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EXPLORING THE USE OF BRAIN GAMES TO ENHANCE STUDENTS' PROBLEM SOLVING SKILLS

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Extended Abstract:

I. INTRODUCTION

Over the years, one of the most important and frequently identified skills that employers consistently suggest as critical to any information system hire they consider is the ability to solve problems. Faculty members clearly recognize this and continue to seek ways to effectively teach critical thinking and problem solving skills. This quest for sound pedagogical approaches to cognitive skill development is an age-old issue that often breeds frustration and mixed results, and the implications are significant as students with solid problem-solving skills, especially skills developed early in their college career, are more likely to get gain the most out of their undergraduate program leading ultimately to a success professional career start.

While there is much supposition about what techniques work to strengthen problem solving skills (Fry 2008; Kamas & Kahn 2011) and speculation that playing games not only unleashes creative thinking but also enhances problem solving abilities (Gilkey & Kilts 2007), more questions remain than are answered. In a quest to better understand and develop effective pedagogical for enhancing problem solving skills, this research in progress proposes to evaluate the emerging trend of brain games as a viable tool to enhance information systems curriculum. Specifically, this study explores several salient questions. Will students who regularly participate in playing online brain games perform better on programming assessments than their peers who do not? After regularly playing online brain games will students perceive that their problem solving skills have improved?

II. PRELIMINARY LITERATURE REVIEW

In the child development literature, play has long been recognized as an impetus for problem-solving skills development (Blumberg & Altschuler 2011; Trawick et al. 2011; Bjorklund et al. 2004). Even multinational corporations such as Google (Poundstone 2012) and Apple (Gilkey & Kilts 2007) have found play to a significant value to unleashing the creativity and problem-solving abilities of their employees.

Problem-based learning approaches have often proven to be successful in contributing to learning effectiveness in information systems courses (Mykytyn et al. 2008), but how do we teach the core analytical skill of problem solving to further enhance the effectiveness of problem-based pedagogical approaches. Numerous learning theories and a variety of models exist (Akela 2010).

In their essay on cognitive fitness, Gilkey and Kilts posit four distinct steps for achieving a state of cognitive proficiency, or fitness: 1) Understand how experience makes brains grow; 2) Work hard at play; 3) Search for patterns; and 4) Seek novelty and innovation. Step 2 is of most relevance and interest to this study. The authors suggest the most effective means to develop healthy cognitive functioning is to "engage in the serious business of play" (p. 58) as play is foundation to our ability to be imaginative and inventive. It follows from this that as we use play to bring out imagination and invention, problem solving falls in line.

Kolb's Experiential Learning Cycle (ECL) provides the most logical theoretical foundation for this study and will serve as the framework for modeling our hypotheses.

Kolb's Experiential Learning Cycle and Problem Solving

Kolb's Experiential Learning Cycle is a "comprehensive and influential model of experiential learning" (Kamis and Kahn 2004) that has been used extensively in the literature. Kolb's model posits that the optimal learning environment occurs when all four stages of the ELC are engaged. Students who feel, watch, think, and do stand the greatest chance of learning.

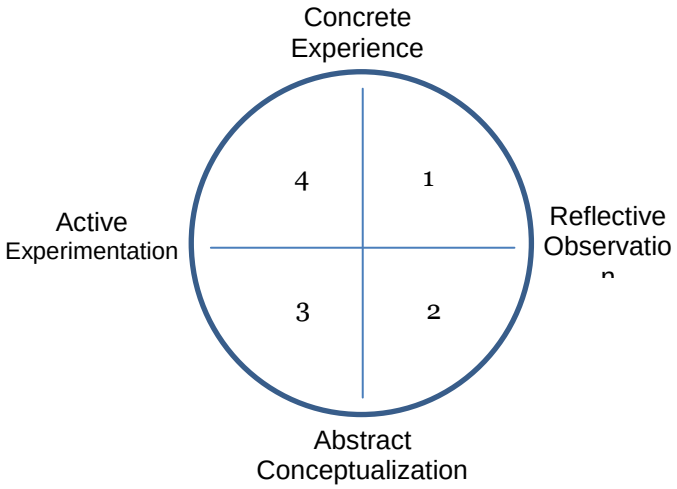

Figure 1. Kolb's Experiential Learning Cycle

Kolb's model thus provides a solid theoretical framework from which to explore the role of brain games in the development of problem solving skills among undergraduate students.

Brain Games

One way to engage individuals in active experimentation and concrete experience is through play. Brain games encompass different methodologies and medium of delivery, but in general they are puzzles, games, and word problems designed to improve some area of cognitive processing through direct engagement and usually an element of fun or play. Recently, a trend in online games designed to improve cognitive processes has emerged. This study will focus specifically on online tools and their potential to improve problem solving when engaged regularly. Online tools were selected because of their accessibility, ease and familiarity of use for the subject group, and the ability to track and collect data for analysis.

