2020

Examining the Role of Trust in Peer-Assisted Learning

Peter Crowe
Wright State University

EXAMINING THE ROLE OF TRUST IN PEER-ASSISTED LEARNING

A Thesis submitted in partial fulfillment of the
requirements for the degree of
Master of Science

by

PETER CROWE

B.S., Towson University, 2010

2020

Wright State University

APPROVAL SHEET (M.S.)

WRIGHT STATE UNIVERSITY

GRADUATE SCHOOL

APRIL 18, 2020

I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY Peter Crowe ENTITLED Examining the Role of Trust in Peer-Assisted Learning BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF Master of Science.

Ion Juvina, Ph.D.
Thesis Director

Scott Watamaniuk, Ph.D.
Graduate Program Director

Debra Steele-Johnson, Ph.D.
Chair, Department of Psychology

Committee on
Final Examination

Valerie Shalin, Ph.D.

Kevin Gluck, Ph.D.

Barry Milligan, Ph.D.
Interim Dean of the Graduate School

ABSTRACT

Crowe, Peter. M.S., Department of Psychology, Wright State University, 2020.
Examining the Role of Trust in Peer-Assisted Learning.

Team and peer-assisted learning methodologies are becoming increasingly prevalent in both academia and industry. Learning with others is used with the assumption that individuals learn better in groups. The studies in this paper examine aspects of Peer-Assisted Learning in order to understand whether the claims of improved individual learning are substantiated, and if so, how that improved learning occurs. The cognitive mechanism examined in the studies below is the development of trust between peers on a learning task. Participants were selected from Wright State University and were predominantly undergraduate Psychology 101 students. Results indicated that Peer-Assisted Learning conditions did not perform significantly better than Individual Learning conditions on a memorization learning task. State Trust dynamics were observed, though the influence of State Trust on individual performance received mixed support. Further research is needed in this domain, exploring more ecologically significant motivational factors, as well as different types of learning tasks.

TABLE OF CONTENTS

LIST OF FIGURES

Figure Page

LIST OF TABLES

Table Page

I. INTRODUCTION

Peer-assisted learning is increasingly used across academic and applied environments in order to enhance individual learning outcomes (Cohen & Bailey, 1997; Michaelsen, Knight, & Fink; Rendell et al., 2011). Social learning and Team-Based Learning are predicated on the belief that individuals learn more effectively in a social setting than individually (Michaelsen and Sweet, 2011). Researchers have noted the benefits of social and team-based learning in enhancing individual and group performance on learning tasks (Koles, Stolfi, Borges, Nelson, & Parmelee, 2010; Levine et al., 2004; Zgheib, Simaan, & Sabra, 2010). However, few studies address the underlying mechanisms associated with individual performance in a peer-assisted learning environment. Mechanisms of individual performance in peer-assisted learning environments explain when, why, and how the processes and outcomes of peer-assisted learning are enabled. Hoppitt and Laland's (2008) work (as cited and summarized in Rendell et al., 2011) suggest the mechanisms examined in past research focus on how humans imitate one another, such as emulation, production imitation, and observational conditioning. These mechanisms appear to only address the question of how humans use information from other humans rather than 'when and why' we use social learning to improve our own performance. Our research examines trust as a possible mechanism associated with individual learning outcomes in a peer-learning environment. We assert that trust formation between peers is an important mechanism in determining when and why we utilize peer-assistance in learning scenarios. We posit that trust development

will reduce confusion and uncertainty associated with decision making on a novel task with unfamiliar peers, thus enhancing individual learning outcomes.

PEER-ASSISTED VS. INDIVIDUAL LEARNING

Research suggests that individuals are more accurate on learning tasks when incorporating advice into their own answers (Bonaccio & Dalal, 2006; Gino, Shang, & Croson, 2009; Jackson & Golub, 2007; Mannes, 2009; Yaniv & Choshen-Hillel, 2012). In Yaniv and Choshen-Hillel's 2012 study, participants made estimates of the caloric content of food. In a full-view condition, participants formed an estimate of a food's caloric content before receiving an advisor's estimate. In a blindfold condition, participants observed advisor's estimates before the presentation of the food and making their own estimate. Participants in this study were more accurate in their estimates when they suspended their own judgments until they could incorporate advice from an advisor (blindfold condition) and were less accurate when they did not suspend their own judgment (full-view condition). Yaniv and Choshen-Hillel (2012) posit that participants in the full-view condition may discount the advice from advisors because of a personal bias. If personal bias influences an individual's decision-making, it follows that reducing personal bias is important in increasing advice taking and improving performance.

PEER-ASSISTED LEARNING PERFORMANCE

Bonaccio and Dalal's (2006) review of the decision-making and advice-taking literature finds further evidence from a range of studies supporting the claim that using advice increases decision making accuracy. One reason proposed by Bonaccio and Dalal (2006) for this increase in accuracy is the reduced random error associated with aggregating advice from multiple advisors. By utilizing multiple veins of advice, a participant is

more likely to converge upon an accurate answer. Conversely, individuals who do not have the benefit of peer assistance are less likely to arrive at an accurate answer than their peer-assisted counterparts.

Because of the benefits associated with using advice from a single advisor, we expect that a scenario incorporating many advisors would aid in the improvement of individual performance. Theoretically, more advice should mean a more accurate aggregation process because of the larger sample size. However, this conclusion is dependent on advisor accuracy. If advisors are untrustworthy and inaccurate, compounded uncertainty may decrease individual accuracy. Accurate assessment of advisor trustworthiness and reliability can help avoid compounded uncertainty. By accurately assessing the trustworthiness of advisors, an individual would be able to weight more heavily the advice from a trustworthy advisor compared to advice from an untrustworthy advisor. We posit that individuals use their assessments of advisor trustworthiness to select what advice they should adopt. When an individual properly assesses an advisor's trustworthiness, they will adopt accurate advice more frequently than inaccurate advice, leading to better performance. With this in mind, we propose our first hypothesis.

Hypothesis 1: Participants in a Peer-Assisted Learning condition will have greater accuracy on a learning task, compared to participants who perform the task independently.

TRUST

One potential mechanism that leads to superior performance in a peer-assisted learning situation is trust. We define trust according to Mayer, Davis, and Schoorman (1995,

p.712) definition, as "the willingness of a party [trustor] to be vulnerable to the actions of another party [trustee] based on the expectation that they will perform a particular action important to the trustor, irrespective of the ability to monitor or control the other party." Research has found that one's trust is dependent on two different but related components, trait trust (i.e., one's general trust in others) and state trust (i.e., one's specific trust in another individual) (Berg et al. 1995; Collins, Juvina, & Gluck 2016). Trait trust influences a trustor's initial behavior when interacting with another person whom the trustor does not know (Berg et al. 1995) while state trust influences a trustor's decisions when interacting with someone the trustor has experience interacting with (Collins, Juvina, & Gluck 2016). Considering Mayer et al.'s (1995) definition and the research on trust in the context of advice taking, we assert that state trust development is important for properly identifying trustworthy advisors and effectively utilizing their advice to improve individual performance in a group or peer assisted situation.

USING TRUST IN PEER-ASSISTED LEARNING

An individual must trust an advisor enough to adopt and incorporate the advice into their own answer in order to improve their individual performance on a learning task. Research indicates that humans are predisposed to egocentric bias when comparing their own knowledge with that of an advisor (Gino, Shang, & Croson, 2009; Yaniv & Choshen-Hillel, 2012; Yaniv & Kleinberger, 2000). This form of egocentric discounting of an advisor's advice indicates a higher degree of trust in oneself than in the advisor. This presents us with the following conundrum: individuals achieve greater accuracy and performance when working with others through advice taking but have a natural predisposition for ignoring advice in favor of their own understanding. When individuals

successfully utilize peer advice and improve their accuracy on a task, we theorize that the utilization is because the individual has assessed and tracked their peer's answers and has accurately assessed the trustworthiness of their peer. The individual is then able to confidently utilize the peer's advice and improve their own performance.

Proper assessment of trustworthiness in advisors may be able to attenuate the effects of egocentrism. Individuals have shown to be more likely to weight equally their advice against that of a trustworthy advisor, compared to an untrustworthy advisor (Bonaccio & Dalal 2006; Yaniv & Kleinberger 2000). If an individual can attribute trustworthiness to an advisor, they may be more likely to take that advisor's advice, and consequently more likely to use that advice to improve their own accuracy.

Corriveau and Harris (2009) examined how children weight information from advisors and found familiarity and recent accuracy play a role in children's assessment of trustworthiness. Children received conflicting information about the names and functions of objects placed in front of them by two informants. One informant was a familiar teacher, and the other an unfamiliar teacher. The children displayed a preference for the familiar teacher's advice when given a choice. However, the trust held by the children towards the teacher was moderated by the teacher's accuracy. These findings support our assertion that trust development is an important component of enhanced learning outcomes in a peer-assisted learning condition. When the children had a trusting relationship with a teacher, whether through familiarity or through accuracy, the children used that trust to inform their selections of advice. Although the trust relationships displayed in Corriveau and Harris' (2009) study were between a child and a teacher, we

expect that the effects of trust should not change significantly when implemented in a peer-to-peer relationship.

