ GAME THEORY AND ECONOMIC ANALYSIS (C. Schmidt, ed., 1995); THE ESSENTIAL JOHN NASH (H.W. Kuhn & S. Nasar, eds., 2002).

² D. Billings, A. Davidson, J. Schaeffer & D. Szafron, *The Challenge of Poker*, 134 ARTIFICIAL INTELLIGENCE J. 201–240 (2002).

³ J. McDonald, STRATEGY IN POKER, BUSINESS & WAR (1950).

⁴ J. McKenna, *Luck vs. Skill*, POKER PLAYER, Dec. 11, 2006, at 20; James McManus, *Mastering the Luck*, FORBES.COM, Dec. 12, 2006, <http://www.forbes.com/2006/12/16/james-mcmanus-poker-cx_jm_games06_1215luck.html>; L. Phillips, ZEN AND THE ART OF POKER: TIMELESS SECRETS TO TRANSFORM YOUR GAME 80 (1999); J. Scarne, SCARNE'S GUIDE TO MODERN POKER 29 (1980).

⁵ D. Oehring, *Triumphant Reemergence? Players who hopefully will get quality TV time at this years WSOP*, POKER PLAYER, July 10, 2006, at 45–46.

⁶ Lucy Bannerman, *Poker is a Game of Luck Not Skill*, Court Rules, TIMESONLINE (London), Jan. 17, 2007, <<http://www.timesonline.co.uk/article/0,,2-2551244,00.html>>.

student chose to fold, the hand would end and the winning hand would be identified. If the student chose to call or raise, a round of betting would occur and then three cards facing up would be dealt and displayed on the center of the screen that served as community cards. These cards are used by all players in building their best hand. The dealing of these cards is called the flop. The student again had the option to call, raise, or fold. By staying in the game, another round of betting occurs and then a fourth card facing up is dealt to the center of the screen. This is called the turn card. The options of call, raise, or fold continued to be available. If the student chose to play this hand, a fifth and final card called the river is dealt facing up, and final betting occurs with a winner being identified. The player with the best five cards selected from the player's own two cards and any of the five community cards in the center of the table wins the hand. If the student had the best hand, the student won all the money that was bet by all players during the hand. If the student did not have the best hand, the student lost the money bet during the hand.

Before each game, software options were set. The auto stop point was set, which caused a stop-playing window to open on the screen after a preset number of hands were played. The repeatable deal feature was also used. This feature allows for the same set of randomly selected hands to be played by all students.

At the start of the experiment, students were randomly assigned to one of two conditions: the instructed treatment group or the poker history control group. Each student then completed a self-assessment questionnaire. The questionnaire was designed to gauge the student's knowledge of poker. Specific questions such as *How long have you been playing poker?* and *How often do you play?* were part of the questionnaire.

Next, the experimenter distributed general rules of poker to both groups. Included in this document was an ordered listing of poker hands from best hand to worst and specifics to the functioning of the computer game.

Once the student was comfortable with the task, he or she began the game by selecting the deal button with the computer mouse. This generated two cards face-down for each of the

nine simulated players and two cards face-up for the student. At this point, the student had the option to fold, call, or raise the bet. Throughout each hand, the display showed the decision each of the simulated players made with respect to calling, raising, or folding.

Students in Study 1 played a total of eight games, each consisting of 25 hands, totaling 200 hands of poker. The games were divided into two sections. The first half contained the first four games and the second half contained the final four games. The repeatable deal number for games 1, 2, 3, and 4 were counterbalanced as were games 5, 6, 7, and 8. Counterbalancing ensured all repeatable deal numbers were played in each ordinal position equally often. For example, the first student played repeatable deal numbers in the order of 1, 2, 3, and 4. The second student played the repeatable deal numbers 2, 3, 4, 1, in order while the third student played games 3, 4, 1, 2 in order and so on. At the end of each round, the total amount of profit or loss was collected.

After the first four games (100 hands) were completed, the treatment group received poker strategy information and the control group received information pertaining to the history of poker. The additional information distributed to the treatment group included a hand ranking strategy chart that provided quality values of the pocket cards dealt at the start of each hand. It also provided information such as the importance of paying attention to the other players' decisions and the concept of playing fewer hands. The control group received a document that discussed the history of poker. After reviewing the additional information, the students completed the final four games.