In the particular online brain game system selected, a brain performance index is determined based on the initial training test completed upon opening an account. This index is then tracked on a daily basis. Other metrics tracked include playing streaks (training completed at least 3 days

in a row), longest streak, average number of days and games played in a week and over time. Figure 2 provides an illustration of some of the data collected. The researchers have access to the data for all subjects in the study.

Brain games in general have been shown to improve cognitive processing in clinical studies, and online brain games have already clearly shown their ability to improve memory and visual attention (Hardy et al. 2010). However, little has been done to examine their use specifically for improving problem solving skills and potential for use in the classroom.

Figure 2. Online Brain Game Data Tracking Examples

III. HYPOTHESES DEVELOPMENT

The development of problem solving skills, as illustrated in Kolb's theory, is achieved through a comprehensive cycle from observation to concrete experience (Kolb 1976). As Figure 1 illustrates, individuals learn through a comprehensive cycle of reflective observation, abstract conceptualization, active experimentation and concrete experience. It's plausible that problem solving and other cognitive processing skills are learned and developed in this same manner.

The primary purpose of this work is to test the effectiveness of online brain games in helping students develop their problem solving skills. The assumption is that problem solving skills are required for successful performance on programming problems.

The overarching hypotheses for this study are as follows:

Hypothesis 1: Students engaged in regularly training the brain through brain games will improve in the brain performance index indicators.

Hypothesis 2: Students engaged in regularly training the brain through brain games will perform better on programming assessments.

Hypothesis 3: Students engaged in regularly training the brain through brain games will perceive improvements in (will be more confident in) their problem-solving abilities.

IV. METHODS

While one can easily argue that most classes in an information systems program will employ these different stages to some degree, a typical programming class, by nature, will engage all four stages: reflective observation, abstract conceptualization, active experimentation and concrete experience. Since the purpose of this research is to explore the use of a specific tool to stimulate development of problem solving skills, an introductory Problem Solving and Introductory Programming course was selected for the experiment. The primary objective of the course is for students to master introductory skills in visual basic. A natural requirement to mastering these skills is the ability to solve problems.

In the course, all undergraduate students begin the quarter with a graded requirement to open and actively participate in an online brain game application. Each week data is collected that measures their weekly game details, improvements (or declines) in performance, and a number of other metrics such as average number of games played. The data for the student group spans a 10-week period.

In addition, prior to beginning the brain games, the students complete a survey instrument measuring self-reported attitudes and behaviors for creative problem solving. At the end of the 10-week period students complete the survey again to record post-study attitudes toward their problem solving skills.

To provide comparison and control data for the initial pilot, all lectures, homework assignments, and exams have been kept identical to the offering of the course in the previous term where brain games were not used. While we're primarily interested in whether individual problem solving improves over the duration of the experiment, performance measures from exams will be compared to the exams of students completing the course before the brain games were implemented as part of the course.

V. DISCUSSION & CONCLUSION

Once all data is collected and analyzed, we anticipate at a minimum to be able to validate the methodology and report preliminary findings. Regardless of the outcome of the data analysis, the findings will, at a minimum, provide further insight to the viability and effectiveness of cognitive development tools such as brain games in IS courses. If proven to be effective, the findings will help IS educators to develop more specific tools and integrate them properly into their curriculum.

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Rhonda A. Syler is a lecturer at Louisiana Tech University. She currently serves on the editorial board of the Journal of Information Systems Education and the Board of Directors for the Association of Information System Education Special Interest Group. In addition to her current research activities in offshoring, systems development, and information systems pedagogy, she continues to travel internationally to examine global issues that impact information systems development. Syler is a recipient of a Best Paper of the Year Award with the Decision Sciences Journal of Innovative Education, a Distinguished Research Award recipient at Allied Academies, and a former award recipient of an institution-level CIEE International Faculty Development Seminar Award for study in India. Prior to entering academia full-time, Syler held professional and executive positions in the financial industry, the federal service for the Department of Defense and the Atlanta Committee for the Olympic Games.

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James J. Cochran has been a Visiting Scholar with Stanford University, the University of South Africa, the Universidad de Talca, and Pôle Universitaire Léonard De Vinci. He has published over 30 peer-reviewed articles and five textbooks in statistics, operations research, and analytics. He was founding co-chair of Statistics Without Borders and established an annual International Operations Research/Statistics Education Workshop series. Cochran is an elected member of the International Statistics Institute and is a recipient of the INFORMS Prize for the Teaching of OR/MS Practice and the Mu Sigma Rho Statistical Education Award. In 2011 Cochran was named a Fellow of the American Statistical Association. Professor Cochran is the founding Editor-in-Chief of the Wiley Encyclopedia of Operations Research and the Management Sciences and the Wiley Series in Operations Research and Management Science. In addition to serving on numerous editorial boards, Cochran has served as the Editor-in-Chief of INFORMS Transactions on Education.