We propose that individuals who develop state trust in their peers will be able to utilize their peer's advice in a manner that enhances individual learning outcomes, because trust will allow participants to reduce their egocentric bias when comparing their advisors' answers with their own answers. When interacting with unfamiliar peers, we hypothesize that individuals with high trait trust characteristics will be more likely to develop high levels of state trust in their peers. The trust component of our study is captured in our second hypothesis.

Hypothesis 2: Trait and state trust measures will each positively correlate with performance.

In addition to our hypothesis that trait and state trust will positively correlate with performance, we also expect that participants will calibrate their assessments of trustworthiness over time and will converge on only the most trustworthy peers. Proper trust calibration is when an individual's assessment of trustworthiness of a peer properly corresponds with the capabilities of the peer (Lee & See, 2004). When the assessment of trustworthiness is too high, the individual over trusts and is susceptible to using inaccurate advice from their peer. When the assessment of trustworthiness is too low, the individual distrusts the peer and is susceptible to ignoring trustworthy advice. We expect that over the course of our experiment, participants will be able to properly calibrate their trust assessments of their peers. Participants will be able to constantly monitor the accuracy of their peers' answers throughout the study, as well as assess their peers' engagement through the combination of answer accuracy and viewing the peers'

interaction with other participants through the adoption of advice. The information on peer accuracy and engagement will enable the participant to accurately calibrate their trust, and will lead to the participant converging on the adoption of trustworthy advice and the avoidance of untrustworthy advice. This is reflected in our third hypothesis.

Hypothesis 3: State trust measures will demonstrate participant calibration as measured by the convergence of viewing and selection of advice from the most accurate peer.

Below, we detail our Study 1 that was undertaken to explore our hypotheses.

II. STUDY 1

In order to examine how individuals learn in peer-assisted learning environments, we selected an experimental task that controlled for potential confounding variables such as an individual's personality or communication skills. We selected the Paired Associate Learning (PAL) task as a basic form of learning. In a PAL task, two unrelated stimuli are artificially associated, thus attenuating the ability of the participant to apply prior knowledge or experience to the execution of the task.

III. STUDY 1 METHOD

DEMOGRAPHICS

For this study 130 participants (Male = 37, Female = 93, M_{age} = 19, SD_{age} = 2.85) were recruited from Wright State University's intro psychology undergraduate classes through the Wright State University SONA subject recruitment website. Participants were required to have normal or corrected 20/20 vision. All participants received class credit upon completion of the study.

PAIRED-ASSOCIATES LEARNING TASK

The experimental task for our study was the Paired-Associates Learning task (PAL). In the PAL task, a four-letter word is associated with one single-digit number (Ex., HAND, 7). Participants must learn the number that corresponds to a specific word. Sixty words were utilized in the experiment, each paired with a single-digit number, resulting in a 6:1 ratio of words to numbers. Each number from 0-9 had 6 words paired. This task is used to simulate a basic form of learning, associating two unrelated stimuli (i.e., words and numbers). Words for the PAL task were selected from Paivio, Yuille, and Madigan's (1968) article for their low meaningfulness (as measured by the average number of written associations produced by participants in 30 seconds), low imagery (defined as a word's capacity to arouse nonverbal images), and low concreteness (as defined by the directness of reference to a sensory experience), as to reduce the risk of inherent associations for the participants.

PAL SOFTWARE

The PAL software used to present this task to participants was developed by Randall Green in collaboration with Dr. Ion Juvina. The PAL software provided instructions to the participants, a framework for participants to perform the Peer-Assisted Learning task, and a medium to test the final retention of the word-number combinations learned by the participants by the end of the study. The software contained characteristics that supported the efforts of this study. Characteristics of the software that supported the study included providing participants the ability to view other participants' answers and providing participants the ability to view other participants' selections. Details on this functionality are provided below in the Study 1 Procedure.

SURVEYS

Throughout the course of the study, participants periodically answered state and trait trust surveys. The trait and state trust surveys originated in Collins, Juvina, and Gluck (2016).

TRAIT TRUST MEASURE

The trait trust questionnaire was a 24 item measure which examined a participant's general willingness to trust others on a five-point Likert-type scale (1: lowest – 5: highest). The trait trust surveys were administered before the first session and after the final testing session. Questions were a combination of items from Rotter's (1967) and Yamagishi's (1986) trust propensity surveys, as well as several items created by Collins, Juvina, and Gluck (2016). Examples of questions on the trait trust questionnaire, answered by rating their level of agreement, include "I generally have faith in humanity" and "I feel that people are generally reliable". The full trait trust measure is found in Appendix D.

STATE TRUST MEASURES

The state trust questionnaire for the peer-assisted learning condition was a combined 14 item measure that examined the participant's state trust during the course of the study on a five-point Likert-type scale (1: lowest – 5: highest). In the peer-assisted learning condition, the state trust survey asked 9 questions that measured the specific trust a participant had in each of their peers with whom the participant interacted during school time, as well 5 questions that measured general state trust in their peers. In the interactive and passive learning conditions, the state trust survey measured the participant's trust in the accuracy of the answers provided by the computer. The state trust surveys were administered after the second, fourth, and sixth sessions. Questions for the state trust survey examined the willingness of the participant to accept the answers of the other players or the answers of the computer as true, as well as the participant's expectations of the other player's behavior. The state trust survey was generated by the experimenters to be congruent with the definition of trust in Mayer, Davis, and Schoorman (1995).

Additionally, State Trust was measured in the peer-assisted learning condition through behavioral indicators. An individual's pattern of viewing and selecting a peer's answers over the course of the study was used to indicate an individual's State Trust in each of their peers. Over the course of the study, participants who demonstrated patterns of viewing and selecting specific peer responses would be identified as having developed state trust in their peer. Participants who did not demonstrate patterns of viewing and selecting particular peer responses were identified as not demonstrating state trust in their peer.

STUDY 1 DESIGN

All participants completed the experiment on individual computers in individual computer booths in a laboratory. Participants did not have verbal or visual contact with other participants during the course of the study. The study was a between-subjects design. Participants were randomly assigned to one of three conditions: A peer-assisted learning condition, an interactive learning condition, or a passive learning condition (explained below). The premise of this study was to emulate a student's experience of a class in school. We structured the study to reflect the competing demands of studying, relaxing, and attending class. To this effect, we segmented the study into sessions, representing the competing demands on a given day. The experiment was divided into six sessions each composed of home time and school time, ending with a final session that tested retention of all word-number combinations presented over the course of the study. The only interaction afforded to participants in the peer-assisted learning condition was behavioral interaction during school time.

During home time, participants were given the options to study the word-number associations of the PAL task, to play relaxation games (solitaire, chess, or minesweeper), or to relax by doing nothing. Home time was a standardized amount of time for all participants and was spent individually in all conditions. All conditions experienced the same duration of home time, allowing all participants the same opportunity to either study or relax.

School Time consisted exclusively of the PAL task, where there were 20 word-pair associations (trials). The demands of school time were different for each of the three conditions.

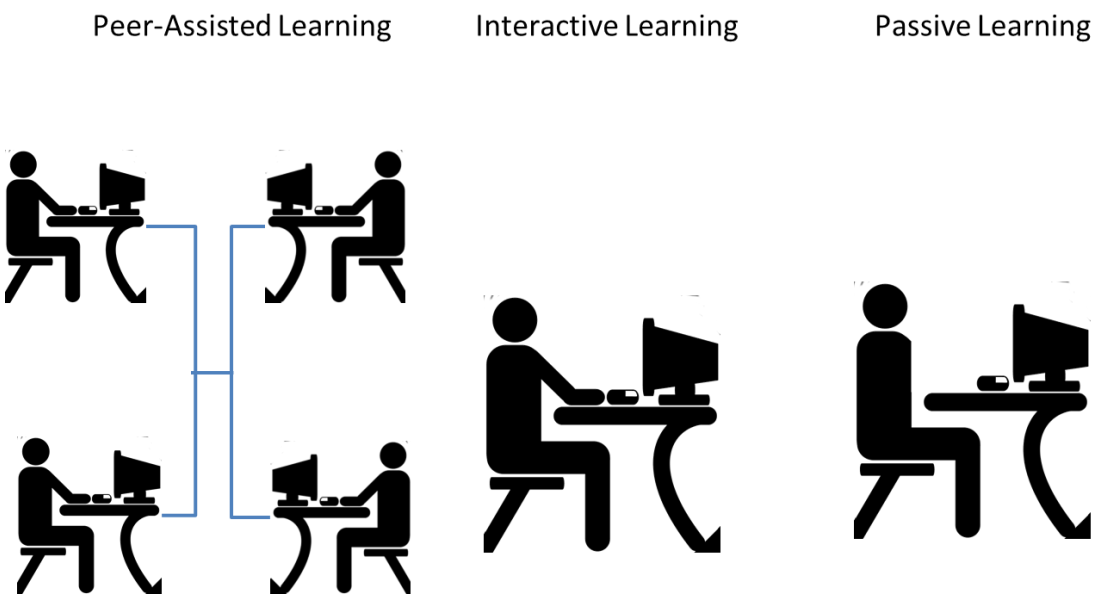


Figure 1. Differences by condition. The Peer-Assisted Learning condition requires 4 participants performing the experiment together and interacting with the PAL software. The Interactive Learning condition is performed individually and interacts with the PAL software. The Passive Learning condition is performed individually and does not interact with the PAL software.