Results

Data for the analysis were gathered from the poker questionnaire and the student's performance in each of the eight games. Performance was based on total amount of money won or lost at the end of each game. An overall mean score of amount won (or lost) was calculated for games 1, 2, 3, 4 and for games 5, 6, 7, 8. This provided a mean score for before and after treatment for control and treatment groups.

The primary data of interest were the results at time 2. This set of games (5, 6, 7, 8) was played after the treatment group received instruction. A univariate analysis of variance was conducted to test the hypothesis that instruction would significantly improve students' poker performance. Specifically, we wanted to see if the group receiving the strategy document showed statistically significant improvement over the control group in poker performance.

The analysis indicated that the between-subjects effect of treatment was significant. The students who received poker instruction outperformed those who had received only information on the history of poker. This can be seen in figure 1. As illustrated, the two groups performed almost identically on the first four games (T1). As can be seen at time 2 (T2), however, both groups improved due to practice effect. The treatment group yielded additional improvement through the use of the strategy document. This analysis provides evidence that individuals who receive instruction in poker perform better than those who do not. If poker was entirely a game of luck, instruction would not result in such improved performance. Another interesting factor found in figure 1 is that both groups were unable to win money. In fact, only three participants finished with positive totals. While the treatment group approached break-even, additional strategies could further enhance ability.

Reliability analysis of the eight games shows moderate reliability. Reliability is the degree to which measurement can be accurately repeated. This suggests the student would have to play more games in order to generate a more accurate representation of their poker ability.

In considering the level of perceived luck in poker, we asked the students their opinions. Out of 41 students, four (9.8%) felt poker was 10–30% luck, eleven (26.8%) felt it was 30–50% luck, eighteen (43.9%) felt the game was 50–70% luck, seven (17.1%) felt poker was 70–90% luck, and one student (2.4%) felt it was 90–100% luck. In total, 64% of the students felt poker was at least 50% luck. Of the total 41 students, 25 considered themselves beginners, 15 intermediates, and 1 an advanced player of poker.

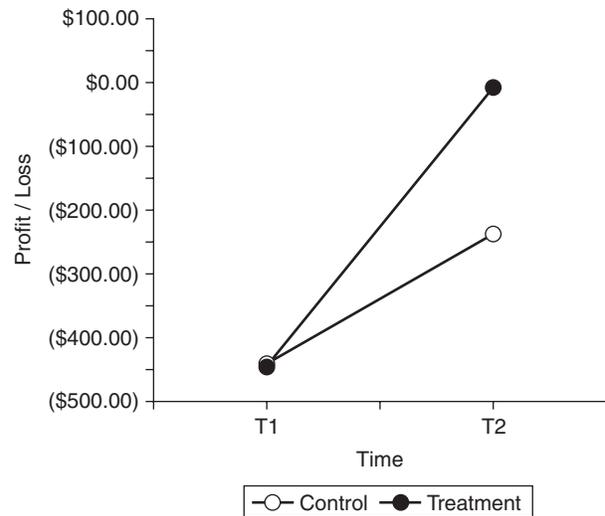


FIG. 1. Study 1 time-based performance trend.

Discussion

The objective of this study was to determine if instruction would make a difference in poker performance. Evidence of improved performance when given minimal instruction suggests poker is a skill-based activity.

A limitation of this study was the students' lack of skill in the game of poker. The vast majority of students were beginners with limited knowledge of the game. Of the 41 students, only three finished all eight games with money. Another potential limiting factor may have been the lack of motivation to play the game to the best of their abilities. Poker is a game of winning and losing. In this lab environment, however, the students had nothing to gain outside of personal satisfaction by playing their best. These issues were considered in a follow-up study.

STUDY 2

Study 2 was designed to test the value of multiple strategies and provide more time to practice the strategies. In addition, an objective was to improve reliability. Utilizing Kuder-Richardson Prophecy formula and data from study 1, it was estimated that students would need to play a minimum of 552 hands to obtain a reliability of .90. As a result, students of Study 2 played a total of 720 hands. In

addition, Study 2 included additional strategy information and a contest designed to motivate students to play their best. This study vastly extended the amount of time playing the game from two hours to six hours. It also increased the number of strategy documents from one to a total of six strategy documents.

Method

Participants

A total of forty-six students from a selective private midwestern university participated in this study. Students were recruited from introductory psychology courses.