STUDY 1 PROCEDURE

In the peer-assisted learning condition participants performed the PAL task in groups of four. At the start of each trial, the four participants in a group were presented with the same target word and given a period of time to respond with the corresponding number. Then each member of the group was given the opportunity to selectively view any of their peers' answers by moving their mouse over their peers' answer boxes. The PAL software was designed to only display participant answers when their answer box was hovered over with the mouse, in order to facilitate the collection of viewing behavior. Every time a participant hovered their mouse over an answer box in order to view that participant's answers, the software tallied the view. Next, participants gave a final answer, either retaining their initial answer or choosing (with a mouse click) an initial

answer given by another one of their peers. Finally, all participants received feedback (i.e., correct or incorrect) about their final answer. The PAL software also provided participants with data on who their peers selected for their final answers. This data augmented the other sources of data for participants to be able to build state trust over the course of the study. The software also allowed participants to view the final accuracy of their peers by hovering over their peers' answer boxes after the final correct answer was given. This design augmented participant knowledge of peer trustworthiness.

During the interactive and passive learning conditions participants performed the PAL task individually, without the aid of peers. In the interactive learning condition, participants were presented with a target word, given a period of time to respond, and then received feedback on their response (correct or incorrect). In the passive learning condition, participants observed the presentation of the target word followed by the correct paired number.

The entire experiment consisted of a total of 6 sessions (one session was composed of a pairing of home time and school time) and a final testing session. Figure 2 illustrates this configuration.

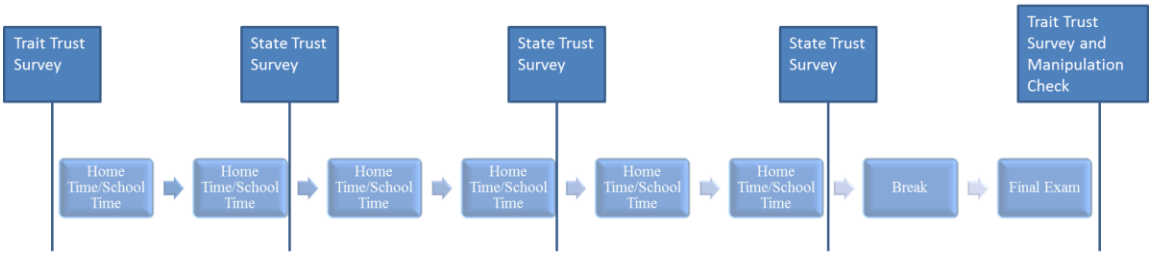


Figure 2 The time course of the experiment. Six sessions were presented over the course of the study. Each session was composed of a home-time and a school-time.

Across all three conditions, the first session consisted of 20 word-number pair combinations. Each following session then consisted of a combination of 10 new word-number pairs and 10 word-number pairs shown in the previous session. Over the course of the experiment, participants were exposed to a total of 60 word-number pairs, with each pair being presented twice in school time. During the final testing session, all participants completed the PAL task individually, being presented again with all 60 word-number pairs.

IV. STUDY 1 RESULTS

Study 1 was intended to test our foundational hypotheses:

Hypothesis 1: Participants in a Peer-Assisted Learning condition will have greater accuracy on a learning task, compared to participants who perform the task independently.

Hypothesis 2: Trait and state trust measures will be positively correlated with each other as well as with performance.

Hypothesis 3: State trust measures will demonstrate participant calibration as measured by the convergence of viewing and selection of advice from the most accurate peer.

PERFORMANCE

To assess the participants' performance across the three conditions, the percent of correct responses during each experimental session was calculated (Figure 3). Over time the participants' performance improved in the peer assisted and interactive condition (Figure 3).

During the final session, when memory of all word-number pairs was tested, performance differences across all three conditions were observed. The interactive learning condition had the highest percentage of recall (M = .77, SD = .14), followed by the passive learning (M = .67, SD = .24), and the peer assisted conditions (M = .57, SD = .28). To test our first hypothesis, an analysis of variance (ANOVA) was performed on the participants' final performance score (percent correct) during the final session across

the three different conditions.

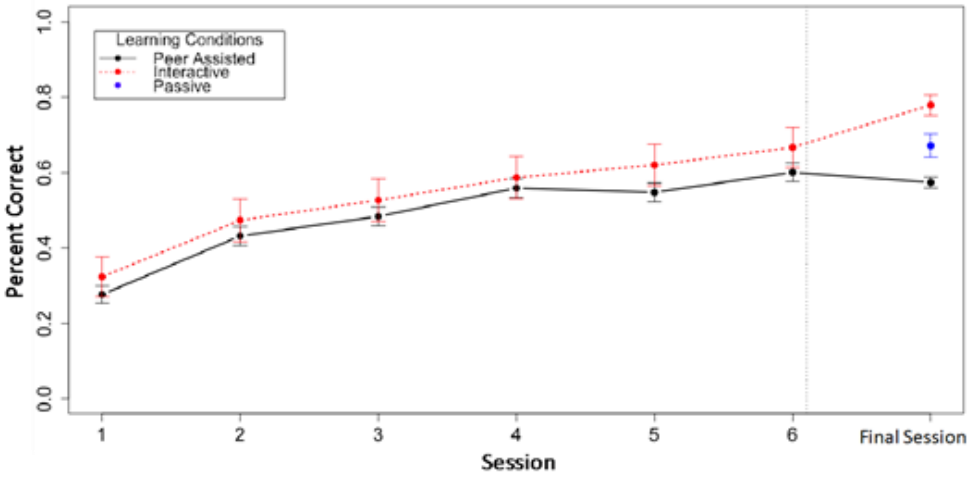


Figure 3 The mean +/- 95% CI of performance per session in school time across the three experimental conditions. Note, the Passive Learning condition shows only final session data because participants in the Passive Learning condition only actively submitted answers during the Final Exam.

The ANOVA revealed a significant difference between the participants' final session performance across all three conditions, $F(2,31) = 2.063$, $p < .02$. A Tukey's post hoc comparison revealed a significant difference in final performance between the peer assisted and interactive learning conditions ($p < .05$). No significant differences between the other conditions were found. The results failed to reject the null hypothesis of Hypothesis 1.

Activities performed during Home Time were also analyzed, with the average time spent on each activity shown in Figure 4.

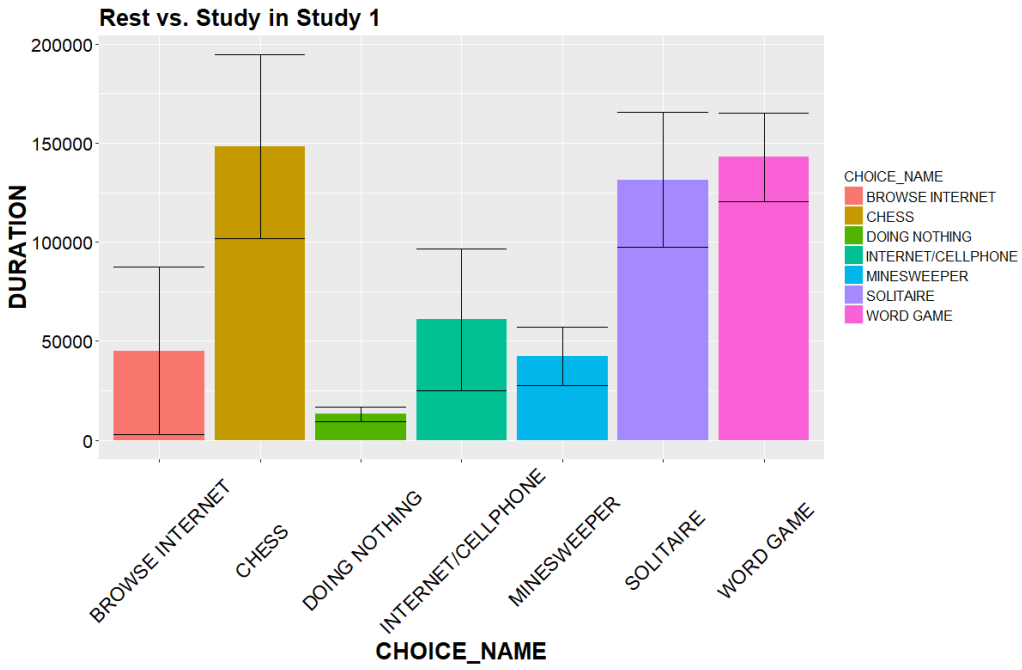


Figure 4. Average time spent per Home Time Activity in Study 1.

TRUST MEASURES

In the peer-assisted learning condition, we predicted that participants developed trust in their peers based on their accuracy on the PAL task. A participant's trust in each peer would then be used to inform the choices of whose answer, if any, to accept during the course of the study. Additionally, we assumed that trust would be related to the participants performance during the study. For this reason, we investigated the extent that trust influenced their behavior over the course of the experiment (Hypothesis 2).

First, we assessed if the participant's state trust in their peers influenced their behavior during the first six sessions. To assess this, we examined the average number of times that each participant viewed the initial answer provided by each of the other three peers and their trust in each peer during the first six sessions of the experiment. A positive relationship between the average number of looks and the participants average state trust score in each of the other group members was found (r (31)= .16, $p < .05$). The

significant correlation between a participants' state trust and average look behavior suggests that state trust influenced which peer the participants compared their initial answer with during the study.

Next, we investigated the extent that the participants' trait and state trust score was associated with their performance during the final session. Initial trait trust was found to slightly, but not significantly, correlate with performance during the final session (r (31)=.11, $p > .05$).

To assess the relationship between state trust and final performance, we looked at the relationship between each participants' highest state trust score across their peers after the 6th session. The participants highest state trust across the three other group members was chosen as a measure of state trust because we hypothesized that participants would be more willing to accept answers from the peer they trusted the most. A positive correlation was found between the participant's state trust and their performance during the final session (r (31)= .34, $p < .01$). The null hypothesis for Hypothesis 2 was rejected.

TRUST CALIBRATION

In order to test the third hypothesis of trust calibration, I examined participant view and selection data over the course of the experiment. I calculated the ratio of the number of times each participant viewed their most accurate peer's response divided by the total number of views each participant performed in a session. This ratio of accurate views divided by total views should increase over the course of the experiment as trust is built and calibrated with a trustworthy peer. I calculated a linear regression to predict the ratio

of accurate views divided by total views based on session number. No significant regression equation was found ($F(1, 211) = -0.01$, $p > 0.05$), with an R^2 of -0.005.

In addition to the ratio of accurate views divided by total views, we calculated the ratio of participant selections from their most accurate peer divided by their total selections. This ratio of selection data should increase over the course of the experiment as trust is built and calibrated. We calculated a linear regression to predict the ratio of selections from the most accurate peer divided by total selections based on session number. A significant regression equation was found ($F(1, 352) = 10.9$, $p < .01$, with an R^2 of 0.03. In addition, we calculated a linear regression to predict the ratio of self-selections by participants by session number. No significant regression equation was found $F(1, 90) = 2.075$, $p > .05$, with an R^2 of 0.01. This indicates that participants did not increasingly select their own answers over the course of the study.

V. STUDY 1 DISCUSSION

The intent of this study was to examine the role of trust in peer-assisted learning. To this end, we compared performance between participants in a peer-assisted learning condition, an interactive learning condition, and a passive learning condition. Hypothesis 1 stated that participants in a peer-assisted learning condition would have greater accuracy on a learning task than participants who performed the learning task individually. This hypothesis was disconfirmed, as participant performance in the interactive learning condition was significantly higher than participant performance in the peer-assisted learning condition.

This finding is unexpected, as it does not align with the many studies that have found that performance is enhanced through social learning (Bonaccio & Dalal, 2006; Gino, Shang, & Croson, 2009; Yaniv & Choshen-Hillel, 2012). Several explanations may account for our findings.

One possible explanation for the performance difference between the peer assisted and interactive learning conditions is that participants suffered from different task demands. Participants in the peer-assisted learning condition were presented with more information and prompted for more action than participants in other conditions. Participants in the peer-assisted learning condition were presented the word, elicited for a response, given an opportunity to review their peers' answers, and then elicited for a second response. This sequence of events is more complex and requires more cognitive resources than the sequences associated with the interactive or passive learning

conditions. It is plausible that participants in the peer-assisted learning condition became overburdened by the task demands and devoted less cognitive resources to their own retention of the word-number combinations.

In addition to task demands influencing participant motivation, participants were not given any explicit objectives apart from maximizing their retention of the word-number combinations. Participants were then much more incentivized to study the word-number combinations instead of more accurately balancing their time between studying and relaxing.

Another potential explanation for the poor results in the peer-assisted learning condition could be sub-optimal interface design (Appendix, Figure 4). Participants in the peer-assisted learning condition were presented with more information on-screen than participants in the interactive or passive lecture conditions. There is a possibility that the information presented was difficult to interpret or that the interface distracted participants from the task at hand. In order to offset the possibility of this confound, we have designed an interface for use in future studies that more clearly organizes the information presented (Appendix, Figure 5). We hope that through more effective interface design, we can enable participants to be more engaged with the task and less distracted by the interface.

A final potential explanation for the performance results could be that participants relied on their peers' answers during the course of the study and did not sufficiently learn the word-number combinations independently during home-time. Although the results indicated a positive correlation between trust data and final session performance, it is important that participants implement trust in tandem with their own effort towards

learning the word-number combinations. Participants may have believed that relying on their peers' answers would be enough to reinforce their retention of the word-number pairings, however individual effort is required to optimize retention.

Hypothesis 2 stated that trust measures will be positively correlated with performance. Support for hypothesis 2 was found, as state and trait trust surveys were each positively correlated with individual performance. Additionally, state trust was positively correlated with how often the participant looked at a particular peer's answers (a behavioral measure of trust). The results relating to trust indicate that trust does play an important role in advice usage, and consequently in performance. The relationship between state trust and final performance suggests that individuals who identified a trustworthy peer and utilized that peer's advice saw an added benefit to their final performance.

Hypothesis 3 was that participants would calibrate their trust over the course of the study, converging on their most accurate peer in both views and selections. Hypothesis 3 was partially supported as a significant regression equation was found for selection data, but no significant regression equation was found for the view data. Failing to find a significant regression equation for view data may be attributed to the amount of time participants were given to review their peers' answers. Participants were afforded enough time to review their peers' answers that there may not have been any significant time pressure to spend time wisely and only view peers the participant trusted. With enough time, participants may have been willing to view their less-trustworthy peers out of curiosity or thoroughness over the course of the experiment. On the contrary, a significant regression equation was found for the ratio of selections of the most accurate

peer over the course of the study. This finding indicates that participants were able to identify their most trustworthy peer and calibrated their selection behavior appropriately.

VI. STUDY 2

As discussed, Study 1 contained a number of problems. A lack of explicit direction regarding participant motivation, confusing interface design, and additional cognitive demands contributed to the results found in the pilot study. Study 2 was undertaken to address the limitations of Study 1. Following analysis of Study 1 data, we identified problematic elements of our experimental design, and addressed those elements in the development of Study 2. In order to address these limitations, we proposed implementing an incentive scheme and altering the user interface.

INCENTIVE SCHEME

The incentive scheme was intended to reflect the various motivations that influence an individual's activity choices in home time and effort allocations during school time. According to literature on student motivation, three main sources of motivation influence an individual's time and effort choices: individual achievement (Ford, 1992; Wentzel, 1999), social factors (Bonaccio & Dalal, 2006; Dweck & Leggett, 1988; Renshaw & Asher, 1983, Wentzel, 1999), and relaxation (Lauricella, Wartella, & Rideout, 2015).

Models of motivation presented by Wentzel (1999) indicate that individuals are primarily motivated by individual achievement. Academic-related goal setting motivates students to study and learn material in order to attain a desired grade or level of comprehension. Because students are most influenced by a desire to pass and do well in a given class, we assigned the highest point values to activities related to individual

school time performance. Individual answer accuracy during school time as well as individual final session accuracy combined for a total of five possible points. These points were intended to encourage the study participant to consider individual academic achievement as the most important factor when weighing competing sources of motivation.

The second most influential source of motivation in Wentzel's (1999) model is the social component of learning. Students desire social relationships with peers (Renshaw & Asher, 1983) as well as adherence to social norms (Bonnaccio & Dalal, 2006). Social norms in an education setting include participation in group activities, advice taking from peers, as well as advice giving (Bonnaccio & Dalal, 2006). In our study, adhering to social norms required the participant to study individually in order to provide trustworthy advice to their peers, as well as utilizing peer answers in order to demonstrate reciprocal trust. Through these actions, a participant would indicate to their peers that they were invested in developing a working relationship and viewed trust and trustworthiness as important components of that relationship. Therefore, we assigned a maximum of three points for group accuracy during school time to represent the influence of social motivators.

Relaxation is the final motivator that influences student time allocation. Students spend a significant amount of time watching television and playing video games, indicating that a desire to relax influences student time allocation (Lauricella, Wartella, & Rideout, 2015; Lee, Bartolic, & Vandewater, 2009). Students may be often motivated by achievement and socialization, but they do not exclusively engage in activities that contribute to their academic achievement or social goals. To reflect the motivation to

find time to relax, we assigned a maximum of two points for engaging in relaxation activities during home time. These points were intended to encourage participants to consider relaxation as an alternative to studying the word number combinations exclusively.

As seen in Table 1, the total number of points available to a participant varied between conditions.

Table 1. Available points per condition. Listed points are the maximum available to be earned.