Procedure and materials

Within Study 2, general game settings were the same as Study 1. Modifications to the game procedures were as follows. This study included 3 two-hour sessions each containing six games of 40 poker hands totaling 720 hands. The first session began after the students reviewed basic poker rules. After the second game, time 1 (T1), the treatment group received the hand ranking strategy document while control group received a poker history document. At the completion of the fourth game, time 2 (T2), the treatment group received a strategy document providing details about the value of position. This document discussed the value of being in a position where one is able to watch other players' decisions before making one's own decision. Again, and in all future strategy periods, the control group received various poker history documents. The end of game six, time 3 (T3) marked the completion of session 1.

The second and third sessions began with a review of material distributed during the previous session. Once the participant had time to review the information, the participant began playing. At the end of the second game (session 2, game 8; session 3, game 14) and fourth game (session 2, game 10; session 3, game 16) of the sessions, the treatment group received additional instruction. At the end of game eight (T4), the treatment group received strategies pertaining to the concept of outs. The concept of outs discussed the probability of getting the optimum cards for the student's hand. A prob-

ability chart identifying the percent chance of getting the needed cards was included. At the end of game ten (T5), the treatment group received strategies relating to playing pre-flop. This included strategies of folding, calling, and betting. The end of game twelve (T6) marked the completion of session 2. Upon completion of game fourteen (T7), the treatment group received information on playing the flop. This included strategies of folding, checking, and betting. At the end of game sixteen (T8), the treatment group received information on playing the turn and river cards. Similar to the flop, this included folding, checking, and betting. The end of game eighteen (T9) marked the completion of session 3 and the experiment.

As in Study 1, the repeatable deal feature was utilized. This ensured all students played the same games. Games 1 through 6, 7 through 12, and 13 through 18 were counterbalanced.

With the purpose of motivating students to play their best, a contest was included in this study. The contest was for an Apple iPod, now very popular among college students. In hopes of motivating all students, the contest was designed as a raffle where higher scoring students received larger numbers of entries.

Results

The primary data of interest were the results posttreatment. While the treatment group received instruction periodically during games 3 through 18, the averages for each of these games were combined to generate a single posttreatment result.

A univariate analysis of variance was conducted to test the hypothesis that additional instruction would significantly improve students' poker performance. Specifically, we wanted to see if the group receiving additional strategy documents showed statistically significant improvement over the control group in poker performance.

The analysis indicated that the between-subjects effect of treatment was significant. The students who received poker instruction outperformed those who had received only information on the history of poker. This improvement continues to provide evidence for the value of instruction in poker.

The added games within each session provided data for additional analysis. In session 1, the treatment group showed significant improvement from time 1. The control group did not show a significant change from time 1 to time 2, but a trend toward significance from time 2 to time 3. The distribution of the initial strategy document seemed to have a more immediate effect on performance while the control group needed to play more hands before seeing a trend toward improvement. Figure 2 provides details of the change in performance based on time points where the treatment group received instruction and the control group received poker history documentation. As illustrated, the treatment group did not demonstrate significant improvement after session 1 even though it continued to receive instruction.

Based on the treatment group's overall performance, the initial strategy document made the strongest impact on performance. This document included the hand ranking strategy chart, which discussed the value of playing only the best starting hands. One of the most common errors made by poker players is playing too many hands.

To investigate the value of playing fewer hands, a sampling of control and advanced strategy participants was taken. Within this sample, every game the participants played was reviewed from a standpoint of number of hands played and amount invested per hand.

The primary data of interest were the results posttreatment. While the treatment group received instruction periodically during games 3 through 18, the averages for each of these games were combined to generate a single post treatment result.

A univariate analysis of variance was conducted to test the hypothesis that the treatment group would play significantly fewer hands than the control group. The analysis indicated that the between-subjects effect of treatment was significant. The treatment group that received poker instruction played significantly fewer hands than the control group that received poker history documentation. This indicated that education made an impact on the number of hands played. Figure 3 provides graphical presentation of number of hands played from session 1 through session 3.

These results indicated that playing fewer hands resulted in improved performance. As identified earlier, the treatment group's improved performance was most significant in session 1 at time 2. As figure 3 illustrates, this is the time the treatment group made the most significant reduction in number of hands played.

Reliability analysis of the 18 games shows an improved reliability. The increase in games and hands led to improved reliability. The subjects, however, were still unable to generate positive financial results.