	Peer-Assisted Learning Condition	**Interactive Learning Condition**	**Passive Learning Condition**
Home Time	20 points for playing relaxation games	20 points for playing relaxation games	20 points for playing relaxation games
School Time	10 points for individual answers, 30 points for team answers	10 points for individual answers	
Final Session	40 points for Final Session accuracy	40 points for Final Session Accuracy	40 points for Final Session Accuracy
Total Points Possible	100 Total Points	70 Total Points	60 Total Points

The difference in total points possible was intended to reflect the added motivations associated with the different activities between conditions. Participants in the Passive Learning condition were only motivated to perform well during the final session of the experiment. Participants in the Interactive Learning condition were motivated to perform well during the final session as well as during school time throughout the experiment in their individual responses to the word game. Participants in the Peer-Assisted Learning condition were motivated to perform well during the final session, during their individual

responses to the PAL task throughout the experiment, and to perform well for their group accuracy score. We sought to reflect the additional sources of motivation associated with the additional tasks required by the participant, while also acknowledging that greater motivation may not necessarily result in higher performance. For example, participants in the Peer-Assisted Learning condition had more possible points than participants in the Passive Learning condition, but participants in the Peer-Assisted Learning condition had more competing motivations to consider when making decisions about their time usage. Alternatively, participants in the Passive Learning condition had fewer total points available than participants in the Peer-Assisted Learning condition but had fewer decisions to make about how to divide their time.

INTERFACE DESIGN CHANGES

Additional cognitive demands of participants in the Peer-Assisted Learning condition may have contributed to the results found in the pilot study. Inefficient and confusing interface design may have contributed to the cognitive loading of participants in the Peer-Assisted Learning condition. As seen in Figure 4 (Appendix, Figure 4), the interface for the Peer-Assisted Learning condition presented information in a manner lacking uniformity or order. In order to alleviate confusion, we redesigned the presentation of information for all participants. As can be seen in Figure 5 (Appendix, Figure 5), the new display provided information in a sequential manner that remained visible for the participant at each step. Participants were able to see each answer provided go into a corresponding spot that remained clear and uncluttered. We expected that the changes to the interface would result in fewer distractions for the participant, and would require less cognitive effort to track and understand.

HYPOTHESES

With the implementation of the incentive scheme and the interface changes, we predicted that we would more accurately assess our hypotheses from Study 1, as well as testing new hypotheses.

HYPOTHESIS 1

Participants in a Peer-Assisted Learning condition will have greater accuracy on a learning task, compared to participants who perform the task independently, as measured by final session performance accuracy.

The Peer-Assisted Learning condition required more of the participant (more actions, more mechanics to remember and utilize) than the Interactive Learning or the Passive Learning conditions, as well as adding potentially misleading information via incorrect peer responses. Despite these challenges, we hypothesized that participants in the Peer-Assisted Learning condition would have greater accuracy than participants in other conditions because of the trust mechanic. We expected that participants would be able to identify a trustworthy peer, and would subsequently filter out untrustworthy peers. This filtering would result in reinforcement of the correct answers due to viewing the trustworthy peer's answer and ignoring untrustworthy peers' potentially incorrect answers. We hypothesized that the reinforcement of the correct answers would help participants in the Peer-Assisted Learning condition to remember more word-number combinations than participants in other conditions. The process of filtering peer answers through the mechanism of trust is reflected in our second hypothesis.

HYPOTHESIS 2

Participants in the Peer-Assisted Learning condition will spend significantly more time studying the word game during home time than participants in the Interactive Learning or Passive Learning conditions.

We predicted this would be the case because of the additional motivation to perform well that was present from social factors. Participants who did not have the social motivators associated with their condition would be less motivated to study the word game, which would in turn influence their final session accuracy.

HYPOTHESIS 3

Trust measures will be positively correlated with performance, as measured by our state and trait trust measures.

State trust was measured by a combination of state trust survey measures administered throughout the study, as well as behavioral measures of trust. We predicted that participants who demonstrated trust through such actions as looking at peer's answers during school time and selecting peers answers during school time (behavioral measures of trust) would have greater final session performance than participants who did not demonstrate trust behaviors. This is because participants who demonstrate trust are reinforcing their own independent learning (from word game studying during home time) with confirmation from trusted peers' answers. We also predicted that state trust measures administered in the Peer-Assisted Learning condition would reflect the development of trust in a particular peer. Finally, we hypothesized that participants in the Peer-Assisted Learning condition who demonstrated behavioral trust in a player other than themselves would have significantly higher accuracy on the final session than those that relied exclusively on their own knowledge and only demonstrated trust in their own

answers. This is because individuals who utilize peer advice have demonstrated better performance on a variety of tasks than individuals who relied exclusively on their own understanding of material (Bonaccio & Dalal 2006; Yaniv & Kleinberger 2000).

VII. STUDY 2 METHOD

DEMOGRAPHICS

For this study 141 participants (Male = 39, Female = 102, M_{age} = 19, SD_{age} = 3.15) were recruited from Wright State University's intro psychology undergraduate classes through the Wright State University SONA subject recruitment website. Participants were required to have 20/20 or corrected 20/20 vision in order to participate. Ability to read and speak English was also required for inclusion in the study, as the task required the learning of English words. Due to the fact that we are interested in the application of this project to academic environments, the use of students as the primary sample for this project is appropriate for generalization to the greater population of students. All participants completed an informed consent form prior to the beginning of testing.

MATERIALS

In order to test our hypotheses, we used the PAL program developed by Randall Green. The PAL program allowed for a server/monitor computer to administer the experimental task to a maximum of four client computers. The experimenter observed on the monitor computer the participant selections such as activity selection during home time (relaxation games or studying) and number responses to words during school time. Statistics such as accuracy percentages, and cumulative time spent on activities were also observable from the monitor computer. The monitor computer was not able to be used to manipulate the participant computers during the course of the study and was solely used to monitor participant activity.

The participant computers were located in individual booths. The booths prevented participants from verbally or visually communicating with other participants. Participants were not offered a chance to become acquainted with their peers. The peers were intended to be unfamiliar with each other to limit the number of confounding variables. Each of the participant computers utilized the PAL program, and communicated with the experimenter's monitor computer in order to coordinate presentation timings and to display data to the experimenter on the monitor computer.

We also applied the same survey measures utilized in Study 1. These surveys will measure participant trait and state trust over the course of the experiment.

PROCEDURE

Participants were provided an informed consent form upon entering the laboratory. Following consent, participants were led to individual testing booths and provided a brief tutorial. The tutorial provided instructions detailing what would be required of them throughout the course of the study. The tutorial also consisted of two sessions of the experimental task in order to familiarize participants with the sequence of events and to provide participants with an opportunity to form questions for the experimenter before beginning the experiment. Upon completion of the tutorial, the experimenter asked for any questions before beginning the main experiment.

The main experiment consisted of six sessions and a final testing session, resulting in a total of seven sessions. A single session consisted of home time and school time. During home time, the participants were given a choice between studying the word-number combinations for the following school time or relaxing by playing games. During school time, participants completed the PAL task in the form dictated by their randomly assigned condition (Peer-Assisted Learning, Interactive Learning, or Passive

Learning). Following the six sessions of home time/school time, participants were tested during the seventh session for their total retention of all word-number combinations presented over the course of the study. Participants were also administered trait and state trust surveys following the first, third, and sixth sessions. The study was completed by participants in under two hours.

VIII. STUDY 2 RESULTS

In order to test our Hypothesis 1 that participants in a Peer-Assisted Learning condition would perform significantly better on the Final Exam portion of the experiment than participants in an Interactive or Passive Learning condition, we performed a one-way ANOVA. The results of the ANOVA indicated that there were no significant differences between the Peer-Assisted Learning condition (M = 0.54, SD = 0.28), the Interactive Learning (M = 0.58, SD = 0.23), or the Passive Learning (M = 0.51, SD = 0.28) conditions $F(2, 130) = 0.62$, $p > .05$. Additionally, no significant differences were found when comparing the top 25% of participants in the Peer-Assisted Learning (M = .864, SD = .072) condition to the Interactive Learning (M = .912, SD = .068) or the Passive Learning (M = .872, SD = .061) condition ($F(2, 29) = 1.502$, $p > .05$). The bottom 25% of participants were similarly distributed, with no significant differences between the Peer-Assisted Learning (M = .199, SD = .078) condition, the Interactive Learning (M = .220, SD = .090) condition, or the Passive Learning (M = .185, SD = .064) condition ($F(2, 30) = .493$, $p > .05$). Our hypothesis that participants in the Peer-Assisted Learning condition would perform significantly better than participants in the Interactive or Passive Learning conditions was not supported.

Comparing the Final Exam accuracy of Study 1 to the Final Exam accuracy of Study 2, no significant difference was found between participants in the Peer-Assisted Learning Condition between Study 1 and Study 2. A significant difference was found between Study 1 and Study 2 of participants in the Interactive Learning condition with

participants in Study 1 (*M* = 0.81, SD = 0.16) performing significantly better than participants in Study 2 (*M* = 0.58, *SD* = 0.28). No significant difference was found between Study 1 and Study 2 in the Passive Learning condition.

Hypothesis 2 was that participants in the Peer-Assisted Learning condition would study significantly more than participants in the Interactive or Passive Learning conditions. This hypothesis was not supported as no significant differences in amount of time spent studying were found between the Peer-Assisted Learning condition (*M* = 143.267 seconds, *SD* = 31.84870), the Interactive Learning condition (*M* = 133.99736, *SD* = 37.01126), or the Passive Learning condition (*M* = 125.31311, *SD* = 50.59287).

With the implementation of the point scheme in Study 2, we intended to motivate the participants to spend more home time relaxing rather than studying, corresponding to what we assumed would happen in ecological settings. We compared the amount of time participants studied between Study 1 and Study 2, and found a significant difference in the Peer-Assisted Learning condition, with participants in Study 1 (*M* = 163.29261 seconds, *SD* = 30.86697) studying significantly more than participants in the Peer-Assisted Learning condition in Study 2 (*M* = 143.26700, *SD* = 31.84870). We also found that participants in the Interactive Learning condition in Study 1 (*M* = 163.82479 seconds, *SD* = 20.90247) studied significantly more than participants in the Interactive Learning condition in Study 2 (*M* = 133.93736, *SD* = 37.01126). Significant differences were also found in the Passive Learning condition with participants studying more in Study 1 (*M* = 152.88242, *SD* = 26.09732) than participants in Study 2 (*M* = 125.31311, *SD* = 50.59287). These findings confirmed that our manipulation worked, that is, the

point scheme encouraged participants in Study 2 to spend less time studying. Figure 5 shows a comparison of average time spent per Home Time activity in study 2.

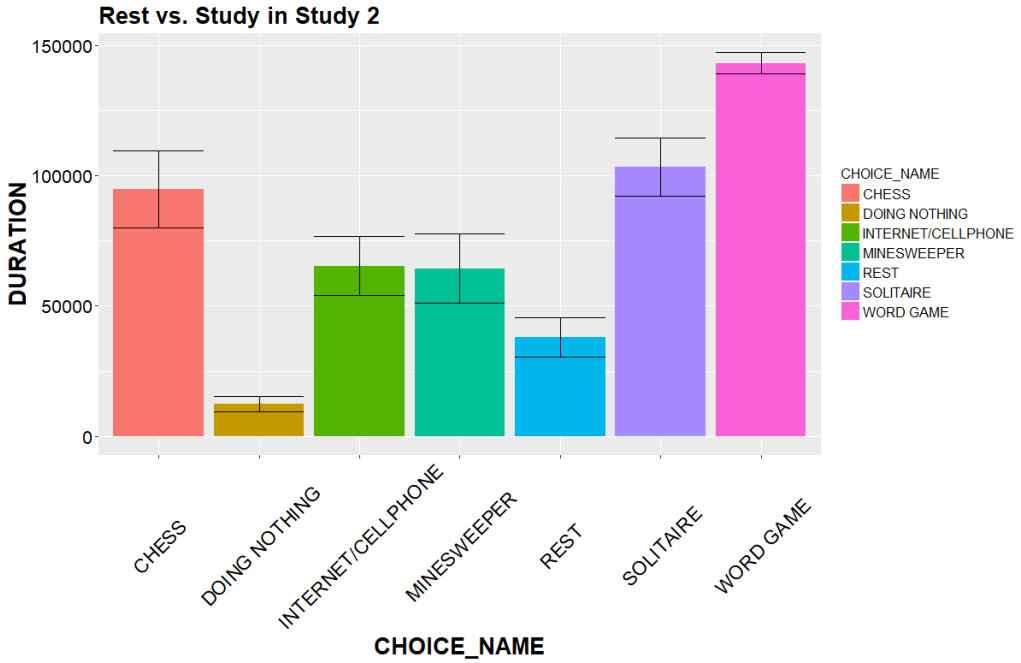


Figure 5. Average time spent on each Home Time Activity in Study 2.

Hypothesis 3 was that state and trait trust measures would correlate with each other as well as individually with final exam performance. In assessing the relationship between the state trust survey measures and state trust behavioral measures, we found a significant positive correlation between the number of times a participant was selected and the assessed trustworthiness of that participant as measured by the average rating of trustworthiness from the participant's peers' state trust surveys $r(54)= 0.64$, $p< .01$. To assess the relationship between the trait trust survey measures and the state trust survey measures we correlated participant responses to these survey measures. We did not find a significant correlation between responses to the state and trait trust surveys, $r(54)= 0.17$, $p > .05$. Further examining the relationship between trait trust measures and state trust, we found no significant correlation between a participant's trait trust scores and

how often that participant was selected by their peers (participant trustworthiness) $r(54)= -0.15$, $p > .05$, no significant correlation between a participant's self-assessment of trait trust and peer assessment of that participant's state trustworthiness as measured by the state trust survey $r(54)= -0.17$, $p > .05$, and no significant correlation between a participant's trait trust score and their assessment of state trustworthiness of the most accurate peer in their group $r(54)= 0.13$, $p > .05$. A positive correlation was found between a participant's standardized selection in a session (percentage of selections made by a participant of the most accurate peer) with that participant's accuracy in the session $r(54)= 0.18$, $p < 0.01$. This finding supported our hypothesis that our state trust behavioral measure of selection behavior would positively correlate with participant accuracy on the experimental task. A significant linear regression was found regressing participant selection of their own answers on session number $F(1, 291) = 8.868$, $p < 0.05$), with an R^2 of 0.03. This finding indicates that participant increasingly selected their own answers over the course of the study.

We also hypothesized that participants would converge upon the most accurate peer, and that this convergence would demonstrate trust calibration by the participant. In order to assess trust calibration, we used a combination of statistical tests. We correlated the number of times a participant selected a peers' responses with the accuracy of the observed peer. We found a significant correlation between the number of times a peer was selected and the trustworthiness of the peer, $r(82)= .54$, $p < .01$. In addition, we correlated the number of times the most accurate peer was selected with the session number of the study, and found a significant positive correlation suggesting that the most accurate peer was increasingly selected over the course of the study, $r(82)= .34$, $p< .01$.

IX. STUDY 2 DISCUSSION

Study 2 was undertaken in an effort to more thoroughly test our hypotheses from Study 1, as well as to test the effects of an incentive scheme on participant performance and time usage. Results from Study 2 indicate that trust relationships can be observed between participants, however participant performance on the experimental task did not follow our hypothesis, as participant performance on the PAL task was not significantly different between experimental conditions.

Study 2 Final Exam results found no significant differences between the Peer-Assisted Learning, Interactive Learning, or Passive Learning conditions. This result differed from Study 1, as participants in the Interactive Learning condition in Study 1 performed significantly better on the Final Exam than participants in the Interactive Learning condition in Study 2. The hypothesized result of Peer-Assisted Learning being the most successful condition in the Final Exam was not supported. Participants performing worse in Study 2 in the Interactive Learning condition could be explained by the implementation of the incentive scheme. Participants were more motivated in Study 2 to relax by playing games than participants in Study 1, as evidenced by the significant increase in time spent playing games in the Interactive Learning condition in Study 2 compared to Study 1. This finding is intriguing, as participants in the Peer-Assisted Learning condition did not perform significantly differently between Study 1 and Study 2, despite participants spending significantly less time studying in the Peer-Assisted Learning condition in Study 2 compared to Study 1. The cross-study performance of the

Peer-Assisted Learning condition paired with the cross-study performance of the Interactive Learning condition suggests that participants in the Paired-Associate Learning condition did not suffer performance issues in Study 2 compared to Study 1, despite having studied less in Study 2. This finding suggests that participant performance on the PAL task in the Peer-Assisted Learning condition was not entirely accounted for by the amount of studying in Home Time. Instead, participants in the Peer-Assisted Learning condition were able to maintain the same level of performance from Study 1 to Study 2 despite less studying, suggesting that participant performance on the PAL task was either a result of performance being at a floor level, or that performance was aided by observing peer answers during School Time. Because performance in the Peer-Assisted Learning condition (M = 0.54) was above chance levels (0.11), it is unlikely that participant performance is attributable to participants performing at floor levels, leaving peer observation as the most likely explanation for the maintained performance across studies. Participants in the Passive Learning condition did not perform significantly different between studies.

In Study 2, we hypothesized that participants in the Peer-Assisted Learning condition would study more during Home Time than participants in the Interactive Learning condition or the Passive Learning condition. This hypothesis was unsupported, as no significant differences in studying were found between any of the conditions. This finding suggests that participants in the Peer-Assisted Learning condition did not experience the hypothesized social pressure of needing to contribute to the group, and therefore were not motivated to study more during Home Time. The reviewed literature stated that students are partially motivated to perform well in school in order to conform

to social pressure, including social pressure to contribute to a group (Bonnaccio & Dalal, 2006). This social pressure was not evidenced in our Studies, as participants did not demonstrate higher levels of studying in the Peer-Assisted Learning condition compared to participants performing the experiment individually. Several explanations may account for this finding. Firstly, participants may have weighted the incentive scheme more heavily than their own social pressures. Participants studied less in the Peer-Assisted Learning condition in Study 2 compared to Study 1, suggesting that the incentive scheme was effective in encouraging participants to study less during home time. Participants may have felt a stronger motivation to achieve points through relaxation games than to achieve points through group collaboration during School Time. Secondly, participants may not have felt social responsibility to their peers, as the experiment dictated that participants could not communicate. Communication may be critical to feeling social responsibility to contribute to a team, and a lack of communication may result in participants feeling isolated and un-beholden to their peers. Thirdly, participants may have been influenced by the lack of real-world consequences for their actions. Social responsibility to peers may only be an effective motivator when the consequences are tangible. Because our Studies were only for class credit and did not implement performance requirements for further rewards, participants may not have experienced the social pressures they would in more ecological scenarios.