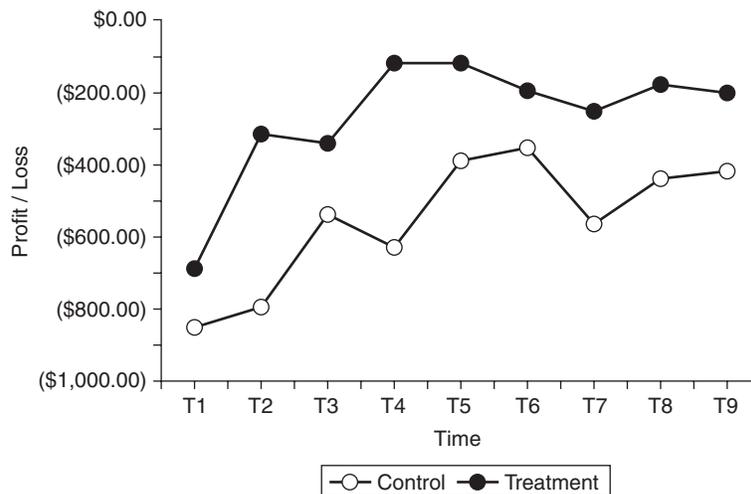


FIG. 2. Study 2 time-based performance trend.

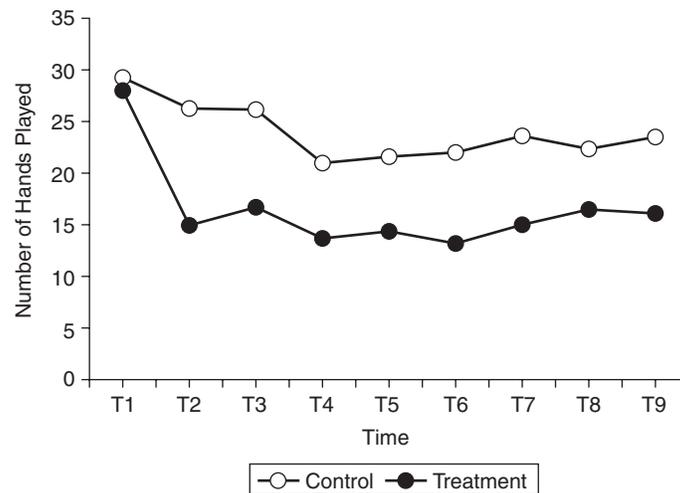


FIG. 3. Study 2 time-based number of hands played.

Discussion

An objective of Study 2 was to improve reliability by further developing participants' poker abilities. This study increased the amount of time and instruction provided to the participants. In addition, a contest was implemented in hopes of keeping the participants motivated to do their best. The resulting improved reliability suggests a more accurate measure of performance. Unfortunately, students who earned a profit were still the minority.

There were three interesting results from this study. First, as with Study 1, performance was improved by strategy documentation. This continues to provide evidence to the value of instruction in poker. The second interesting result was the difference in time of improvement between the control and treatment groups. The treatment group's improvement occurred almost immediately upon receiving strategy documentation at time 2. The control group had to play more hands before a trend in improvement was evident at time 3. Finally, as many poker books suggest, playing fewer hands does result in improved performance. After instruction, the treatment group reduced their number of hands played from an average of 27 to an average of 15 hands per game, or 37% of hands dealt. While this resulted in im-

proved performance, they still played too many hands. Most poker professionals recommend playing 15% of hands dealt. The playing of too many hands could be a cause for the continued loss of money by the students.

CONCLUSION

The question at the start of this study was *Is poker a game of luck or skill?* The unequivocal finding is that poker is a game of skill. In both studies, participants who were instructed outperformed those who were not instructed. Given that poker is a complex skill, it is somewhat surprising that even elementary instructions and limited practice had an effect.

The reason that poker appears to be a game of luck is that the reliability of any short session is low. In a casino game of poker, about 25 hands are dealt per hour. In Study 2, participants played 720 hands equivalent to about 30 hours of casino play. Study 2 met the psychometric qualification for moderate reliability of a psychometric task. What this suggests is that obtaining accurate estimates of poker ability may not be easy. Luck (random factors) disguises the fact that poker is a game of skill. However, as these studies show, skill is the determining factor in long-term outcome.