Our hypotheses relating to trust formation were largely supported in Study 2. Participants were effective at identifying the most accurate peer over the course of the study, and increasingly selecting that peer over time. Participants also were consistent in their ratings of peers via the State Trust surveys compared to their State Trust behavior

through selections during School Time. State Trust was found to be readily identifiable as participants selected accurate peers, ignored inaccurate peers, and reported high levels of State Trust in the most accurate peers. Trait Trust surveys were not found to be significantly correlated with State Trust surveys or behavior.

X. CONCLUSIONS

The mixed results of Studies 1 and 2 indicate the difficulty and complexity of eliciting, observing, and measuring participant behavior in this experimental paradigm. Learning and retaining the word-number combinations over the course of the study was consistently demonstrated through both Study 1 and Study 2. The consistent ability to learn the word-number combinations indicates the effectiveness of the PAL task as an experimental learning task. Unfortunately, the effectiveness of the experimental manipulations via conditional differences is less clear. The hypotheses regarding superior accuracy in the Peer-Assisted Learning conditions compared to the Interactive and Passive Learning conditions were not supported, as the Peer-Assisted Learning conditions resulted in on-par performance at best, and sub-par performance at worst compared to the other conditions. These results could be due to a number of explanations, including the complexity of the Peer-Assisted Learning condition, time constraints, or motivational factors. Motivational factors may have played a key role, as Study 2 demonstrated that participants were willing to play the relaxation games more frequently than studying for School Time. Balancing the motivations of social conformation, relaxation, and individual achievement, may have been a more complex dynamic than was able to be accurately modeled using the incentive structure. In addition to the challenges of representing each source of motivation within the incentive structure, simply motivating participants to engage with the incentive structure may have been a significant barrier. Incentivizing participants via a point scheme may not have

been as appealing as a monetary or class credit incentive, though monetary or class credit incentives were not selected as they would undermine the ability to study competing motivations. Monetary and class credit incentives would unduly incentivize studying during Home Time, and would invalidate those measures. Appropriately incentivizing participants to engage with the study while maintaining ecological validity related to participant motivation may have been an insurmountable barrier to finding significant differences in accuracy between conditions.

Trust dynamics in both Study 1 and Study 2 were effectively identified. Participants in both studies' Peer-Assisted Learning conditions were able to identify the most accurate peer and adjusted their selection behavior accordingly. In Study 2, participants' ability to identify their most accurate peer and to consistently select that peers' answer offset the decreased amount of time spent studying in Home Time between studies 1 and 2. Despite participants in Study 2 studying less during Home Time than participants in Study 1, Final Session performance was equivalent between the two studies.

Notedly, developing trust in an advisor is heavily dependent on the communication between the trustee and the trustor (Mascaro and Sperber, 2009). Mascaro and Sperber (2009) discussed the relationship between trust and communication, identifying a concept of "epistemic vigilance". According to Mascaro and Sperber, epistemic vigilance is the ability of a trustor to filter misinformation from a trustee based on the trustee's communication. The relationship between communication and trust was not studied in our experiment. It may be that communication is so integral to an effective trust relationship, that the two should not be separated in an experimental context.

Although we attempted to examine trust in this study, it may be that trust was not fully formed in the absence of communication.

FUTURE RESEARCH

The combination of accuracy and trust results indicate that State Trust can be built over the course of a study and that developing State Trust with an accurate peer may assist individual achievement, however this set of studies were unable to establish that the trust relationship enhances individual achievement above and beyond individual learning methods. According to Mascaro and Sperber (2009), the trust relationship we attempted to study may not be fully formed in the absence of communication. Future research should examine our experimental questions with the added context of inter-personal communication between participants. Additionally, future research should examine the experimental questions posed in this paper in an applied environment such as a classroom setting. By examining the effects of trust development in a Peer-Assisted Learning environment in a classroom, the motivational factors we attempted to model in Study 2 would be on full display. Instead of attempting to model the motivational conflicts of "real-life", participants in a classroom setting would actually contend with those conflicting motivations in their daily lives.

Future research could also examine different types of learning. Michaelsen and Sweet's (2011) theories on Team-Based Learning suggest that learning from peers is particularly effective when the nature of the learning subject is enhanced via alternate viewpoints generated by peers. It is possible that the type of learning associated with the PAL task was not assisted by peer collaboration. Future research should explore more complex domains of learning, as rote memorization may not benefit from developing

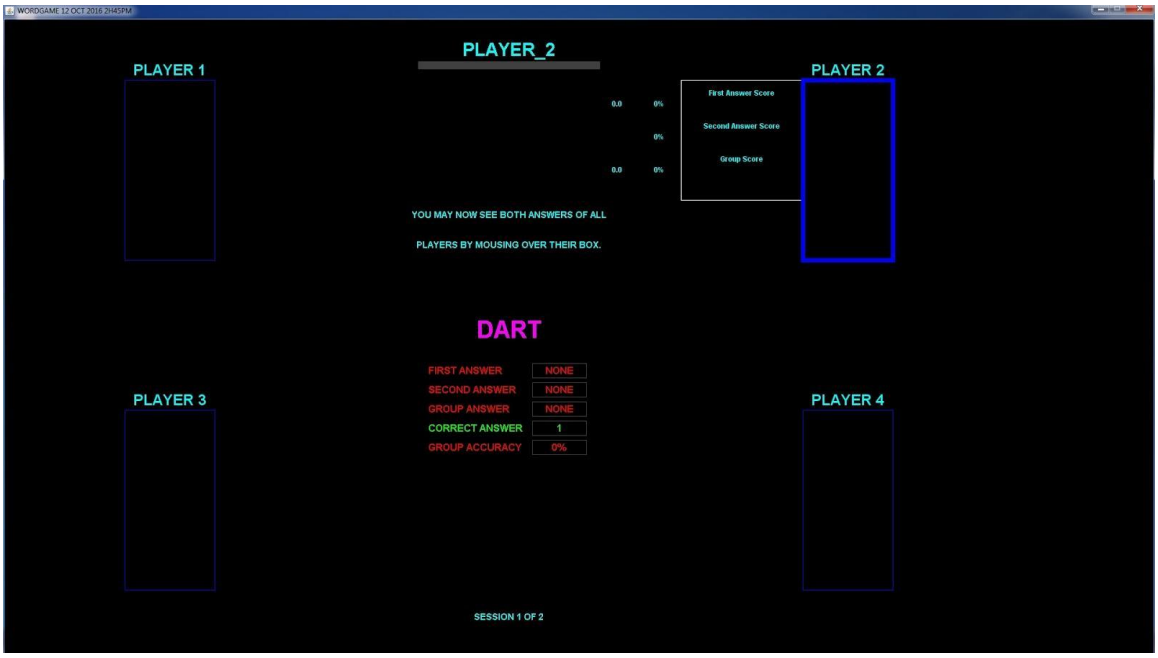
trust with a peer. Rote memorization may not be an effective paradigm to study trust dynamics, as research has indicated that communication, and complex critical thinking paradigms may necessitate collaboration and utilizing trust dynamics (Mascaro and Sperber, 2009; Yniv and Kleinberger, 200). Future research could examine types of learning that involve peers taking differing viewpoints on a subject and explaining those viewpoints to peers. This type of learning may lead to more visible differences in learning between individual and Peer-Assisted Learning conditions.

Further exploration into the field of Peer-Assisted Learning is an important avenue for Psychology as a discipline. The studies represented in this paper suggest that there are cognitive mechanisms at work within Peer-Assisted Learning environments, and these mechanisms need to be more fully explored in order to effectively employ best practices in education.

APPENDIX A

SCREENSHOTS OF PEER-ASSISTED LEARNING CONDITION

Study 1 peer-assisted learning condition school-time player screen.



Proposed study peer-assisted learning condition school time player screen.

APPENDIX B

STATE TRUST SURVEYS PASSIVE AND INTERACTIVE LEARNING CONDITIONS

Please answer this survey as accurately as possible:

1= Strongly disagree

2= Disagree

3= Neither agree nor disagree

4= Agree

5= Strongly Disagree

1. (PL, IL) I felt that looking at the correct answer provided by the computer was very helpful.
2. (IL) I felt that actively trying to recall the answer was very helpful. (PL) I tried to come up with my own answer before the correct answer was displayed.
3. (PL, IL) I did not look at the correct answer provided by the computer.
4. (PL, IL) I thought the final score matched my overall impression about how I was performing throughout the study.
5. (PL, IL) I always looked at the correct answer provided by the computer.

APPENDIX C

STATE TRUST SURVEYS FOR PEER-ASSISTED LEARNING CONDITION

Please answer this survey as accurately as possible:

1= Strongly disagree

2= Disagree

3= Neither agree nor disagree

4= Agree

5= Strongly Disagree

Player 1	Player 2	Player 3	Player 4

1. I feel that this player would not try to trick me into answering incorrectly.
2. The player behaves consistently.
3. The player can be trusted.
4. I feel that the player is capable/competent.
5. I believe that the player wants to help me achieve the best possible score for this task.
6. The player is trying to make me do poorly.

7. I wouldn't let the player have any influence on my answers.
8. I would be willing to let the player have complete control over our team answers
9. I like playing with this player in this game.

Please answer this survey as accurately as possible:

1= Strongly disagree

2= Disagree

3= Neither agree nor disagree

4= Agree

5= Strongly Disagree

1. I felt that looking at my teammate's responses was very helpful.
2. I relied on one teammate more than the others.
3. I didn't look at my teammate's responses.
4. My teammates performed worse than I did.
5. I looked at my teammate's responses the entire time.

APPENDIX D

TRAIT TRUST SURVEY ALL CONDITIONS

Please answer this survey as accurately as possible:

1= Strongly disagree

2= Disagree

3= Neither agree nor disagree

4= Agree

5= Strongly Disagree

1. I generally have faith in humanity.
2. I feel that people are generally reliable.
3. I generally trust other people unless they give me a reason not to.
4. Most people are basically honest.
5. Most people are trustworthy.
6. Most people are basically good and kind.
7. Most people are trustful of others.
8. I am trustful.
9. Most people will respond in kind when they are trusted by others.
10. Hypocrisy is on the increase in our society.

11. One is better off being cautious when dealing with strangers until they have provided evidence that they are trustworthy.
12. Those devoted to unselfish causes are often exploited by others.
13. Fear and social disgrace or punishment rather than conscience prevents most people from breaking the law.
14. Most experts can be relied upon to tell the truth about the limits of their knowledge.
15. Most people tell a lie when they can benefit by doing so.
16. Most people answer public opinion polls honestly.
17. The judiciary is a place where we can all get unbiased treatment.
18. Most repairmen will not overcharge, even if they think you are ignorant of their specialty.
19. Most people are primarily interested in their own welfare.
20. Most students in school would not cheat even if they were sure they could get away with it.
21. Most people can be counted on to do what they say they will do.
22. Most salesmen are honest in describing their products.
23. Most elected officials are really sincere in their campaign efforts.
24. In these competitive times, one has to be alert or someone is likely to take advantage of you.

APPENDIX E

STIMULUS WORDS

1. WORD
2. FACE
3. MASK
4. QUIP
5. CARD
6. HAND
7. ROPE
8. GAME
9. BANK
10. PIPE
11. JACK
12. KING
13. SOCK
14. VENT
15. WALL
16. DART
17. NECK
18. TENT
19. XRAY
20. ZINC
21. LAMB
22. CAMP
23. FOAM
24. KISS
25. HALL
26. GOLD
27. JAIL
28. COIN
29. BIRD
30. LAWN
31. DAWN
32. TANK
33. MULE
34. STAR
35. SHIP
36. NAIL
37. MIND

38. TOOL
39. ROCK
40. POLE
41. SEAT
42. FOWL
43. OATS
44. DELL
45. CANE
46. CHIN
47. FROG
48. CELL
49. ARMY
50. DUST
51. GOLF
52. VEST
53. WINE
54. SOIL
55. STUB
56. TREE
57. SERF
58. SUDS
59. WIFE
60. SOUL

REFERENCES

1. Barrick, M. R., Stewart, G. L., Neubert, M. J., & Mount, M. K. (1998). Relating member ability and personality to work-team processes and team effectiveness. *Journal of applied psychology*, *83*(3), 377.

2. Bonaccio, S., & Dalal, R. S. (2006). Advice taking and decision-making: An integrative literature review, and implications for the organizational sciences. *Organizational Behavior and Human Decision Processes*, *101*(2), 127-151.

3. Cohen, S. G., & Bailey, D. E. (1997). What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of management*, *23*(3), 239-290.

4. Collins, M. G., Juvina, I., & Gluck, K. A. (2016). Cognitive Model of Trust Dynamics Predicts Human Behavior within and between Two Games of Strategic Interaction with Computerized Confederate Agents. *Frontiers in psychology*, *7*.

5. Corriveau, K., & Harris, P. L. (2009). Choosing your informant: Weighing familiarity and recent accuracy. *Developmental science*, *12*(3), 426-437.

6. Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological review*, *95*(2), 256.

7. Ford, M. E. (1992). *Motivating humans: Goals, emotions, and personal agency beliefs*. Sage.

8. Gino, F., Shang, J., & Croson, R. (2009). The impact of information from similar or different advisors on judgment. *Organizational Behavior and Human Decision Processes*, *108*(2), 287-302.

9. Harvey, N., & Fischer, I. (1997). Taking advice: Accepting help, improving judgment, and sharing responsibility. *Organizational Behavior and Human Decision Processes*, *70*(2), 117-133.

10. Hoppitt, W., & Laland, K. N. (2008). Social processes influencing learning in animals: a review of the evidence. *Advances in the Study of Behavior*, *38*, 105-165.

11. Jackson, M., & Golub, B. (2007). Naive learning in social networks: Convergence, influence and wisdom of crowds.

12. Koles, P. G., Stolfi, A., Borges, N. J., Nelson, S., & Parmelee, D. X. (2010). The impact of team-based learning on medical students' academic performance. Academic Medicine, 85(11), 1739-1745.

13. Lauricella, A. R., Wartella, E., & Rideout, V. J. (2015). Young children's screen time: The complex role of parent and child factors. *Journal of Applied Developmental Psychology, 36*, 11-17.

14. Lee, J. D., & See, K. A. (2004). Trust in automation: Designing for appropriate reliance. *Human factors*, *46*(1), 50-80.

15. Lee, S. J., Bartolic, S., & Vandewater, E. A. (2009). Predicting children's media use in the USA: Differences in cross-sectional and longitudinal analysis. *British Journal of Developmental Psychology, 27*(1), 123-143.

16. Levine, R. E., O'Boyle, M., Haidet, P., Lynn, D. J., Stone, M. M., Wolf, D. V., & Paniagua, F. A. (2004). Transforming a clinical clerkship with team learning. *Teaching and learning in medicine*, *16*(3), 270-275.

17. Lyons, J. B., Stokes, C. K., & Schneider, T. R. (2011). Predictors and outcomes of trust in teams. *Trust in military teams*, 31-48.

18. Mascaro, O., & Sperber, D. (2009). The moral, epistemic, and mindreading components of children's vigilance towards deception. *Cognition*, *112*(3), 367-380.

19. Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *Academy of management review*, *20*(3), 709-734.

20. Mannes, A. E. (2009). Are we wise about the wisdom of crowds? The use of group judgments in belief revision. *Management Science*, *55*(8), 1267-1279.

21. Michaelsen, L. K., Knight, A. B., & Fink, L. D. (Eds.). (2002). *Team-based learning: A transformative use of small groups*. Greenwood publishing group.

22. Michaelsen, L. K., & Sweet, M. (2011). Team-based learning. *New directions for teaching and learning*, *2011*(128), 41-51.

23. Paivio, A., Yuille, J. C., & Madigan, S. A. (1968). Concreteness, imagery, and meaningfulness values for 925 nouns. *Journal of experimental psychology*, *76*(12), 1.

24. Rendell, L., Fogarty, L., Hoppitt, W. J., Morgan, T. J., Webster, M. M., & Laland, K. N. (2011). Cognitive culture: theoretical and empirical insights into social learning strategies. *Trends in cognitive sciences*, *15*(2), 68-76.

25. Renshaw, P. D., & Asher, S. R. (1983). Children's goals and strategies for social interaction. *Merrill-Palmer Quarterly (1982-)*, 353-374.

26. Rotter, J. B. (1967). A new scale for the measurement of interpersonal trust. *Journal of personality*, *35*(4), 651-665.

27. Wentzel, K. R. (1999). Social-motivational processes and interpersonal relationships: Implications for understanding motivation at school. *Journal of educational psychology*, *91*(1), 76.

28. Yamagishi, T. (1986). The provision of a sanctioning system as a public good. *Journal of Personality and social Psychology*, *51*(1), 110.

29. Yaniv, I., & Choshen-Hillel, S. (2012). Exploiting the wisdom of others to make better decisions: Suspending judgment reduces egocentrism and increases accuracy. *Journal of Behavioral Decision Making*, *25*(5), 427-434.

30. Yaniv, I., & Kleinberger, E. (2000). Advice taking in decision making: Egocentric discounting and reputation formation. *Organizational behavior and human decision processes*, *83*(2), 260-281.

31. Zgheib, N. K., Simaan, J. A., & Sabra, R. (2010). Using team-based learning to teach pharmacology to second year medical students improves student performance. *Medical teacher*, *32*(2), 130-135.